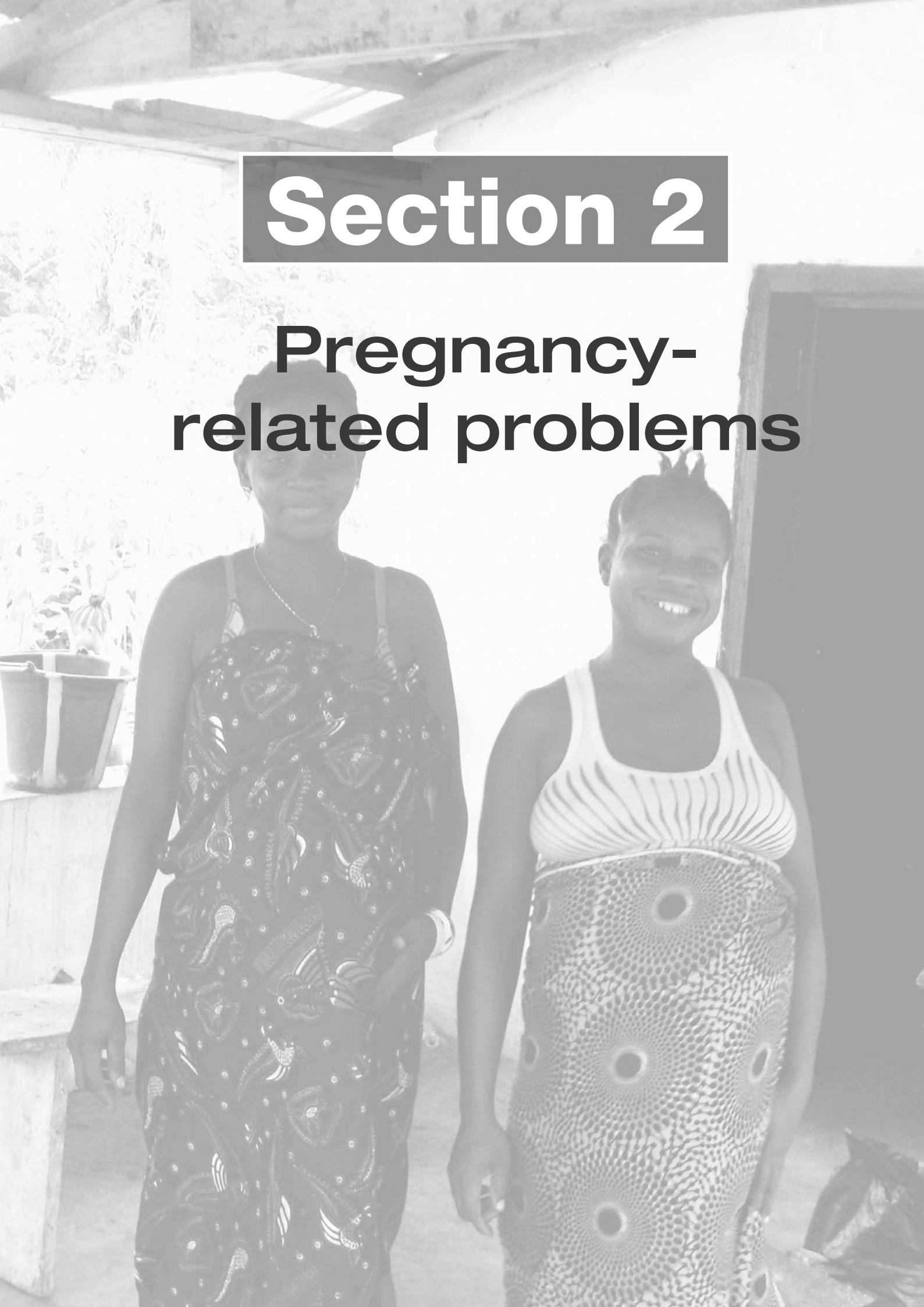


Section 2

Pregnancy-related problems



2.1

Antenatal care and the hospital

Introduction

For a variety of logistic and cultural reasons in resource-limited countries, the first time a woman attends a health facility during pregnancy may be because of a medical problem or because she is in labour. This often means that she is medically compromised even before giving birth, and at high risk of morbidity and mortality.

Antenatal care in such settings tends to be opportunistic, and the ways in which care is delivered must be innovative and optimised to ensure that comprehensive care reaches as many pregnant women and girls as possible. This might mean outreach teams going out to the rural areas ('trekking'), rather than the women having to make the long journey to the healthcare facility, often on foot. Usually the staff who undertake such visits are midwives and nurses, rarely doctors.

Such problems particularly affect rural areas at long distances from the nearest facility and where roads are poor. Hospital workers have a duty to ensure that they work with the community health teams to facilitate antenatal care.

Definitions of pregnancy-related events

Maternal mortality is the death of any woman or girl, from any cause, while pregnant or within 42 days of the end of pregnancy.

Gravidity is the number of times that a woman or girl has been pregnant. **Parity** is the number of times that she has given birth to a fetus with a gestational age of 24 weeks or more, regardless of whether the child was born alive or was stillborn.

For example, in gravida 2:para 2 (G2 + P2) the woman or girl has had two pregnancies and two deliveries after 24 weeks, and in gravida 2:para 0 (G2 + P0) the woman or girl has had two pregnancies, neither of which survived to a gestational age of 24 weeks. If these individuals are both currently pregnant again, they can be referred to as G3 + P2 and G3 + P0, respectively.

- A **nulliparous** woman or girl has not given birth previously (regardless of outcome).
- A **primigravid** woman or girl (a primigravida) is in her first pregnancy.
- A **primiparous** woman or girl has given birth once.
- A **multigravid** woman or girl (a multigravida) has been pregnant more than once.
- A **multiparous** woman has given birth more than once.
- A **grand multipara** is a woman who has already delivered four or more infants who have achieved a gestational age of 24 weeks or more. Such women are considered to be at higher than average risk in subsequent pregnancies.
- A **grand multigravida** has been pregnant four times or more.

Multiple pregnancies present a problem with regard to terminology. A multiple gestation counts as a single event, and a multiple birth, should be interpreted as a single parous event.

Rationale for antenatal care

Antenatal care is primarily a means of screening for, diagnosing, and treating conditions which could cause problems during the pregnancy, at delivery and after birth. These conditions may be pre-existing maternal medical disorders or obstetric or fetal complications which arise during the pregnancy itself.

Basic antenatal care

Two conditions are of particular importance to detect and manage antenatally, namely **pre-eclampsia** and **anaemia**, as they contribute to a large proportion of maternal and perinatal deaths.

Pre-eclampsia may vary in severity, but commonly presents with mildly raised blood pressure and proteinuria, and may progress to full-blown pre-eclampsia with dangerously high blood pressures, heavy proteinuria and generalised oedema (see Section 2.5.E). Mild and moderate pre-eclampsia is usually asymptomatic, and therefore routine testing of blood pressure and urine in pregnancy is crucial to its detection.

Severe pre-eclampsia can be associated with symptoms such as headache, visual disturbance and epigastric pain, and commonly leads to eclamptic fits, cerebrovascular accidents or HELLP syndrome (Haemolysis, Elevated Liver enzymes and Low Platelets), all of which carry a very high mortality. Timely intervention, by lowering the blood pressure, delivering the baby and treating fits if they occur, may be life-saving.

It is also vitally important to detect and treat anaemia antenatally, to reduce the woman's risk of dying should she experience a postpartum haemorrhage (see Sections 2.5.B and 2.8.D).

As far as possible there should be a structured approach to antenatal care. (A card or booklet designed and implemented by individual Ministries of Health for pregnant women or girls to keep and bring to clinics is helpful.) At the first encounter, an attempt should be made to obtain as full a history as possible, time permitting. This should include the following details:

- the date of the last menstrual period (LMP), regularity of the menstrual cycle, any contraceptive usage, the date of the positive pregnancy test (if available), and any particular complaints in pregnancy to date
- the previous obstetric history, including complications, mode of delivery and outcome
- the previous medical history
- the family history, especially with regard to hypertension, diabetes mellitus, multiple births and congenital abnormalities
- use of drugs, smoking, and alcohol consumption
- allergies.

The patient must always be examined.

- Look for signs of anaemia (pallor, leuconychia or white

- nails, koilonychia or spoon-shaped nails, and angular stomatitis), malnutrition, oedema and other medical conditions unrelated to the pregnancy.
- The blood pressure must be measured, and ideally the woman should be weighed.
 - The chest should be examined for cardiac and respiratory signs.
 - Abdominal inspection and palpation should be done, looking for scars and checking for signs of pregnancy, including measurement of the symphysis-fundal height and feeling for the number of fetuses, fetal lie and presentation, and engagement of the presenting part (see Figures 2.1.1 and 2.1.2).
 - An attempt should be made to auscultate the fetal heart with a Pinard's stethoscope, if the uterus is palpable abdominally.

Accurate dating of the pregnancy is important, as it influences decision making during the antenatal period, particularly around the timing of delivery and whether this is by Caesarean section (CS) or induction of labour. It also aids assessment of the maturity of the fetus if the mother goes into spontaneous labour early.

Bimanual examination, which must be undertaken in an aseptic and careful way (especially if there could be an ectopic pregnancy), is a useful diagnostic tool for dating an early pregnancy (in conjunction with the menstrual date), and in the absence of scanning facilities might be the only available means of calculating the estimated date of delivery (EDD).

At around 4 weeks' gestation, the cervix starts to change in colour and texture, feels soft and acquires a bluish tinge which may be visualised on speculum examination. The uterus first becomes palpable abdominally at around 12 weeks' gestation.

Prior to this an estimation of gestational age can be obtained from vaginal examination by assessing uterine size with the following comparisons:

- 6 weeks is equivalent to a plum or golf ball
- 8 weeks is equivalent to a tennis ball
- 10 weeks is equivalent to an orange
- 12 weeks is equivalent to a grapefruit
- 14 weeks is equivalent to a small melon (palpable abdominally).

The accuracy of clinical assessment may be reduced by obesity, fibroids, and if the uterus is retroverted.

Multiple pregnancy and molar change can also lead to a pregnancy larger than dates. At follow-up visits, the history

and examination can be more focused on pregnancy events since the last visit. Examination should look for signs of intercurrent problems, anaemia and oedema. At every visit, the blood pressure must be measured and the abdomen palpated to check on the progress of pregnancy.

At all visits after 20 weeks there should be direct questioning for symptoms of pre-eclampsia. If the blood pressure is elevated or rapidly progressive oedema is present, a urine sample **must** be tested for protein.

Prior to the due date, there should be a discussion about the mode and place of delivery for women with a previous Caesarean section scar. Birth attendants and family members must be informed that there is a high risk of scar rupture, and the woman must deliver in a healthcare site where emergency facilities are available if needed.

They should also be informed of any concerns you may have which might put them at risk of needing intervention at delivery (e.g. twins, a high fetal head at term). These would indicate that they must deliver at an appropriate healthcare facility.

Ideally, there should be waiting homes near the healthcare facility where comprehensive emergency obstetric care (EmOC) is available, set up by the regional health teams, to which they and their attendants can move near to the time of delivery so that they do not have to make a long and potentially dangerous journey while in labour.

All of these details, along with the results of any investigations, should be noted on a small hand-held record (http://eepd.org.uk/wiki/index.php?title=Hand_Held_Records) which the pregnant woman or girl is encouraged to carry with her at all times throughout the pregnancy.

As the pregnancy progresses, the uterus continues to grow and has usually reached the level of the umbilicus by 20–24 weeks (see Figure 2.1.1). Measuring the height of the fundus above the symphysis pubis can also provide a good indication of the growth and gestation of the fetus. The woman should first empty her bladder. The measurement is then made by placing the zero point of the tape measure on the upper border of the symphysis and taking the tape along the uterus in a longitudinal direction to the upper border of the fundus, with the mother lying in the left lateral tilt position.

Between 20 and 34 weeks' gestation, the length of this measurement (in centimetres) should correspond to the gestational age in weeks of a well-grown fetus (see Figure 2.1.2).

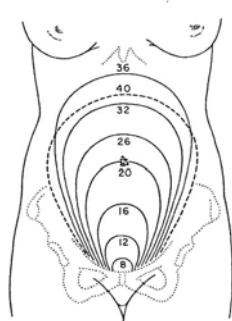


FIGURE 2.1.1 Average size of normal gravid uterus at different gestations.

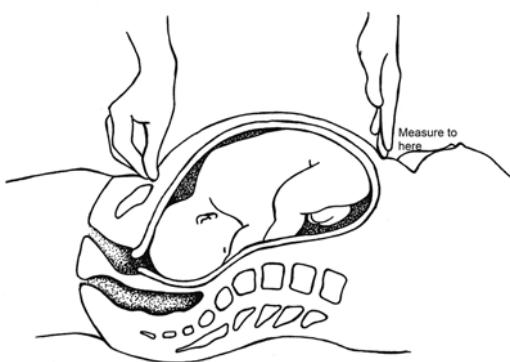


FIGURE 2.1.2 Measuring fundal height.

A difference of more than 2 cm too long or too short can indicate complications such as multiple pregnancy (too long), intrauterine growth retardation (too short), or inaccurate measurements of the estimated date of delivery.

It should be recognised that fundal height is not an accurate assessment of gestation or fetal size. Even in the absence of confounding factors such as multiple gestation and poly/oligohydramnios, it varies widely depending on the height and weight of the mother and lie of the fetus. In addition, the 'normal' fetal size also varies widely depending on patient build and ethnic origin.

Antenatal investigations and interventions

- Ideally a full blood count should be done at least once during the pregnancy, to check the haemoglobin level and, if possible, the red cell indices. Portable systems for measuring haemoglobin include the haemocue and WHO colour card from a finger prick sample, or perhaps, in the future, percutaneous measurement using a transcutaneous haemoglobinometer (currently under development by Masimo).
- Urinalysis must be performed at every visit, to check for protein and glucose.
- Screening for bloodborne viruses (hepatitis B and C and HIV) is not always available (see Section 1.8). All mothers should be advised of the risks involved, and of the precautions they can take to reduce the risk of transmission. Healthcare professionals also need to be made aware of universal precautions and adhere to them at all times.
- Serum samples should be taken for blood grouping and Rhesus status.
- All women should be tested for and when appropriate treated for syphilis (see Section 2.8.H).

ABO and Rhesus incompatibility

At a mother's first visit to the healthcare site, blood should be taken for ABO typing, determination of Rhesus (Rh) status and detecting the presence of harmful antibodies.

The main antibodies of concern are anti-D (usually acquired following feto-maternal haemorrhage), anti-c and anti-kell (which usually follow blood transfusion), all of which can cause severe haemolytic disease of the newborn. ABO incompatibility can also cause neonatal jaundice in one in 30 cases.

Potential Rh-D sensitising events for a Rhesus-negative mother include miscarriage, termination of pregnancy, ectopic pregnancy, antepartum haemorrhage, and invasive procedures such as external cephalic version. If the mother is not given anti-D immunoglobulin after such events, a second challenge will lead to a massive rise in anti-D antibodies in the mother's circulation, which can then cross the placenta and destroy Rhesus-positive fetal cells, causing fetal anaemia. The anti-D immunoglobulin should ideally be given within 3 days of the sensitising challenge, but may be effective when given up to 13 days after the challenge. The WHO recommends 125 IU per mL of fetal red blood cells found in the maternal circulation. A Kleihauer test can be performed to identify the presence and quantity of feto-maternal haemorrhage. In well-resourced countries, a dose of 250 IU of anti-D immunoglobulin is given before 20 weeks' gestation, and 500 IU after 20 weeks. (This is almost always adequate but additional units are given if the Kleihauer test indicates a larger feto-maternal haemorrhage.)

Due to limited infrastructure, blood bank facilities will not be available at all healthcare sites, but staffed laboratories should be available in district hospitals where the serum sample, taken at the healthcare site, adequately labelled and batched, can be sent for processing.

Immunisation and antimalarial prophylaxis

Routine administration of anti-tetanus toxoid should be offered to all women to reduce the risk of neonatal and maternal tetanus. For women who have never received tetanus toxoid vaccine, or who have no documentation of such immunisation, a total of five doses is recommended – two doses given 1 month apart in the first pregnancy, then one dose in each subsequent pregnancy (or at intervals of at least 1 year), up to a total of five doses.

A single dose does not offer adequate protection, and as the highest level of antibody occurs 24 weeks following the second dose, ideally this should be given around 16 weeks' gestation, with the first dose being given at least 4–8 weeks earlier in the first trimester, if early attendance allows this.

Intermittent antimalarial prophylaxis should also be offered. Among its other advantages, this may reduce the burden of severe anaemia (see Section 2.8.D).

Ultrasound scanning

Facilities for ultrasound scanning in this setting are usually limited. There may be no funding for a machine. If there is a machine, the staff need to be adequately trained and have the time to use it. Scanning can be useful for assessing the site of pregnancy, the period of gestation, viability, the number of fetuses, presentation and the progress of the pregnancy. If the image quality is good enough, it may also allow the detection of abnormalities, and although intervention might not be possible, this would mean that problems could be anticipated, delivery planned and the mother counselled appropriately.

Specific antenatal problems

It is not possible to discuss the management of every antenatal condition here. Conditions such as anaemia, hypertension and diabetes, which are common complications of pregnancy and becoming increasingly so, are discussed in detail elsewhere in this textbook.

Hyperemesis

Some nausea and vomiting is common in early pregnancy. However, in a small proportion of patients, severe vomiting (hyperemesis) can occur. This condition is more common where there is a larger than normal placental mass (e.g. in multiple pregnancy and molar pregnancy).

Signs of dehydration such as tachycardia, dry mucous membranes and a slow skin pinch can develop. The patient often develops ketoacidosis, which makes the nausea and vomiting worse. For details on managing this condition, see Section 2.6.I.

Organising an effective antenatal care system

Blood bank facilities

A functional and effective blood transfusion service (see Section 1.7) is a vital component of a national health system.

The WHO expects all countries to have national policies and a legislative framework for blood safety, with a centrally coordinated and quality system in place. Ideally, all donors should be unpaid volunteers, and unnecessary transfusion should be avoided. Currently there are large discrepancies between wealthy and resource-limited countries in the availability of this service.

Antenatal care networks

One important factor in the delivery of an effective antenatal service is establishing good networks between the community and the healthcare facilities in which births occur.

As was mentioned in the introduction to this section, 'trekking' is the setting up of an outreach service by which healthcare providers go to the women, rather than vice versa. This serves to offset the problems of distance and lack of transportation, and may be the first step in facilitating these linkages, as the staff have an opportunity to offer education to the mothers, birth attendants, family and community members on the potential benefits for women of delivering in a healthcare facility. The staff can also advise on warning signs to look out for, and on emergency measures that can be taken before professional help arrives.

Patients and their attendants need to know that they will receive the care they need regardless of whether or not they can afford it.

Perhaps most importantly, hospital staff need to reiterate the vital role that community members can have in averting

a tragedy. This will hopefully reduce suspicion and encourage early communication when help is needed, so that critical delays in getting help to a mother can be avoided. A local emergency taxi service set up in each village, and ideally funded by the community and available at all times for women to be taken to the healthcare facility, is one way of addressing this.

One of the responsibilities of the regional health teams is to provide **waiting homes** near to a health facility, providing comprehensive EmOC, as mentioned earlier, where the high-risk expectant mother and her family members can stay for a short period prior to the birth in case an emergency arises.

If help is summoned following an emergency in the community, an emergency ambulance system, manned by personnel who have been trained in resuscitation and stabilisation, can be used for retrieval, further reducing the delay before the mother first receives skilled care (e.g. wheelbarrow ambulances, <http://naje.com/blog/kibera-wheelbarrow-ambulance-innovation-out-of-necessity/>).

Conclusion

The main keys to providing effective antenatal care are education on the role that it plays and emphasis on the importance of teamwork by all of the parties involved, to ensure the best possible outcome for both mother and baby.

2.2

Nursing pregnant women and girls in hospital (midwifery)

Introduction

Irrespective of where midwifery care is provided, there are universal requirements that should govern the provision of care:

- 1 provision of a safe healthcare environment for patients and staff
- 2 respectful and compassionate care for women, the neonate(s) and the family
- 3 skilled and competent staff to provide a good standard of evidence-based care
- 4 health education and promotion.

These areas of critical importance are further considered and described concisely in the subsections below. More detailed information on each area can be found in the references listed at the end of this section.

The global human resources target for effective delivery of obstetric care is one skilled birth attendant (SBA) for every 100 expected births. SBAs are defined as midwives, nurses, health officers, medical doctors and obstetricians/gynaecologists.

Definition of maternal death

In every action that is undertaken as part of midwifery, the prevention of maternal death must be the first priority.

According to the WHO, pregnancy-related death is defined as the death of a woman or girl while pregnant or within 42 days of the termination of pregnancy, irrespective of the cause of death.

Safe environment

WHO checklist

The WHO has recently produced a helpful checklist for patient safety with regard to childbirth (www.who.int/patientsafety/implementation/checklists/en/index.html).

Infection control

The microorganisms that cause infection can be transmitted to patients and staff by several routes. These include aerosol, droplet (e.g. coughing and sneezing) and faecal-oral routes, direct contact (person to person), indirect contact (through contaminated food or water, contaminated surfaces or objects), via blood and body fluids, and via insects and parasites. It is vital that basic infection control practices

TABLE 2.2.1 Elements of the WHO Safe Childbirth Checklist

| Checklist item | Qualifying caption | |
|--|--|---|
| <i>On admission of the mother to the birth facility</i> | | |
| Does the mother need referral? | <input type="checkbox"/> Yes, organised | According to the facility's criteria |
| | <input type="checkbox"/> No | |
| Partograph started? | <input type="checkbox"/> Yes | Start plotting when cervix is ≥ 4 cm, then cervix should dilate ≥ 1 cm/hour. Every 30 minutes, plot heart rate, contractions and fetal heart rate. Every 2 hours, plot temperature. Every 4 hours, plot blood pressure |
| | <input type="checkbox"/> No, will start when ≥ 4 cm | |
| Does the mother need to start antibiotics? | <input type="checkbox"/> Yes, given | Give if temperature is $\geq 38^{\circ}\text{C}$, or if there is a foul-smelling vaginal discharge, rupture of membranes longer than 18 hours, <i>or</i> labour longer than 24 hours |
| | <input type="checkbox"/> No | |
| Does the mother need to start magnesium sulphate? | <input type="checkbox"/> Yes, given | Give if (1) diastolic blood pressure is ≥ 110 mmHg and 3+ proteinuria, <i>or</i> (2) diastolic blood pressure is ≥ 90 mmHg and 2+ proteinuria, and any of the following: severe headache, visual disturbance <i>or</i> epigastric pain |
| | <input type="checkbox"/> No | |
| Does the mother need to start antiretroviral medicine? | <input type="checkbox"/> Yes, given | Give if the mother is HIV positive and in labour |
| | <input type="checkbox"/> No | |
| <input type="checkbox"/> Supplies are available for cleaning hands and wearing gloves for each vaginal examination | | |
| <input type="checkbox"/> Birth companion encouraged to be present at birth | | |
| <input type="checkbox"/> Confirm that the mother and/or companion will call for help during labour if the mother has a danger sign | | Call for help if the mother has bleeding, severe abdominal pain, severe headache, visual disturbance, urge to push, <i>or</i> difficulty emptying bladder |
| <i>Just before pushing (or before Caesarean section)</i> | | |
| Does the mother need to start antibiotics? | <input type="checkbox"/> Yes, given | Give if temperature is $\geq 38^{\circ}\text{C}$, or if there is a foul-smelling vaginal discharge, rupture of membranes longer than 18 hours now, labour longer than 24 hours, <i>or</i> Caesarean section |
| | <input type="checkbox"/> No | |
| Does the mother need to start magnesium sulphate? | <input type="checkbox"/> Yes, given | Give if (1) diastolic blood pressure is ≥ 110 mmHg and 3+ proteinuria, <i>or</i> (2) diastolic blood pressure is ≥ 90 mmHg and 2+ proteinuria, and any of the following: severe headache, visual disturbance <i>or</i> epigastric pain |
| | <input type="checkbox"/> No | |
| Are essential supplies at the bedside for the mother? | <input type="checkbox"/> Gloves | Prepare to care for the mother immediately after birth: (1) Exclude the possibility of a second baby, (2) Give oxytocin within 1 minute, (3) Use controlled cord traction to deliver the placenta, (4) Massage the uterus after the placenta has been delivered |
| | <input type="checkbox"/> Soap and clean water | |
| | <input type="checkbox"/> Oxytocin 10 IU in syringe | |
| Are essential supplies at the bedside for the baby? | <input type="checkbox"/> Clean towel | Prepare to care for the baby immediately after birth: (1) Dry the baby and keep them warm, (2) If the baby is not breathing, stimulate and clear the airway, (3) If they are still not breathing, cut the cord, ventilate with bag and mask, and (4) shout for help |
| | <input type="checkbox"/> Sterile blade to cut cord | |
| | <input type="checkbox"/> Suction device | |
| | <input type="checkbox"/> Bag and mask | |

| Checklist item | | Qualifying caption |
|--|---|---|
| <input type="checkbox"/> Has an assistant been identified and informed to be ready to help at birth if needed? | | |
| <i>Soon after birth (within 1 hour)</i> | | |
| Is the mother bleeding too much? | <input type="checkbox"/> Yes, shout for help | If blood loss is ≥ 500 mL, or if blood loss is ≥ 250 mL and the mother is severely anaemic, massage the uterus, consider additional uterotonic drugs, start an intravenous line, and treat the cause |
| | <input type="checkbox"/> No | |
| Does the mother need to start antibiotics? | <input type="checkbox"/> Yes, given | Give antibiotics if the placenta is manually removed, or if the temperature is $\geq 38^\circ\text{C}$ and any of the following are present: foul-smelling vaginal discharge, lower abdominal tenderness, rupture of membranes longer than 18 hours at time of delivery, <i>or</i> labour longer than 24 hours at time of delivery |
| | <input type="checkbox"/> No | |
| Does the mother need to start magnesium sulphate? | <input type="checkbox"/> Yes, given | Give if (1) diastolic blood pressure is ≥ 110 mmHg and 3+ proteinuria, <i>or</i> (2) diastolic blood pressure is ≥ 90 mmHg and 2+ proteinuria, and any of the following: severe headache, visual disturbance <i>or</i> epigastric pain |
| | <input type="checkbox"/> No | |
| Does the baby need a referral? | <input type="checkbox"/> Yes, organised | According to the healthcare facility's criteria |
| | <input type="checkbox"/> No | |
| Does the baby need to start antibiotics? | <input type="checkbox"/> Yes, given | Give these if antibiotics were given to the mother, or if the baby has any of the following: breathing too fast (> 60 breaths/minute) or too slow (< 30 breaths/minute), chest in-drawing, grunting, convulsions, no movement on stimulation, <i>or</i> too cold (temperature $< 35^\circ\text{C}$ and not rising after warming) or too hot (temperature $> 38^\circ\text{C}$) |
| | <input type="checkbox"/> No | |
| <input type="checkbox"/> Does the baby need special care and monitoring? | | Recommended if more than 1 month early, birth weight < 2500 grams, needs antibiotics, <i>or</i> required resuscitation |
| Does the baby need to start an antiretroviral drug? | <input type="checkbox"/> Yes, given | Give antiretroviral drug if the mother is HIV positive |
| | <input type="checkbox"/> No | |
| <input type="checkbox"/> Started breastfeeding and skin-to-skin contact (if mother and baby are well)? | | |
| <input type="checkbox"/> Confirm that the mother or companion will call for help if: | | The mother has bleeding, severe abdominal pain, severe headache, visual disturbance, breathing difficulty, fever/chills, <i>or</i> difficulty emptying bladder |
| | | The baby has fast breathing or difficulty breathing, fever or is unusually cold, stops feeding well, is less active than normal, <i>or</i> the whole body becomes yellow |
| <i>Before discharge</i> | | |
| Is the mother's bleeding controlled? | <input type="checkbox"/> Yes | |
| | <input type="checkbox"/> No, treat and delay discharge | |
| Does the mother need to start antibiotics? | <input type="checkbox"/> Yes, given | Give if the temperature is $> 38^\circ\text{C}$ and any of the following: chills, foul-smelling vaginal discharge, <i>or</i> lower abdominal tenderness |
| | <input type="checkbox"/> No | |
| Does the baby need to start antibiotics? | <input type="checkbox"/> Yes, give antibiotics, delay discharge, and give special care or refer | Give if the baby is breathing too fast (> 60 breaths/minute) or too slow (< 30 breaths/minute), or if there is chest in-drawing, grunting, convulsions, no movement on stimulation, too cold (temperature $< 35^\circ\text{C}$ and not rising after warming) or too hot (temperature $> 38^\circ\text{C}$), has stopped breastfeeding well, <i>or</i> there is umbilical redness extending to the skin or draining pus |
| | <input type="checkbox"/> No | |
| Is the baby feeding well? | <input type="checkbox"/> Yes | |

| Checklist item | Qualifying caption |
|--|---|
| <input type="checkbox"/> No, help and delay discharge | |
| <input type="checkbox"/> Family planning options discussed and offered to mother | |
| <input type="checkbox"/> Confirm that the mother or companion will call for help after discharge if: | The mother has bleeding, severe abdominal pain, severe headache, visual disturbance, breathing difficulty, fever/chills, or difficulty emptying bladder |
| | The baby has fast breathing or difficulty breathing, fever or is unusually cold, stops feeding well, is less active than normal, or the whole body becomes yellow |
| <input type="checkbox"/> Follow-up arranged for mother and baby | |

are adhered to in order to reduce or eliminate the sources and spread of infection (see Section 1.2).

Situations in which equipment, treatment rooms and delivery beds are covered in dirt, old blood and rat droppings, with goats and pigs wandering freely through the grounds and rats nesting in incubators and other equipment (all of which can be seen in resource-limited settings in public health facilities) are unacceptable and a source of infection. It is important to understand the reasons why women are developing serious wound infections post Caesarean section, which include, for example, over-crowded recovery rooms, with beds and surroundings not cleaned properly for months.

Washing hands between patients and after all invasive procedures is one of the infection control procedures that is of paramount importance, as dirty hands play a large part in spreading infection. Facilities for handwashing (i.e. a basin and clean towels), plus the availability of soap and water, are essential within any ward or healthcare facility.

It is also extremely important to ensure that any equipment used for the care of patients is cleaned after every use, with anything broken being replaced or mended. It is also necessary for the equipment to be stored in a clean and tidy area, so that it does not become contaminated when not in use. This will ensure that vital equipment is kept clean and in working order, ready to be used safely at any time.

An example of a situation where the above basic minimum standards are not met is the absence of clean oxygen tubing with nasal cannulae to help a baby to survive, and only dirty equipment available, with nothing to thoroughly clean it. There is then the dilemma of whether to use the unclean equipment with the associated severe risk of infection to the sick infant.

The environment in which women and babies are cared for also needs to be regularly cleaned. This includes regular cleaning of trolleys, bedding and sanitation facilities. Omission of these tasks will lead to the harbouring of infection, whether this is through direct or indirect contact or by the attraction of flies and mosquitoes to dirty surfaces or pools of fluid.

It is appreciated that, in some healthcare facilities, cleaning solutions (e.g. disinfectant) can be difficult to obtain because of lack of supplies or their cost making them unavailable. Using basic soap and water or even just cooled boiled water is better than not cleaning at all, and will remove microorganisms and the organic matter on which they thrive.

Instruments and other equipment that penetrates skin or mucous membranes or enters the vascular system or sterile spaces needs to be free of viable microorganisms, including viruses and bacterial spores. This is achieved by sterilising the equipment, usually in a hot oven or autoclave. It is important that the healthcare staff maintain the ovens and/or autoclaves in working order. They also need to fully appreciate how the process of sterilisation works. It is not appropriate for instruments to be placed in hot ovens or autoclaves without first cleaning them to remove visible blood and organic debris. Another common mistake is for healthcare staff to remove sterilised instruments and then proceed to cool them off using unsterilised water from the roof or tap.

Healthcare staff should wear protective clothing when indicated, if it is available. This includes new sterile gloves for every invasive procedure, and disposable or cleanable plastic aprons to avoid contamination of uniforms with bodily fluids during messy or potentially messy procedures.

Another extremely important element of infection control is to ensure that healthcare staff have received appropriate training in the disposal of used sharps (e.g. needles) into sharps boxes. The process for removal of these full sharps boxes from the health facility, and their incineration, also needs to be clear and robust, to prevent contaminated sharps from ending up on the local village dump, where children often scavenge and play.

Physical safety

The safety of the physical environment in which women and their babies are cared for is also very important, and staff need to give this full consideration. Broken beds and equipment can be dangerous. The former may collapse, and the latter may have sharp edges that can cause a wound. Babies can fall off high surfaces if these are not guarded.

Respectful and compassionate care

A good midwife or healthcare worker will treat every woman, irrespective of her personal circumstances, with compassion and respect. Pregnancy, labour, delivery and the postnatal period can all be anxious times for a woman. It is at these times that guiding, supportive and empathetic care is required. It is completely unacceptable within any society for women to be verbally and physically assaulted by their carers. Fellow staff should never tolerate this type of behaviour from colleagues towards women.

Good care will involve providing full, understandable explanations of any required interventions to the woman and her family, with the woman giving her consent to those interventions.

When in labour, women often find the intense pain of contractions easier to bear if they can be upright and moving about. This position is also better physiologically, as it promotes the progress of labour and promotes the well-being of the fetus. In most cases this is the position which should be encouraged until delivery is imminent. The position for delivery should, where possible, be the one that the woman prefers (e.g. upright or squatting), but this will also be dictated by the type of delivery and the degree of observation of the mother and her baby that is required. Women should not be instructed by their carers to lie flat on a hard trolley for almost their entire labour, as there is no necessity for them to do so, and this position is detrimental to the progress of labour and to the well-being of the fetus.

It is also important during labour and delivery to ensure that the basic care needs of women for a comfortable, safe environment are met. Light food and drinking water need to be available, with intake of water encouraged throughout labour to prevent dehydration. Ideally a relative or friend should be able to stay with the woman during labour and delivery to provide emotional support throughout. However, this may not always be possible in the very cramped, busy delivery wards that exist in some countries. If this is the case, there is all the more need for caring, empathetic staff. Strong analgesics for pain relief during labour may be unavailable in developing countries, and therefore these women often require greater resilience and coping skills, so encouragement and support from healthcare staff and the family is crucial throughout this time.

Skilled and competent staff

Management of emergencies

All midwives, traditional birth attendants and healthcare staff who provide maternity care need training to recognise what is normal and what is abnormal for both the mother and the fetus/neonate. Healthcare workers should know how to manage emergency situations relevant to their level of knowledge, and when and who to call for help.

In many areas within resource-limited countries there is no accessible surgical or anaesthetic care, and the nurse-midwife may well be the last point of referral. The nurse-midwife therefore needs to be trained and competent in all emergency procedures that may need to be performed within the environment in which they work. These emergency procedures are described in more detail within the relevant sections of this book.

General care

In the antenatal period, it will be the midwives' responsibility to ensure through physical examination, fetal heart auscultation, blood pressure monitoring, urinalysis, and screening for and treatment of anaemia that the pregnancy is progressing satisfactorily (see Section 2.1). WHO recommends 4 routine antenatal visits: <16, 24–28, 30–32 and 36–38 weeks gestation, and more frequently if at any stage it is identified as a high-risk pregnancy. During the pregnancy it may be necessary for the midwife to initiate treatment and follow up any problems that are discovered (e.g. anaemia, hypertension, infections).

When a woman goes into established labour her well-being and progress should be regularly monitored by either the traditional birth attendant or ideally a skilled birth attendant. This monitoring should include a 4-hourly check of the blood pressure and body temperature, a half-hourly check of the maternal pulse and fetal heart rate, and vaginal examination 4-hourly in the first stage of labour to check that the labour is progressing appropriately. During labour, the woman should be encouraged to void urine at regular intervals and as a minimum every 4 hours to avoid having an overfull bladder which could impede descent of the fetus through the birth canal. For poor progress in labour, amniotomy and/or careful augmentation with oxytocin may be indicated.

All observations that are recorded in labour should be recorded on a WHO partograph. Use of the partograph will help healthcare staff to recognise poor labour progress and/or observations of concern.

Fetal heart auscultation with a Pinard's stethoscope or portable Doppler ultrasound device (e.g. a Sonicaid) also needs to occur regularly, although the required frequency of the latter in the first stage of labour will be determined by the availability of facilities for performing an urgent Caesarean section for fetal distress. Once the second stage of labour has been reached the woman will usually start to experience the urge to push, and the midwife should encourage pushing in normal labour once this urge is sufficiently intense. Vaginal examinations should then occur at least hourly to assess progress if delivery is not imminent. At this stage it can be possible to deliver the fetus more rapidly (if the fetal heart rate is indicating signs of distress) by using episiotomy, forceps or ventouse. The second stage of labour can be particularly stressful for the fetus and therefore in the second stage the fetal heart should be auscultated at least every 15 minutes to determine signs of distress that would necessitate an accelerated delivery.

During delivery, the nurse-midwife needs to assist the woman in having a controlled delivery in order to avoid perineal trauma and/or harm to the newborn child. Active management of the third stage of labour by a skilled birth attendant with oxytocin is essential. Sterile delivery equipment needs to be available. At the very least in the community for the traditional birth attendant this should include a sterile instrument to cut the cord, with a sterile cord clamp and/or ties.

As previously stated, the healthcare worker needs to be constantly alert for any deviation of labour and delivery away from the normal (e.g. premature delivery, twin delivery, haemorrhage, hypertension, etc.), so that care can be adapted accordingly and emergency assistance sought if it is required and available.

The healthcare worker needs to be able to perform basic resuscitation of the newborn if this is required at delivery. Therefore bag-valve-mask resuscitation equipment needs to be readily available to healthcare staff trained in its use, including traditional birth attendants.

In addition, during the postnatal period the healthcare worker will need to ensure that they have the skills and knowledge necessary to provide appropriate care for the mother and child. This will include monitoring the progress of both mother and child, again being able to recognise the abnormal and initiate and/or provide the appropriate care to address any problems. The healthcare worker will need to be able to give all necessary advice to the mother and her

family on her postnatal recovery and childcare, including advice and support with infant feeding.

Health education and promotion

The midwife or healthcare worker should use every interaction she has with the woman and her family throughout pregnancy, labour and the postnatal period as an opportunity to provide health advice, promote good health and deliver education. This should include antenatal education and information on the recognition of danger signs occurring at any stage during the pregnancy and in the postnatal period, including haemorrhage, abdominal pain, reduced fetal movements, severe headache and any other signs and symptoms of pre-eclampsia, and the immediate action to take when these signs occur. The healthcare worker also needs to provide education on parenting and childcare, again with advice on recognising abnormalities in the child, in order to seek appropriate medical advice. There will also be an ideal opportunity to give family planning advice and advice on the necessary immunisations,

prophylactic treatments and available health screening for the whole family.

Critical incident audit and feedback to improve perinatal and maternal mortality and morbidity

There is little doubt that this is a vital activity that should be undertaken on a regular basis, and that resources and time must be made available for this. Effective methods of preventing maternal and perinatal mortality are available, but the systems of care that should ensure they are put in place are frequently impaired. Critical incident reviews are potentially a simple cost-effective way of defining the local problems and pointing the way to local solutions.

Further reading

Pattinson RC, Say L, Makin JD et al. (2005) Critical incident audit and feedback to improve perinatal and maternal mortality and morbidity. *Cochrane Database of Systematic Reviews*, Issue 4. Art. No.: CD002961. DOI: 10.1002/14651858.CD002961.pub2.

2.3

Managing normal labour and delivery

BOX 2.3.1 Minimum standards

- WHO partograph
- Disinfectant cream for vaginal examinations
- Sterile gloves
- Fetal heart monitor (Pinard's or Doppler)
- Oxytocin and a safe way of giving it
- Amniotic hook
- Sterile vaginal speculums
- Postnatal care programmes for mother and baby

Positions for assisting with delivery of the baby

All mothers in labour should be sitting upright or in a lateral or semi-recumbent position (see Figure 2.3.3). They should not lie flat on their back, as this causes compression of the inferior vena cava and aorta, with reduced cardiac output, as well as limited ability to push. They should be encouraged to stand and be mobile for as long as is comfortably possible.

Basic anatomy to aid understanding of the birthing process

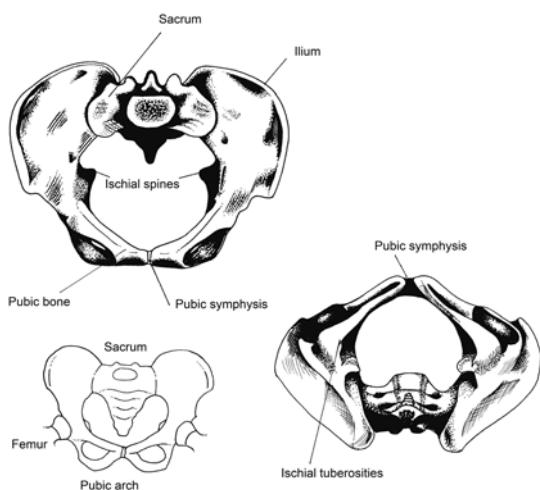


FIGURE 2.3.1 Basic anatomy of the pelvis.

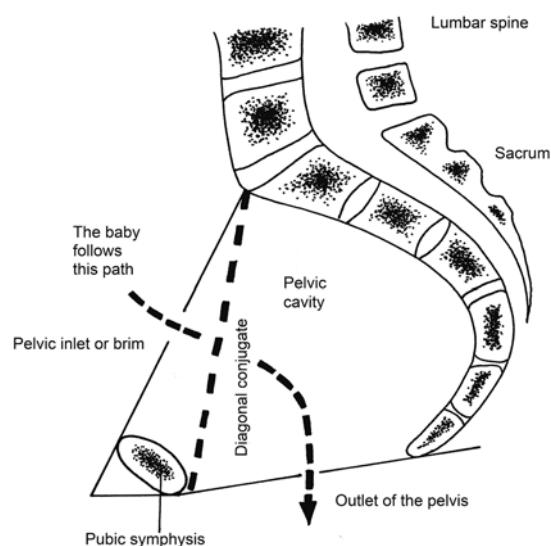


FIGURE 2.3.2 The baby's birth path.

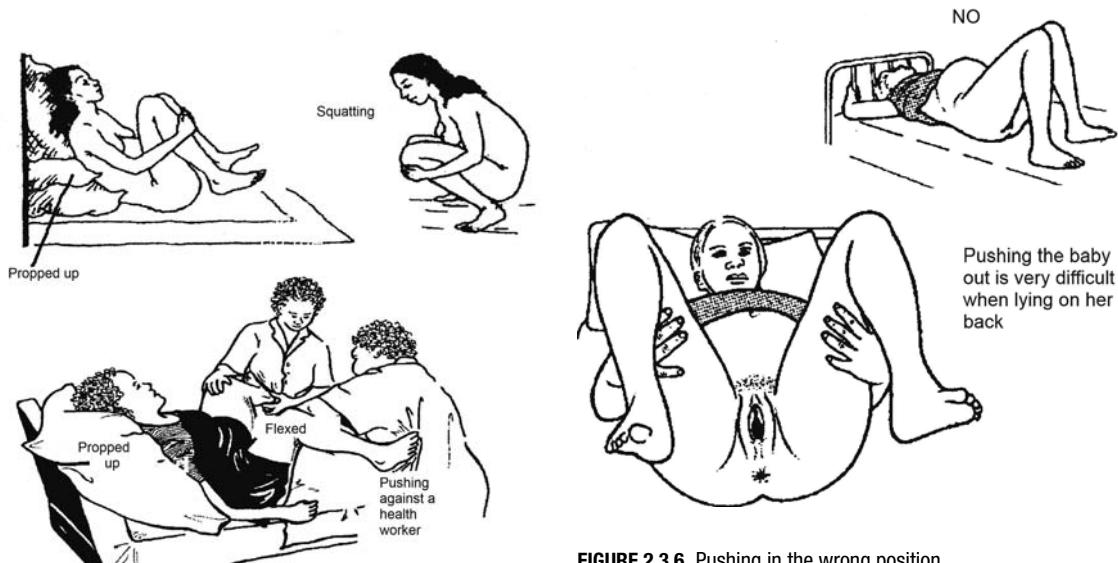


FIGURE 2.3.3 Good positions during the second stage.

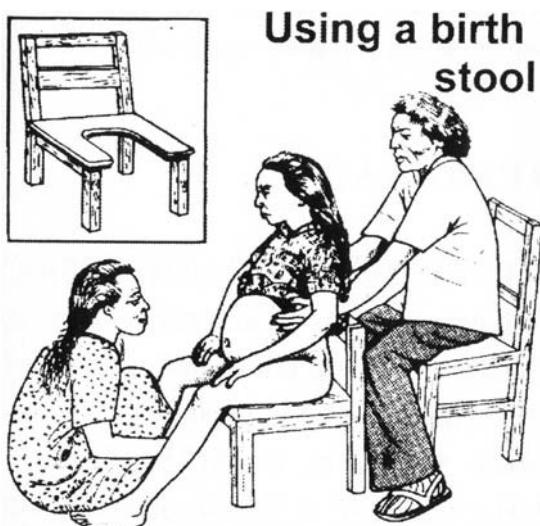


FIGURE 2.3.4 Using a birthing stool.

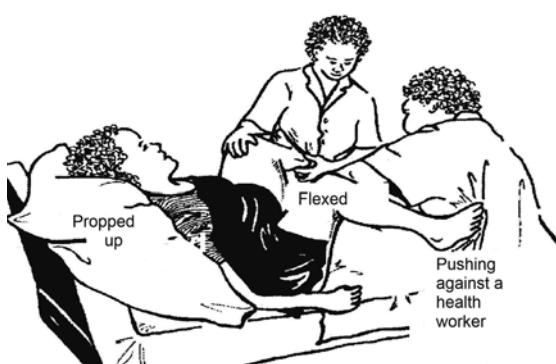


FIGURE 2.3.5 The pushing position, pushing with healthcare worker support.

FIGURE 2.3.6 Pushing in the wrong position.

Figure 2.3.4 shows delivery on a birth stool. A TBA is delivering this mother's baby, and the husband is helping. Sitting up like this helps the uterus to contract, and it also makes it easier for the mother to bear down. In addition, when the mother opens her legs they act as pivots to help to increase the diameter of the pelvis.

The WHO partograph

See World Health Organization (2008) *Managing Prolonged and Obstructed Labour* (http://whqlibdoc.who.int/publications/2008/9789241546669_4_eng.pdf).

The partograph is a graphic record of the progress of labour and relevant details of the mother and fetus. It was initially introduced as an early warning system to detect labour that was not progressing normally. This would allow for timely transfer to occur to a referral centre, for augmentation or Caesarean section as required. The partograph indicates when augmentation is needed, and can point to possible cephalopelvic disproportion before labour becomes obstructed.

It increases the quality and regularity of observations made on the mother and fetus, and it also serves as a one-page visual summary of the relevant details of labour.

The partograph has been used in a number of countries, and has been shown to be effective in preventing prolonged labour, in reducing operative intervention, and in improving the neonatal outcome.

It is important to ensure that adequate supplies of the form are always available.

The WHO partograph begins only in the active phase of labour, when the cervix is 4 cm or more dilated (see below).

However, it is a tool which is only as good as the health-care professional who is using it. The observations that are recorded will document the following:

- **Maternal well-being:** record pulse rate every 30 minutes, blood pressure and temperature 4-hourly, urine output and dipstick testing for protein, ketones (if available) and glucose after voiding, **and** record all fluids and drugs administered. If the findings become abnormal, increased frequency of observation and testing will be required, and intervention may be implemented.

- **Fetal well-being:** record fetal heart rate for 1 minute every 15–30 minutes after a contraction in the first stage, and every 5 minutes in the second stage. If abnormalities are noted, urgent delivery can be considered.
- **Liquor:** clear, meconium stained (thick or thin), bloody or absent. Thick meconium suggests fetal distress, and closer monitoring of the fetus is indicated. Check every 30 minutes.
- **Frequency, duration and strength of uterine contractions (assessed by palpation):** record every 30 minutes.
- **Abdominal examination:** to assess descent of the fetal head.

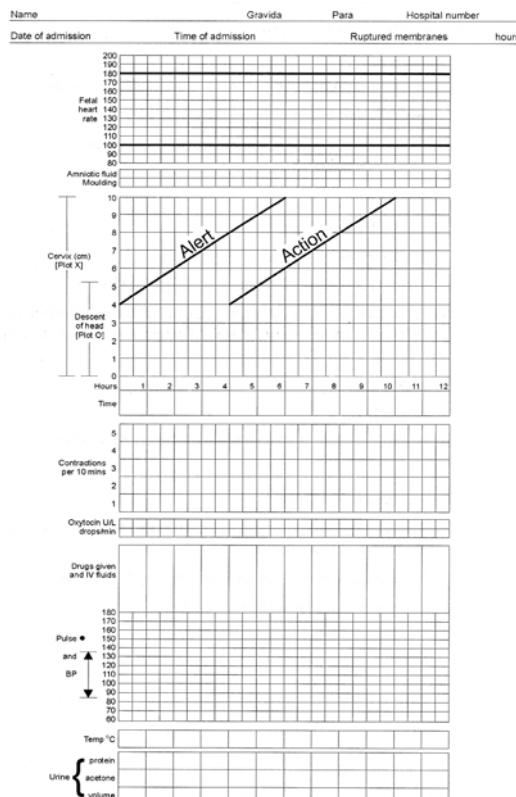


FIGURE 2.3.7 The modified WHO partogram without latent phase.

- **Vaginal examination:** this should be done no less than every 4 hours to assess cervical dilatation, descent of the fetal head, and moulding of skull bones. More frequent examination is only undertaken if indicated.

There must be a team approach, and senior staff must oversee the care of high-risk patients. Ideally there should be one-to one care.

Key to partogram

- **Amniotic fluid:** I = membranes intact, C = membranes ruptured, clear fluid, M = meconium-stained fluid, B = bloodstained fluid.

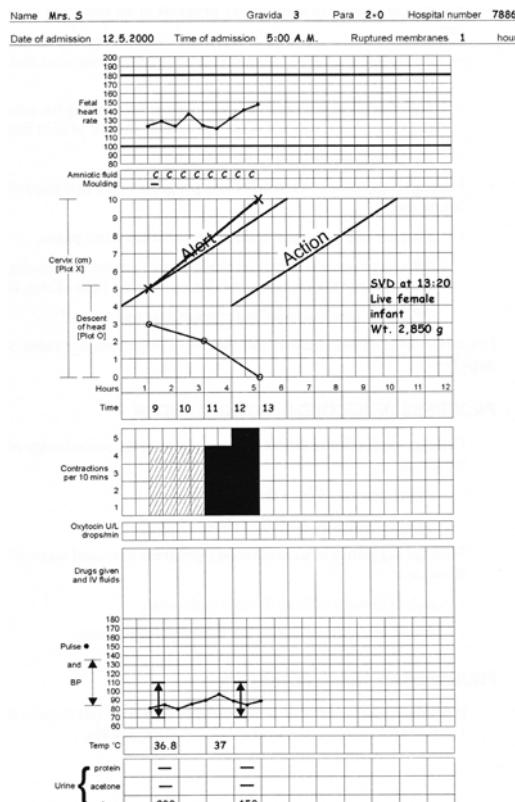


FIGURE 2.3.8 Sample partogram showing normal progression of labour.

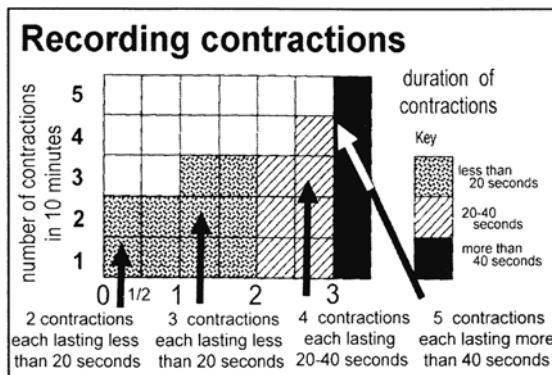


FIGURE 2.3.9 How to record contraction frequency and length. The number of squares filled in records the number of contractions in 10 minutes. The shading shows the length of contractions.

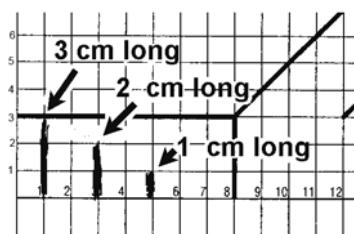


FIGURE 2.3.10 Recording effacement: the length of the cervix. Effacement can be recorded by thickening a line with a pen as shown in the diagram, or 'percentage' effacement can be written in the squares.

- **Moulding:** 0 = bones are separated and sutures can be easily felt; + 1 = bones are just touching each other; + 2 = bones are overlapping but can be reduced; + 3 = bones are severely overlapping and irreducible.
- **Cervical dilatation:** assess at each VE and mark with a cross x. Begin at 4 cm.
- **Alert line:** starting at 4 cm of cervical dilatation, up to the point of expected full dilatation at the rate of 1 cm per hour.
- **Action line:** parallel and 4 hours to the right of the alert line.
- **Descent assessed by abdominal palpation:** this refers to the part of the head (which is divided into five parts) palpable above the symphysis pubis; recorded as a circle (O) at every vaginal examination. At 0/5, the sinciput (S) is at the level of the symphysis pubis.
- **Hours:** this refers to the time elapsed since the onset of the active phase of labour (observed or extrapolated).
- **Time:** record the actual time at 30-minute intervals.
- **Contractions:** chart every 30 minutes; palpate the number of contractions in 10 minutes and their duration in seconds (< 20 seconds, 20–40 seconds, > 40 seconds).
- **Oxytocin:** record the amount (in units) of oxytocin per volume of IV fluids, and the number of drops per minute, every 30 minutes when used.
- **Drugs given:** record any additional drugs given.
- **Pulse:** record every 30 minutes and mark with a dot (•).
- **Blood pressure:** record every 4 hours and mark with arrows, unless the patient has a hypertensive disorder or pre-eclampsia, in which case record every 30 minutes.
- **Temperature:** record every 4 hours.
- **Urine, ketones and volume:** ideally record every time urine is passed.

Maternal condition

Maternal vital sign observations are crucial in labour, in order to detect pre-eclampsia, haemorrhage (accompanied by a rise in heart rate, or, as it worsens, a fall in blood pressure) and sepsis (fever). A fall in blood pressure is usually a late and ominous sign. The pulse rate and respiratory rate are valuable early features of worsening maternal condition.

Fetal condition

The fetal heart rate should be measured every 15 to 30 minutes immediately after a contraction, for 1 minute, with the mother sitting or in the lateral tilt position.

The normal baseline fetal heart rate is 110–160 beats/minute. The fetus's baseline heart rate should remain stable throughout labour. Fetal heart rate accelerations are healthy features, whereas decelerations may suggest fetal compromise. This applies particularly if the decelerations do not recover immediately after the contraction (this is described as a late deceleration). A baseline rate of > 160 beats/minute (tachycardia) or < 110 beats/minute (bradycardia) may indicate fetal distress, as can a rising baseline.

Membranes and liquor

If the membranes are intact, write 'I'.

If the membranes are ruptured:

- if liquor is clear, write 'C'
- if liquor is meconium-stained, write 'M'
- if liquor is absent, write 'A'
- if liquor is bloodstained, write 'BS'.

If liquor is absent, or if there is meconium staining of liquor, draining, fetal distress should be considered and monitored for closely (meconium staining is present in 15–30% of all pregnancies, with a higher prevalence after 41 weeks' gestation).

Moulding of fetal skull bones (see Figure 2.3.11)

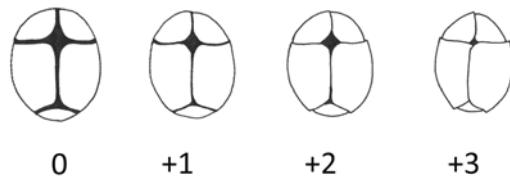


FIGURE 2.3.11 Degrees of moulding of the bones of the fetal skull.

Increasing moulding may be a sign of cephalo-pelvic disproportion, as the fetal skull bones overlap to aid passage through the maternal pelvis.

Key: 0 = bones are separated and sutures can be easily felt, + = bones are just touching each other, ++ = bones are overlapping but can be reduced, +++ = bones are severely overlapping and irreducible.

Stages of labour

Labour is divided into **latent** and **active** phases.

- The **latent phase** is cervical dilatation from 0 cm to 4 cm with gradual shortening of the cervix.
- The **active phase** is cervical dilatation from an effaced 4 cm cervix to full dilatation with good contractions. Progress should be at the rate of at least 1 cm/hour.

Latent stage of labour (0 cm to 4 cm cervical dilatation)

In the latent phase of labour, contractions usually start off as irregular, establishing into regular painful uterine contractions. In the primigravida, this can take up to a few days to occur, but usually takes less time in the multigravida.

The well-being of the mother and fetus in the latent phase should be assessed without unnecessary interventions, and mobilisation should be encouraged. Adequate hydration and nutrition are important, and the woman should be enabled to empty her bladder as required. During this time it is important to check the haemoglobin level and review the notes with regard to possible future problems with delivery.

Unnecessary vaginal examinations in the latent phase can lead to life-threatening infections in the mother and baby.

Active phase of labour

First stage

There should be regular painful contractions, and the cervix should efface and dilate at a rate of about 1 cm/hour from 4 cm to full dilatation (10 cm).

Vaginal examinations during labour must be recorded and only done by those caring for and monitoring the mother. They should not be undertaken more than 4-hourly unless there is a reason for doing so. During such examinations, the use of Hibitane cream or similar disinfectant cream can help to prevent infections. Care should be taken when diagnosing active labour as misdiagnosis can

lead to unnecessary medical intervention and risk to the mother and fetus. The cervix should be 4 cm and effaced and there should be regular contractions. It should be noted that in multiparous women the cervix is often soft and easily stretchable to 4 cm and even beyond. This can be the case in the latent phase and sometimes even before the onset of contractions.

The progress of labour

Measurement of cervical dilatation

Cervical dilatation is assessed by vaginal examination, which should be performed every 4 hours, unless there are indications to do so more frequently.

The cervical dilatation can be plotted on a partograph against time. When the patient is admitted in active labour, the dilatation is immediately plotted on the alert line, the first line drawn upwards on the graph illustrating a rate of 1 cm/hour from this first plot. If subsequent progress is satisfactory, the cervical dilatation will be on, or to the left of, this alert line in later vaginal examinations.

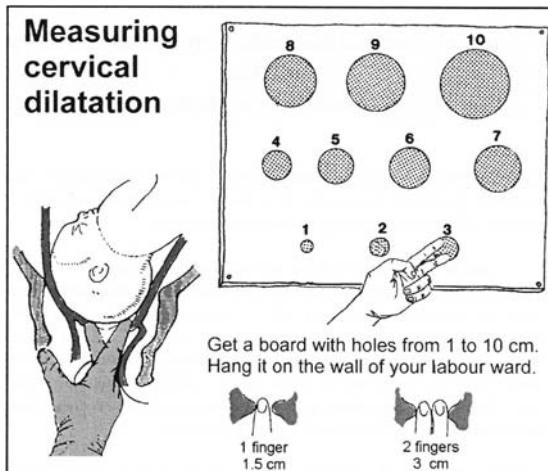


FIGURE 2.3.12 Measuring cervical dilatation. A cervical dilatation board shows the diameter of the cervix from 1 cm to 10 cm.

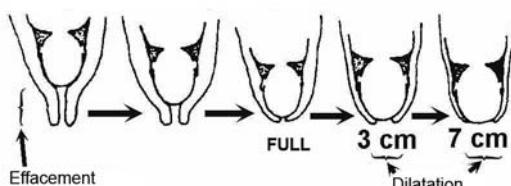


FIGURE 2.3.13 Effacement and dilatation.

Before the onset of labour, the cervix will usually be tubular. Effacement is the process whereby the cervix subsequently loses its length, to become flattened against the fetal presenting part.

In primigravid women, effacement occurs in early labour, followed by cervical dilatation. In multiparous women, the cervix commonly dilates before full effacement.

Diagnosis of the stages and phases of labour

Cervix not dilated = not in labour

Cervix dilated < 4 cm = first stage and latent phase

Cervix dilated 4–9 cm = first stage and active phase (usually 1 cm/hour) and onset of fetal descent
Cervix fully dilated (10 cm) = second stage (non-expulsive phase), no urge to push and fetus continues to descend
Cervix fully dilated (10 cm) = second stage (expulsive phase), urge to push and fetus reaches pelvic floor
Delivery of the baby = Onset of third stage
Delivery of the placenta = End of third stage

Bishop's Score: The early pre-labour/early labour changes that occur to the cervix can be quantified by using the Bishop's score which assigns a score of 0 to 2 for each of the following characteristics: dilatation, effacement, consistency, position of cervix and station of the head (see below). It is useful both for assessing progress in the latent phase of labour, and also for assessing the 'favourability' of the cervix for induction of labour. A patient with a favourable cervix has a Bishop score of 6 or more and is likely to be easier to induce. It should also be possible to rupture the membranes by the time the Bishop score is 6.

| Characteristic | 0 | 1 | 2 | 3 |
|--------------------|-------------|--------|----------|--------------|
| Dilatation | Closed | 1–2 cm | 3–4 cm | 5 cm or more |
| Effacement | >4 cm | 3–4 cm | 1–2 cm | Effaced |
| Consistency | Hard | Medium | Soft | – |
| Station of head | –3 or above | –2 | –1/0 | +1/+2 |
| Position of cervix | Posterior | Mid | Anterior | – |

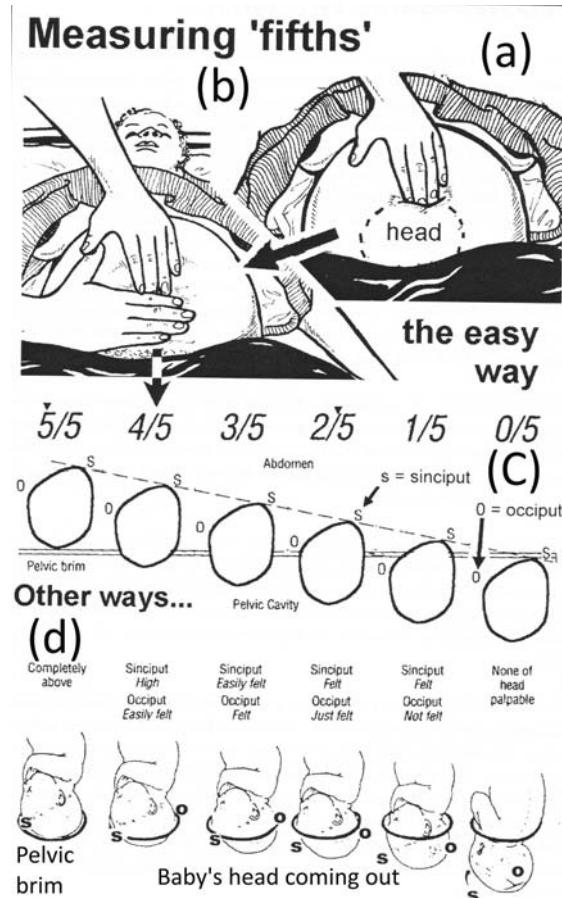


FIGURE 2.3.14 Measuring 'fifths'.

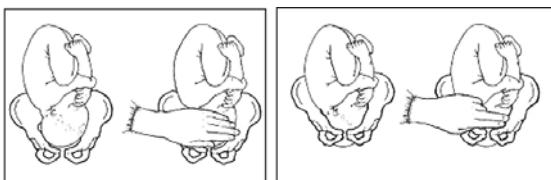


FIGURE 2.3.15 Fetal head descent palpated abdominally showing 4/5 and 2/5.

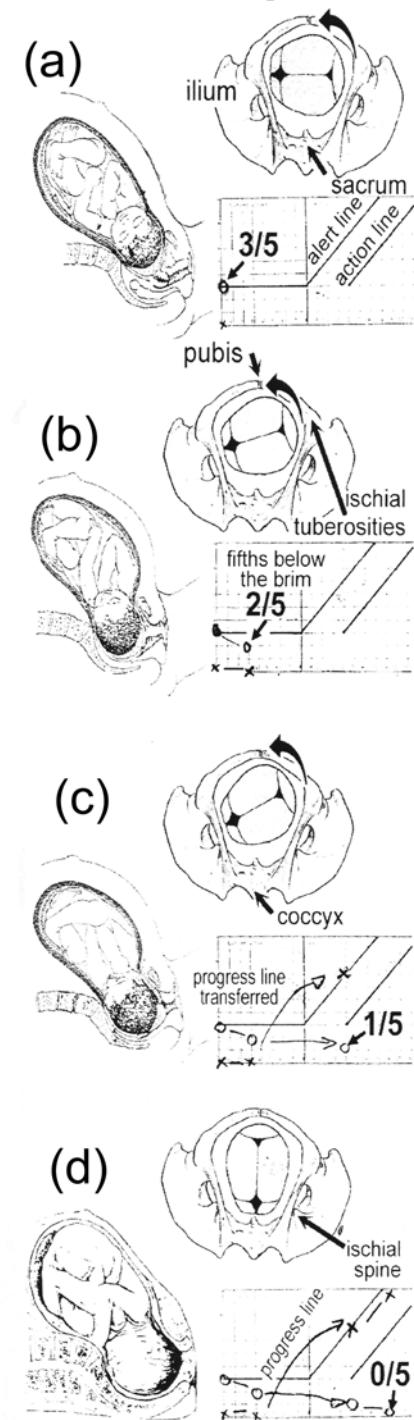


FIGURE 2.3.16 Descending fetal head showing vaginal appearance to palpation. Alongside each picture of the fetus is a view of the head from below and a partogram to show the stage of the mother's labour.

Descent of the fetal head

Dilatation of the cervix should be accompanied by descent of the head, although this may not occur until advanced labour. Sometimes descent does not occur until full dilatation, especially with the pelvis of African women.

The descent of the head is measured in fifths (20% increments) palpable above the pelvic brim.

Abdominal examination should always be performed immediately before vaginal examination, and plotted on the partogram with the cervical dilation.

Assessing fetal descent

By abdominal palpation

This method involves measuring by fifths of the head palpable above the symphysis pubis as described above.

- 5/5: head entirely above the inlet of the pelvis (head totally free)
- 0/5: head deep in the pelvis.

By vaginal examination

This method measures the descent of the head past the mother's ischial spines. When the presenting fetal head is at the level of the spines, this is designated '0'.

Figure 2.3.16a shows the occiput entering the brim of the pelvis on the left side, so the fetus is left occipito-lateral. Later drawings show the occiput moving round to the front so that in (d) it becomes anterior (OA). The mother was admitted soon after labour began. The baby's head is 3/5 palpable, it will soon engage in the pelvis and has started to flex. The membranes are intact, and the cervix is 2 cm long (uneffaced).

In Figure 2.3.16.b, the fetal head is now 2/5 palpable; it is more flexed and has just started to turn towards the front (anteriorly). The cervix is fully effaced but has not begun to dilate. The membranes are still intact.

In Figure 2.3.16.c, the fetal head is now 1/5 palpable; the neck is more flexed and has turned a little more. The cervix is now 7 cm dilated, so the progress line has been transferred to the alert line on the partogram. The membranes are still intact. Until now the mother has been allowed to move and walk about. She has chosen to lie down for delivery.

In Figure 2.3.16.d, the fetal head is 0/5 palpable, the occiput is anterior and the scalp is visible. The mother is almost fully dilated, so the first stage is almost over.

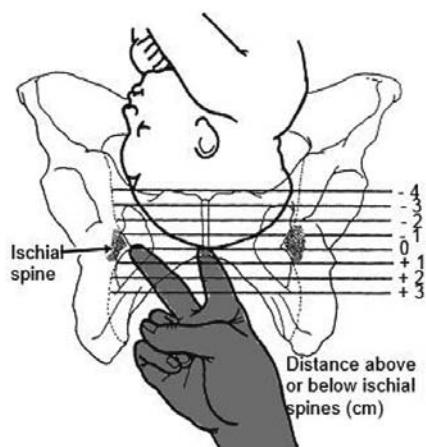


FIGURE 2.3.17 Measuring the descent of the vertex using the ischial spines.

Figure 2.3.17 shows the use of the ischial spines to measure descent of the head. Feel the vertex with your index finger and feel for an ischial spine with your third finger. Is the vertex higher or lower than the ischial spines? You may only be feeling caput. Measuring fifths abdominally is more reliable but can be difficult, especially in obesity.

Uterine contractions

For labour to progress satisfactorily there must be good contractions. They normally become more frequent and longer-lasting as labour progresses.

Uterine contractions are assessed by **palpation**, usually hourly in the latent phase, and every 30 minutes in the active phase. The frequency is measured by the number of contractions felt in a 10-minute period, and the duration is measured from the start of the contraction until it passes off (e.g. 3 in 10 minutes, each lasting for 45 seconds).

Management of the first stage of labour

- 1 Place an IV cannula early on in all high-risk patients.
- 2 If a fever develops give intravenous antibiotics (ampicillin 2 grams IV/IM 6-hourly plus gentamicin 80 mg IV/IM 8-hourly or 5 mg/kg IV/IM once every 24 hours).
- 3 If the first stage is prolonged, consider the following:
 - malpositions or malpresentations
 - pelvis too small or head too big
 - contractions too weak
 - membranes need rupturing (only if there are no malpresentations or malpositions)
 - dehydration, ketosis and/or exhaustion.

Pain control in labour

At present in low resource settings the only safe pharmacological treatment is nitrous oxide plus oxygen. Epidural anaesthesia is effective but requires careful monitoring (unlikely to be available), risks local infection, and can increase the need for Caesarean section. Opiate drugs, such as pethidine and morphine, have many potentially harmful effects on the woman and newborn infant.

Our recommendation is that, where possible, nitrous oxide plus oxygen should be made available for all women who need pain control, particularly the primigravida.

Nitrous oxide plus oxygen

It is recommended that a maximum concentration of 50% nitrous oxide and 50% oxygen should be used.

The labour ward must be adequately ventilated and the mask fit well to avoid contamination of others in the vicinity.

The drug is always self-administered to ensure its safety (if drowsiness occurs, the woman will drop the mask).

It should not be used for more than 24 hours, and can interfere with vitamin B₁₂ metabolism if used continuously rather than intermittently (i.e. only during contractions).

The cylinder must not be mixed up with those containing 100% nitrogen. Nitrous oxide and oxygen mixture (Entonox) is supplied in a blue cylinder with white quadrants on the shoulder, whereas 100% nitrogen is supplied in a plain blue cylinder without white shoulders.

Treatment

The woman should inhale the gas only during painful

contractions. After starting an inhalation, it takes 30 seconds to 1 minute for the nitrous oxide and oxygen mixture to act, and ideally the onset of the contraction should be anticipated, and inhaling started 30 seconds before it begins. Between contractions the mouthpiece or mask should be removed and the woman should breathe normally from room air.

Between patients the mouthpiece or mask must be cleaned and disinfected.

Side effects include drowsiness, dizziness, nausea and vomiting, and buzzing in the ears.

Nitrous oxide and oxygen is contraindicated in patients with impaired consciousness.

It does not modify uterine contractions or cause harm to the neonate.

Prolonged pregnancy

This is defined as a pregnancy that continues for more than 14 days after the expected date of delivery. This is a particularly difficult management issue in low-resource settings, where the dates of the last menstrual period may not be recalled by the time of antenatal presentation, and where early ultrasound scanning during pregnancy is unlikely to have been performed.

Prolonged pregnancy is associated with fetal distress, shoulder dystocia, poor progress in labour, and increased fetal, maternal and neonatal mortality.

If there is reasonable evidence that a patient is at or above 40 weeks' gestation, stretching and sweeping of the membranes in a suitably equipped healthcare facility can be helpful in starting off labour, and may thus avoid the need for formal induction of labour (see below).

Stretching the cervix and sweeping the membranes

First check the fetal position and ensure that the head is not high, and record the fetal heart rate. **If there has been any antepartum haemorrhage this procedure must not be undertaken because of the risk of placenta praevia.** The woman should empty her bladder.

A vaginal examination in the lateral tilt position using sterile gloves coated with an obstetric antiseptic cream (e.g. chlorhexidine) should be undertaken. **If there is any evidence of vaginal infection or spontaneous rupture of membranes, a membrane sweep must not be performed.**

The cervix should be assessed for effacement, whether it is soft or hard, and for dilatation. If there is no cervical dilatation or the head is not at a minimum of -3, then a sweep should not be undertaken.

If the cervix is closed but soft, it may be massaged until it allows the insertion of a finger. Once the cervical os is open (more likely post term), introduce a finger into the cervical os and pass it circumferentially around the cervix. This should separate the membranes and result in the release of local prostaglandins, increasing the likelihood of the onset of labour within 48 hours.

The whole procedure is uncomfortable but afterwards it should produce only slight pain or bleeding with irregular contractions. If pain or bleeding is marked, keep the woman under close observation in the healthcare facility.

The process can be repeated if labour does not start spontaneously after 36 hours.

Induction or enhancement of labour

This may be required if there is prolonged pregnancy, pre-labour prolonged rupture of membranes, placental abruption, or a hypertensive disorder. Ensure induction is indicated, as failed induction is usually followed by Caesarean section.

Artificial rupture of membranes (ARM)

This is undertaken to either induce or augment labour. Induction of labour usually also requires uterotonic drugs.

Slow progress in labour can often be corrected by ARM. However, in areas of high HIV prevalence, leaving the membranes intact for as long as possible may reduce the risk of perinatal transmission.

ARM risks infection and cord prolapse. It is contraindicated where placenta praevia is possible, in the first episode of active herpes infection, and in vasa praevia. It is more risky with a high fetal head or polyhydramnios.

Procedure for ARM

ARM is best delayed until the cervix is 'favourable' as this will reduce the length of time the membranes are ruptured (and hence risk of chorioamnionitis), and limit the duration of any oxytocin infusion used. It is also likely to result in a reduced risk of failed inductions and thus unnecessary caesarian sections. A favourable cervix is one where softening, dilatation and effacement has started to occur, and corresponds to a Bishop score of 6 or more.

It is therefore advised to 'ripen' the cervix with one of the following before ARM: misoprostol, a Foley catheter or an oxytocin infusion (all discussed below), whichever is considered the most appropriate.

- Listen to – and note – the fetal heart rate.
- Ensure that the woman has emptied her bladder.
- Palpate the abdomen. If the presenting part is well descended, cord prolapse is less likely.
- Ideally perform an ultrasound scan to identify the position of the placenta.
- Wearing sterile gloves and with chlorhexidine obstetric cream on your fingers, examine the cervix, and note the consistency, position, effacement and dilatation. Confirm the fetal presentation.
- With the other hand (again with obstetric cream) insert an amniotic hook or a Kocher clamp into the vagina.
- Guide the clamp or hook along the fingers of your first hand towards the membranes in the vagina.
- Place two fingers against the membranes and gently rupture them with the instrument in the other hand. Allow the amniotic fluid to drain slowly around your fingers.
- Check that no cord can be felt.
- Note the colour (clear, yellow, greenish or bloody) and smell of the fluid. If thick meconium is present, suspect fetal distress. Some light bleeding may occur.
- After ARM, listen to the fetal heart during and after a contraction. If the fetal heart rate is abnormal (less than 110 beats/minute or more than 160 beats/minute), suspect fetal distress.
- If delivery has not occurred within 18 hours, give prophylactic antibiotics (IV ampicillin 1 gram 6-hourly plus gentamicin 80 mg IV/IM 8-hourly or 5 mg/kg body weight IV/IM once every 24 hours) in order to help to prevent infection in the baby and the mother. If there are no signs of infection in the mother after delivery, discontinue antibiotics.

- If the liquor is foul smelling or there is a maternal fever or other indication of uterine infection/chorioamnionitis treat with the antibiotics as above but with the addition of metronidazole 500mg IV 8 hourly.
- Regularly monitor vital signs.

Oxytocin infusion

Indications

- If active labour is not established within 2–4 hours after ARM, and only if contractions are weak, begin oxytocin infusion. If there are strong contractions and no progress, look for a reason (e.g. obstructed labour).
- If labour is induced because of severe maternal disease (e.g. sepsis, eclampsia), begin oxytocin infusion at the same time as ARM.

Contraindications

- It is essential that obstructed labour is excluded before oxytocin is administered.
- Use oxytocin with great caution, as fetal distress can occur from hyperstimulation and, rarely, uterine rupture can occur. Multiparous women are at higher risk for uterine rupture (see below).
- Carefully observe all women receiving oxytocin. **They must never be left alone.**
- **Never use oxytocin in a woman or girl who has undergone two or more previous Caesarean sections, or who has a uterine scar for another reason, such as fibroid removal or traumatic uterine rupture.**
- If labour has been progressing and then stops in a multiparous woman there is likely to be a reason for this secondary arrest, such as cephalo-pelvic disproportion or malposition. The use of oxytocin (rather than Caesarean section) in this situation is dangerous, as uterine rupture may occur. However, in low-resource settings this concern has to be balanced against the risks associated with Caesarean section (assuming that this procedure is even available without transfer). We recommend that secondary arrest in a multiparous woman should result in urgent transfer to a facility where Caesarean section can be undertaken.
- Never use oxytocin where a previous classical Caesarean section has been performed. Provide a timed Caesarean section.

Concerns about oxytocin and the need for great care in its use

- If a woman has undergone one previous Caesarean section, the use of oxytocin is associated with a much increased risk of uterine rupture, and these patients must be delivered in a facility where immediate Caesarean section can be performed if required. Oxytocin may, in this latter setting, be used with great care and discontinued when adequate contractions are present.
- If more than four pregnancies after 24 weeks' gestation have been delivered, there is increased risk of uterine rupture. Oxytocin must be used with great care and discontinued when adequate contractions are present.
- Wait before starting oxytocin if misoprostol or another prostaglandin has been given within the previous 8 hours.

Administration of oxytocin

The individually needed effective dose of oxytocin varies greatly; so all patients must be monitored carefully.

Fluids can be calculated in drops per minute. Identify from the IV giving set what the 'drop factor' is (in standard giving sets it may be 10, 15 or 20 drops/1 mL). For micro-drop systems, (with burettes), 1 mL is 60 drops. Set the infusion rate with the flow controller below the chamber where the drops occur, and always count the rate over a full minute.

Cautiously administer oxytocin in IV fluids (Ringer-lactate or Hartmann's solution), gradually increasing the rate of infusion until active labour is established (three contractions in 10 minutes, each lasting more than 40 seconds). Maintain this rate until delivery. The uterus must relax between contractions.

A burette in-line IV giving set (see Figure 2.3.18) can help to prevent too much oxytocin being given.



FIGURE 2.3.18 Burette for safer and more accurate administration of oxytocin.

When oxytocin infusion results in an active labour pattern, maintain the same rate until delivery.

Ensure that the woman is in the left lateral tilt or recovery position.

- Record on a partogram every 30 minutes:
- rate of infusion of oxytocin (note that changes in the woman's arm position may alter the flow rate)
- duration and frequency of contractions
- fetal heart rate: listen every 30 minutes, always immediately after a contraction; if less than 100 beats/minute, stop the infusion.

Monitor pulse, blood pressure and contractions every 30 minutes. Keep a fluid balance chart. Regularly reassess for contraindications.

Details of oxytocin infusion

An ampoule of oxytocin usually contains 5 international units in 1 mL. Insert oxytocin 5 international units (5000 milliunits) in 500mL of Ringer-lactate or Hartmann's solution. The concentration of this solution is 10 milliunits in 1 mL.

Start infusion at 2.5 milliunits/minute (i.e. at 5 drops/minute with a standard giving set with a drop factor of 20 drops/1 mL).

Increase infusion rate by 2.5 milliunits/minute (5 drops/minute using a standard giving set with a drop factor of 20 drops/1 mL) every 30 minutes until a good contraction pattern is established – that is, contractions lasting more than 40 seconds, and occurring 3 times in 10 minutes.

Maintain this rate until delivery is completed.

If there are not three contractions in 10 minutes, each lasting more than 40 seconds, with the infusion rate at 20 milliunits/minute (40 drops/minute if using a giving set with a drop factor of 20 drops/1 mL):

- In multigravida, further increases may risk uterine

rupture. The reason for this may be cephalo-pelvic disproportion or malposition. Therefore **consider Caesarean section**.

- In the **primigravida**, infuse oxytocin at a higher concentration (rapid escalation).
 - Change to a more concentrated solution with oxytocin 10 international units (10 000 milliunits) in 500mL of Ringer-lactate or Hartmann's at a concentration of 20 milliunits/mL.
 - Give an initial infusion of 20 milliunits/minute (20 drops/minute if using a giving set with a drop factor of 20 drops/1 mL).
 - Increase the infusion rate by 5 milliunits/minute (additional 5 drops/minute if using a giving set with a drop factor of 20 drops/1 mL) every 30 minutes until good contractions are established.
 - **If good contractions are not established at 40 milliunits/minute** (40 drops/minute if using a giving set with a drop factor of 20 drops/1 mL), deliver by Caesarean section.

Do not use oxytocin 10 international units in 500 mL (i.e. 20 milliunits/mL) in multigravida.

If hyperstimulation occurs (i.e. any contractions lasting longer than 60 seconds or more than 4 contractions in 10 minutes), stop the infusion. The half-life of oxytocin is short (between 1 and 5 minutes), and therefore any hyperstimulation should stop with appropriate titration of the dose given. If hyperstimulation resolves, restart oxytocin infusion at half of the last dose given.

Consider terbutaline, 250 micrograms subcutaneously if the uterus does not relax.

Possible side effects of oxytocin infusion

These include the following:

- uterine hyperstimulation (see above).
- hyponatraemia due to water retention from vasopressin-like actions (unlikely if diluted with Ringer-lactate or Hartmann's and more likely with prolonged infusions). Monitor urine output carefully and, if possible, measure plasma sodium concentrations.
- hypotension, flushing and tachycardia if oxytocin is given as a bolus IV by mistake.

The use of oral misoprostol to induce labour

Because of its stability at high room temperatures and low cost, misoprostol is increasingly being used to induce labour, especially in low-resource settings. Close monitoring of uterine contractions is still essential, and misoprostol must not be used if there has been a previous Caesarean section.

Misoprostol is available as a vaginal or oral tablet or an oral solution. The latest Cochrane reviews suggest that oral misoprostol solution is the most appropriate.

Dose of oral misoprostol solution

A single misoprostol tablet is dissolved in drinking water (200-microgram tablet in 200mL of water or 100-microgram tablet in 100mL of water), and 20–25 mL of misoprostol solution (20–25 micrograms) are then given orally every 2 hours. It may be used in women with ruptured membranes, where the oral route has the additional benefit of avoiding vaginal installations with their increased risk of infection. Solutions are stable for up to 24 hours, but should then be discarded. For safety reasons it may be better to discard

unused solutions and make up a 20- to 25-microgram dose every 2 hours. Review progress by a doctor after 100 micrograms have been given although the induction can be continued with further doses if necessary.

When induction of labour is urgent and delivery indicated within a short period of time (e.g. eclampsia) consider increasing the misoprostol dose to 50 micrograms orally every 2 hours. This may increase the speed of the induction but may also increase the risk of hyperstimulation. The recent Cochrane review recommends an oral dose of 20-25 micrograms and not more than 50 micrograms every 2 hours.

Oral misoprostol tablets

It is possible to cut 100-microgram misoprostol tablets into quarters that are 25 micrograms in size and administer them orally every 2 hours up to a maximum of six doses. However, this is not accurate, and there is a danger of giving an incorrect dosage. The oral misoprostol solution described above is safer.

The use of a Foley catheter to induce labour

An effective alternative to misoprostol is to use a Foley catheter to mechanically 'ripen' the cervix and induce labour. The Foley catheter tip is passed through the cervical os either during a sterile digital examination, or with the use of a sterile/high-level disinfected speculum and forceps. The inflatable bulb is introduced beyond the internal cervical os and then inflated with 10ml of sterile water. The catheter tip is then left in situ for up to 24 hours to allow cervical ripening and contractions to begin. It may fall out in the interim if the cervix dilates adequately. Once removed amniotomy and oxytocin can be commenced if needed.

This method is particularly useful in women at high risk of rupture as it does not risk hyperstimulation.

Delay in the first stage of labour

If progress is initially good, but then slows down or stops, there may be:

- malpositions or malpresentations
- obstructed labour
- an increased risk of shoulder dystocia.

Prolonged active phase (first stage) of labour

If cervical dilatation crosses the alert line, this warns that labour is slow and there may be problems. If possible, transfer the patient to an obstetric unit practicing comprehensive EmOC. If the action line (4 hours to the right according

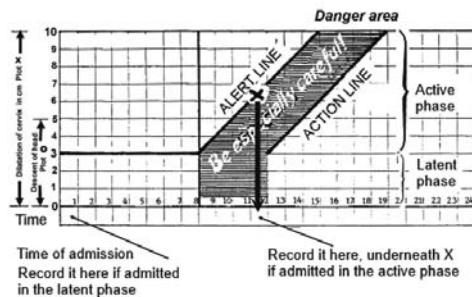


FIGURE 2.3.19 The partogram showing the portion relating to cervical dilatation. The numbers 1 to 24 represent the number of hours since the mother was admitted, but only if she was admitted in the latent phase.

A common mistake

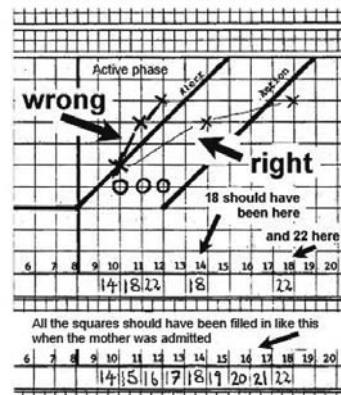


FIGURE 2.3.20 Correct placement of data on the partogram. A common mistake is to put the next record ('x' and 'o') in the next square, and not to allow for the time that elapses between one observation and the next.

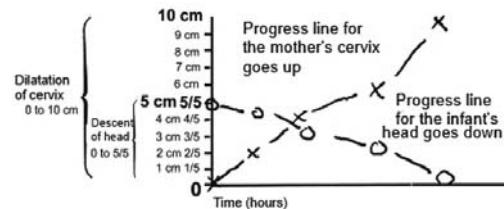


FIGURE 2.3.21 Lines on the partogram.

to the WHO, or 2 hours to the right according to recent evidence from South Africa) is reached, the mother must be reassessed to ascertain the reason for lack of progress and further management determined.

Other complications of the first stage of labour

Urgent help may be required to diagnose and manage cord prolapse (see Section 2.6.G), placental separation (see Section 2.5.D.iii) or ruptured uterus (see Section 2.5.F).

Second stage of labour

This begins when the cervix is fully dilated. Fetal descent occurs, but initially there may be no urge to push usually occurring only when the fetal head reaches the pelvic floor. It may be helpful for the mother to stand up or squat during this time to assist pushing. She must not lie flat on her back. (Note; some patients have an urge to push early in labour with a high head, generally with an occipito-posterior presentation)

Delivery of the baby may be allowed to take 2 hours from full cervical dilatation in the primagravida, and 1 hour in the multigravida, before there is cause for concern. The mother must not push if the cervix is not fully dilated.

During delivery, trauma to the perineum should be minimised. Routine episiotomy is not indicated, but should be performed if significant perineal trauma is anticipated, or to aid more rapid delivery if indicated. Anterior episiotomy/reversal of genital mutilation may be required in some women.

- Episiotomy is recommended for the following:
- complicated vaginal delivery (breech, shoulder dystocia, forceps and some vacuum extractions)
- scarring from female genital mutilation (see above) or poorly healed third- or fourth-degree tears
- fetal distress.

Sometimes contractions become less strong when the cervix becomes fully dilated. After confirming the well-being of the mother and fetus, mobilise the mother, hydrate her orally, including sufficient calories to help to prevent ketosis, and then wait for up to 1 hour for the head to descend. If the mother is unable to tolerate oral fluids, administer IV glucose and fluids. However, be alert for the possibility of cephalo-pelvic disproportion. After 1 hour encourage pushing, provided that the cervix is fully dilated.

Ensure that delivery of the head is controlled so that there is not a sudden release of pressure on it as it delivers (this may damage the neonatal brain).

If there is fetal distress, or delivery has not occurred after 2 hours in a primigravida or 1 hour in a multigravida, assisted vaginal delivery should be considered. A ventouse or forceps may be considered so long as none of the head is palpable per abdomen. **The cervix must be fully dilated.**

Delivery of the baby

- Ask the mother to pant or give only small pushes with contractions.
- Control the birth of the head by placing the fingers of one hand against the baby's head to ensure that it does not deliver too quickly.
- Support the perineum with your other hand as it distends and the head is delivered.
- In low-resource countries, if meconium is present, suck it out of the baby's nose and mouth on the perineum as soon as the head is delivered.
- Call the paediatrician (if available) if you consider that the baby might need resuscitation.
- Once the head is delivered, ask the mother not to push.
- Feel around the baby's neck for the umbilical cord:
 - If it is round the neck but loose, slip it over the baby's head.
 - If it is so tight round the neck that it is preventing delivery of the baby's shoulders, double clamp it and cut it before unwinding it from the neck. Delivery can often be achieved with the cord left in place.
- Allow the baby's head to turn spontaneously.
- After the head has turned, place a hand on each side of the head and ask the mother to push gently without the need to wait for contractions.
- Avoid tears by delivering one shoulder at a time. Routine traction of the baby's head in an axial direction should be used and should result in delivery of the anterior shoulder.
- Lift the baby's head anteriorly to deliver the shoulder that is posterior.
- Support the baby's body as it slides out.
- After delivery of the baby, give the mother 10 units of oxytocin IM to reduce the risk of haemorrhage, **but only do this if the possibility of a second twin has been excluded by earlier ultrasound examination or by abdominal palpation.** Alternatively, 10 units of oxytocin plus 500 micrograms of ergometrine

(called Syntometrine) IM can be given, but never **give ergometrine if the mother has hypertension or pre-eclampsia**, as it can increase blood pressure and cause a cerebrovascular accident.

- Dry the baby, cover with a dry clean towel and assess the baby (see Section 3.1).
- If the baby does not need resuscitation, place on the mother's abdomen for 1 to 3 minutes to provide a transfusion of placental blood to the baby, but keep warm (for details, see Section 3.1).
- Then cut the umbilical cord and place the baby in skin-to-skin contact with the mother, ensuring that the body and head are covered to keep the baby warm. The baby may seek to suck on the breast which should be encouraged.
- If the baby needs resuscitation, cut and clamp the cord immediately, and proceed to open the airway and breathe for the baby (see Section 3.2).
- If the mother is not well, ask an assistant or relative to care for the baby.

Always prepare for the need to resuscitate the baby, especially if there is a history of eclampsia, prolonged or obstructed labour, bleeding, preterm birth or infection. Always have a bag-valve-mask of the right size available next to the mother, and ideally on a Resuscitaire®, in case assisted ventilation is required.

If the head retracts on to the perineum during delivery (the turtle sign), this suggests shoulder dystocia (see Section 2.5.F).

Active management of the third stage of labour

This is advised for preventing postpartum haemorrhage (PPH), and it consists of four possible interventions:

- 1 a prophylactic uterotonic drug after delivery of the shoulders of the baby and after ensuring that another fetus is not present in the uterus
- 2 early cord clamping and cutting
- 3 controlled cord traction
- 4 uterine massage after delivery of the placenta.

Of these, a uterotonic drug (see above), is the most important, with oxytocin the first choice because it causes uterine contraction to prevent atony rapidly with minimal adverse effects. Atony is the most common cause of PPH (around 80% of cases). If oxytocin is unavailable, or does not work, other uterotonic drugs should be used, including ergometrine or misoprostol.

All uterotonic drugs should be given within 1 minute of the complete birth of the fetus, to aid separation of the placenta by enhancing uterine contractions and reducing the risk of bleeding from an atonic (relaxed) uterus. **It is essential that you are certain there is not another fetus in the uterus before such drugs are given.**

Ensure that both oxytocin and ergometrine are protected from heat damage by close attention to the cold chain and their storage, otherwise they may not be effective. Ideally oxytocin should be stored in a fridge, but it can be kept at 15–30°C for 3 months. Oxytocin must never be frozen. Always store ergometrine in a fridge at 2–8°C. Misoprostol is not affected by ambient temperature.

Ergometrine is contraindicated in patients with heart

disease, hypertension, pre-eclampsia or eclampsia, as it raises the blood pressure by vasoconstriction, with the risk of cerebrovascular accidents.

Early cord clamping and cutting (the second intervention listed above) as part of the active management of the third stage of labour is no longer recommended unless the infant needs resuscitation (see above).

Controlled cord traction (the third intervention listed above) is optional where delivery is undertaken by a skilled birth attendant, but contraindicated if a skilled attendant is not available. It must not be undertaken if a uterotonic drug has not been given.

- 1 After the cord has been clamped, use cord clamp/straight clamp to hold the cord close to the perineum.
- 2 Place the other hand just above the pubis, and counter the uterus during traction of the cord to prevent it from inverting (see Figure 2.3.22).
- 3 Keep slight tension on the cord and wait for a uterine contraction.
- 4 When the uterus becomes rounded or the cord lengthens, assume that the placenta has separated, and pull gently down on the cord to deliver the placenta. Do not wait for or expect a gush of blood before applying traction. Continue to apply counter traction on the uterus with your other hand.
- 5 If the placenta does not descend and deliver within 1 minute of cord traction the placenta is not separating. Therefore stop traction, wait for the next contraction and repeat the process.
- 6 As the placenta delivers, the membranes can tear off. To avoid this, hold the placenta in two hands and gently turn it until the membranes are twisted.
- 7 Gently pull to complete the delivery.
- 8 If the membranes do tear, wearing sterile gloves gently examine the upper vagina and cervix and use a sterile sponge forceps to remove any fragments of membrane that are present.
- 9 If the cord is pulled off the placenta, uterine contractions may still push it out, but if this does not happen a manual removal may be needed (see Section 2.13).
- 10 If the uterus is inverted, push it back immediately (see Section 2.6.H).

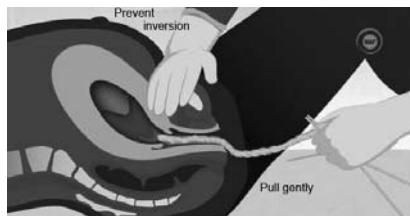


FIGURE 2.3.22 Controlled cord traction for active management of the third stage. Reproduced with the permission of Medical Aid Films, www.medicalaidfilms.org

In Figure 2.3.22 the operator's right hand is holding back the uterus while traction is applied to the cord.

Strong uterine massage (the fourth intervention listed above) should always be undertaken immediately after delivery of the placenta, until the uterus is contracted and remains so. Check the state of contraction of the uterus every 15 minutes for 2 hours, and repeat the massage if at any time the uterus becomes soft and relaxed.

All postpartum women and girls must be closely

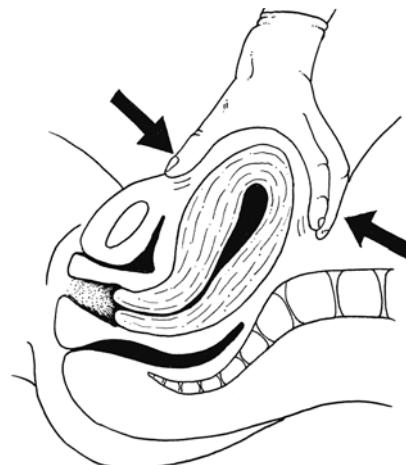


FIGURE 2.3.23 Strong massage applied to cause uterus to contract.

monitored to ensure that PPH does not occur. They should be examined every 15 minutes for the first hour after delivery, and then every 4 hours until 24 hours after delivery.

In order to prevent PPH during or after Caesarean section, oxytocin plus cord contraction is recommended in preference to manual removal of the placenta.

Expectant management of the third stage of labour if uterotonic drugs are not available

Unfortunately, it is not uncommon for hospitals to run out of uterotonic drugs. In this avoidable and dangerous situation, expectant/physiological management should be undertaken.

- 1 Place the baby on the mother's breast.
- 2 Leave the cord alone.
- 3 Observe for the following signs of placental separation:
 - the uterus becomes more rounded and contracted
 - there is lengthening of the cord at the introitus
 - the mother feels uncomfortable, feels a contraction and wants to 'bear down'.
- 4 Deliver the placenta.
 - Sit the mother upright
 - Encourage her to bear down with a contraction (only after separation of the placenta).
 - Catch the placenta. If membranes are dragging behind, gently twist a few turns and with slight traction and an up-and-down movement deliver the placenta plus the membranes.

Most placentas separate within 1 hour after birth. If this does not happen, seek help.

Controlled cord traction should not be undertaken prior to the separation of the placenta in the absence of uterotonic drugs.

Monitoring after the placenta has been delivered by active or expectant management

Monitor the patient's vital signs, blood pressure, pulse rate and volume, and the state of the uterus (is it contracted?) every 15 minutes for 2 hours after delivery of the placenta.

Examine the placenta for completeness.

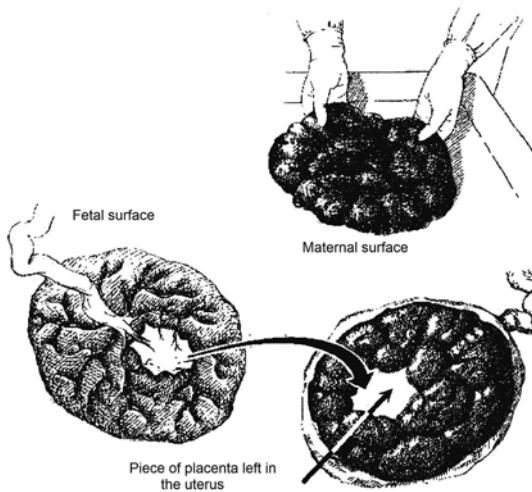


FIGURE 2.3.24 Examining the placenta in a sink. In this case the fetal and maternal surfaces show a piece missing, which has probably been left in the uterus.

Checking the placenta

Check that the placenta and membranes are intact. If they are not, there are retained products of conception which may pass spontaneously or that may need to be removed manually through the vagina.

Checking for tears

Examine the patient for tears in the cervix or vagina, and repair these as well as any episiotomy (see Section 2.13).

Skin-to-skin contact between mother and baby

If neither the mother nor the baby need resuscitation, ensure that the newborn baby is placed in skin-to-skin contact with the mother for at least 1 hour after birth, and encourage and support the baby to attach to and suck on the breast.

This approach recommended by the Baby Friendly Hospital Initiative (step 4) improves temperature control and respiratory function, increases milk production and helps to ensure weight gain for the baby.

Vitamin A for all recently delivered mothers

High-dose vitamin A should be avoided during pregnancy because of the risk of birth defects. A single dose of 200 000 units should be given to all postpartum mothers within 6 weeks of delivery, when the likelihood of pregnancy is very low, and when infants benefit most from its presence in breast milk.

Discharge of mothers and their babies from hospital after uncomplicated deliveries

In high resource settings there is evidence of lower economic costs associated with early discharge (e.g. at 6 hours after delivery compared with 48 hours). However, there is no conclusive evidence for or against the policy of early postnatal discharge in resource-limited healthcare facilities. Care should be taken when extrapolating the results of studies from countries with good socio-economic conditions to communities where resources are scarce. Consideration should also be given to different settings even within the same country (e.g. urban versus rural settings), and the cultural contexts in which the trials are conducted.

Postnatal care for mothers and their babies in resource-limited settings

In resource-limited African settings, 50% of postnatal maternal deaths occur in the first week after birth, with the majority occurring in the first 24 hours. The two most important causes of postnatal maternal death are PPH and puerperal sepsis. Mothers who are HIV positive are most at risk.

One in four deaths in childhood occurs during the neonatal period. Birth asphyxia is the most common cause, and occurs on day 1. Preterm babies most commonly die during the first week of life, and neonatal sepsis is most common after 7 days, especially in low-birth-weight/preterm babies. The origins and markers of many long-term childhood development problems occur or are seen in the first 6 weeks of life.

Despite a lack of research, mothers and their babies should remain in hospital for at least 24 hours after birth in low resource settings in order to ensure that breastfeeding is established and that any complications in the mother and baby are identified and treated. Those with high risk factors should remain in hospital for longer, and before going home all mothers should be trained to recognise danger signs in themselves and their babies.

The WHO has produced a landmark paper on postnatal care in Africa, and Tables 2.3.1 and 2.3.2 summarise their advice.

When and how many postnatal visits should occur?

The optimum number and timing of postnatal care (PNC) visits, especially in resource-limited settings, is a subject of debate. Although no large-scale systematic reviews have been conducted to determine this protocol, three or four postnatal visits have been suggested. Early visits are crucial because the majority of maternal and newborn deaths occur during the first week, most frequently on the first day, and this period is also the key time for promoting healthy behaviours. Each country should make decisions based on the local context and existing care provision, including who can deliver the PNC package and where it can be delivered.

The following information is offered as a guide.

First contact

If the mother is in a healthcare facility, she and her baby should be assessed within 1 hour of birth and again before discharge. Encouraging women to stay in the facility for 24 hours, especially after a complicated birth, should be considered. If birth occurs at home, the first visit should target the crucial first 24 hours after birth.

Follow-up contacts

These are recommended at least at 2–3 days, 6–7 days and 6 weeks after birth.

Extra contacts

Babies who need extra care (LBW babies or those whose mothers are HIV-positive) should have two or three visits in addition to the routine visits.

Where should postnatal care be provided and by whom?

The supervision and integration of postnatal care packages is essential.

TABLE 2.3.1 Routine postnatal care (PNC): What, when, where and who?

| What should be routine postnatal care? |
|---|
| Preventive care practices and routine assessments to identify and manage or refer complications for both mother and baby, including the following: |
| Essential routine PNC for all mothers |
| <ol style="list-style-type: none"> 1 Assess and check for bleeding; check temperature. 2 Support breastfeeding, checking the breasts and advising how to prevent mastitis. 3 Manage anaemia, promote nutrition and insecticide-treated bed nets, and give vitamin A supplementation. 4 Complete tetanus toxoid immunisation, if required. 5 Provide counselling and a range of options for family planning. 6 Refer for complications such as bleeding, infections or postnatal depression. 7 Counsel on danger signs and home care. |
| Essential routine PNC for all newborns |
| <ol style="list-style-type: none"> 1 Assess for danger signs, measure and record weight, and check temperature and feeding. 2 Support optimal feeding practices, particularly exclusive breastfeeding. 3 Promote hygiene and good skin, eye and cord care. 4 If prophylactic eye care is local policy and has not been given, it is still effective up to 12 hours after birth. 5 Promote clean dry cord care. 6 Identify superficial skin infections, such as pus draining from the umbilicus, redness extending from the umbilicus to the skin, more than 10 skin pustules, and swelling, redness and hardness of the skin, and treat or refer if the baby also has danger signs. 7 Ensure warmth by delaying the baby's first bath until after the first 24 hours, practising skin-to-skin care, and putting a hat on the baby. 8 Encourage and facilitate birth registration. 9 Refer the baby for routine immunisations. 10 Counsel on danger signs and home care. |
| Extra care for low-birth-weight (LBW) or small babies and other vulnerable babies, such as those born to HIV-infected mothers (two or three extra visits) |
| The majority of newborn deaths occur in LBW babies, many of whom are preterm. Intensive care is not needed to save the majority of these babies. Around one-third could be saved with simple care, including the following: |
| <ol style="list-style-type: none"> 1 Identify the small baby. 2 Assess for danger signs and manage or refer as appropriate. 3 Provide extra support for breastfeeding, including expressing milk and cup feeding, if needed. 4 Pay extra attention to warmth promotion, such as skin-to-skin care or kangaroo mother care. 5 Ensure early identification and rapid referral of babies who are unable to breastfeed or accept expressed breast milk. 6 Provide extra care for babies whose mothers are HIV-positive, particularly for feeding support (see Section 2.8.C). |

TABLE 2.3.2 Early identification and referral or management of emergencies for mother and baby

| |
|--|
| Appropriate detection and management or referral is necessary to save the mother and the baby in the event of life-threatening complications. |
| Danger signs for the mother |
| <ol style="list-style-type: none"> 1 Excessive bleeding. 2 Foul-smelling vaginal discharge. 3 Fever with or without chills. 4 Severe abdominal pain. 5 Excessive tiredness or breathlessness. 6 Swollen hands, face and legs with severe headaches or blurred vision. 7 Painful engorged breasts or sore cracked bleeding nipples. |
| Danger signs for the baby |
| <ol style="list-style-type: none"> 1 Convulsions. 2 Movement only when stimulated, or no movement even when stimulated. 3 Not feeding well. 4 Fast breathing (more than 60 breaths/minute), grunting or severe chest in-drawing. 5 Fever (above 38°C). 6 Low body temperature (below 35.5°C). 7 Very small baby (less than 1500 grams or born more than 2 months early). 8 Bleeding. |

At the hospital

This is more likely if the mother gives birth in hospital, but even then women and babies do not necessarily receive an effective PNC contact before discharge from the health-care facility, and even if the mother comes to hospital for the birth, she may not return during the first few days after discharge. Where a waiting home is available, the mother and baby could remain there until it is considered safe for them to go home.

Through outreach services:

- 1 A skilled provider can visit the home to offer PNC to the mother and baby.
- 2 Home visits from a specially trained community health worker (CHW) linking to the hospital or other healthcare facilities for referral as required.
- 3 A combination of care in the healthcare facility and at home. PNC may be provided in the hospital following childbirth, and at home during the crucial first 2–3 days, with subsequent visits to a healthcare facility or clinic at 6–7 days and 6 weeks after the birth, when the mother is better able to leave her home.

Further reading

World Health Organization. Reproductive Health Library of videos on YouTube: www.youtube.com/user/WHOHL

World Health Organization and UNICEF. *Baby Friendly Hospital Initiative*: www.unicef.org/babyfriendly/; www.unicef.org/newsline/tensteps.htm

World Health Organization (2006) *Opportunities for Africa's Newborns: Practical data, policy and programmatic support for newborn care in Africa*: www.who.int/pmnch/media/publications/canfullreport.pdf

2.4**Pathways of care summarising the diagnosis of complications of pregnancy or delivery**

(Please note that in all conditions included the presenting symptoms and clinical signs may be atypical and therefore diagnosis more difficult.)

2.4.A Abdominal pain in early pregnancy**TABLE 2.4.A.1 Abdominal pain due to obstetric or gynaecological causes**

| Presenting symptoms | Clinical signs on presentation | Investigations | Diagnosis | Treatment |
|---|---|--|---|--|
| Lower abdominal pain, intermittent and very sharp Vomiting | Mass in lower abdomen or on vaginal examination Warning: when performing a vaginal examination in a patient with abdominal pain who may be pregnant, consider ectopic pregnancy | Pregnancy test is helpful in early pregnancy | Ovarian cyst which may become twisted (consider torsion if there is severe pain and vomiting) | Consider surgery if this is safe and available |
| Lower abdominal pain Signs of early pregnancy: tiredness, nausea and/or vomiting (especially in the early morning), breast swelling, increased urinary frequency Light vaginal bleeding (takes > 5 minutes for clean pad to be soaked) Shoulder pain Fainting if ruptured Amenorrhoea with perhaps only one missed period Rectal pain | Shock if ruptured (pale, sweating, fast heart rate > 100 beats/minute), weak pulse volume, low blood pressure (systolic < 90 mmHg), drowsy, irritable, unconscious) Caution must be exercised when performing a vaginal examination if an ectopic pregnancy is possible, because of the risk of rupture during and due to the examination Vaginal examination may show signs of early pregnancy (soft uterus), closed cervix, light bleeding, tender mass in one fornix, tenderness with cervical movement | Pregnancy test positive Ultrasound | Ectopic pregnancy which may be ruptured | Prepare operating theatre for immediate salpingectomy Treat shock Group and cross-match 4–6 units of blood |
| Pelvic pain Pain on intercourse Vaginal discharge | Fever Tender lower abdomen Tender on vaginal examination but do not undertake this if ectopic pregnancy is a possibility | Raised white blood cell count Ultrasound High vaginal swab for microscopy, culture and sensitivity | Pelvic inflammatory disease | Antibiotics IV if severe: metronidazole plus: either a macrolide such as erythromycin or azithromycin or doxycycline or ofloxacin |
| Lower abdominal pain History of termination of pregnancy attempted (may not be given even if this has occurred) Vaginal bleeding | Fever Vaginal bleeding (moderate to heavy) Purulent vaginal discharge If very severe, peritonitis (see above) | White blood cell count Haemoglobin Blood culture | Septic abortion | Treat shock IV antibiotics May need an intervention such as manual vacuum aspiration to remove infected products of conception, or even hysterectomy (after stabilisation) |

TABLE 2.4.A.2 Abdominal pain due to coincidental causes

| Presenting symptoms | Clinical signs on presentation | Investigations | Diagnosis | Treatment |
|---|---|--|--------------------|--|
| Lower abdominal pain Nausea and/or vomiting Anorexia Constipation may occur | Low-grade fever ($> 37.5^{\circ}\text{C}$) Tenderness of the right iliac fossa, sometimes with rebound Tender in the right iliac fossa on rectal examination (care is needed if ectopic pregnancy is a possibility) | Pregnancy test Raised white blood cell count Ultrasound if skilled | Acute appendicitis | Appendicectomy |
| Severe abdominal pain Vomiting | High fever Abdominal distension Rigid abdomen Absent bowel sounds Shock (see above for signs) | | Peritonitis | Treat shock IV antibiotics Nasogastric tube Immediate laparotomy in operating theatre |
| Pain on passing urine Increased frequency of passing urine Nocturia | Fever (unusual) | Microscope urine Stick tests for infection (if available) Urine culture and sensitivity (if available) | Cystitis | Antibiotics by mouth |
| Pain in the lower abdomen or loin Nausea and/or vomiting Increased frequency of passing urine with or without dysuria Rigors | High fever Tenderness of one of the loins over the kidney Normal bowel sounds | Microscope urine Stick tests for infection (if available) Urine culture and sensitivity (if available) | Pyelonephritis | IV antibiotics (IV gentamicin if patient has rigors or is shocked) In the case of shock, initiate immediate treatment |

2.4.B Abdominal pain in late pregnancy

TABLE 2.4.B.1 Abdominal pain due to obstetric causes

| Symptoms | Signs | Diagnosis | Investigations | Treatment |
|---|--|--------------------------------|----------------|--|
| Intermittent lower abdominal pain Vaginal fluid loss before 37 weeks' gestation suggesting premature rupture of membranes Light vaginal bleeding* | Palpable uterine contractions Cervical dilatation Check for prolapsed cord if there is rupture of membranes | Possible preterm labour | Partogram | Give two 12 mg doses of betamethasone or dexamethasone IM 12 hours apart Tocolysis only to give time for the steroids to work. Nifedipine 20 mg orally, followed by 20 mg orally after 30 minutes. If contractions persist, therapy can be continued with 20 mg orally every 3–8 hours for 48–72 hours, with a maximum dose of 160 mg/24 hours |
| Intermittent lower abdominal pain Vaginal fluid loss after 37 weeks' gestation suggesting rupture of membranes Light vaginal bleeding | Palpable uterine contractions Cervical dilatation and effacement Check for prolapsed cord if there is rupture of membranes | Term labour | Partogram | See Section 2.3 |

(continued)

| Symptoms | Signs | Diagnosis | Investigations | Treatment |
|---|---|---|--|---|
| Lower abdominal pain, intermittent and very sharp | Mass in lower abdomen or on vaginal examination. Difficult to feel in pregnancy per abdomen or per vagina as the uterus is enlarged | Ovarian cyst which may become twisted (this is very rare in late pregnancy) | Ultrasound | May need laparotomy |
| Severe constant abdominal pain Light or heavy vaginal bleeding* Fetal movements stop | Shock Tense and very tender uterus on abdominal examination Fetal distress or absent fetal heart | Placental abruption | Ultrasound | Call for surgical and anaesthetic help Left lateral tilt or recovery position IV fluid boluses for shock Cross-match 4 units of blood and freeze-dried plasma if available Deliver fetus as soon as possible if alive |
| There is a change (usually during labour) from intermittent labour contractions to a constant pain which may become less after rupture has occurred Sometimes there is an oxytocin drip in place Vaginal bleeding which may be light or heavy History of a previous Caesarean section or other operation on the uterus | Shock Abdominal distension Tender over the uterus, with more easily palpated fetal parts Absent fetal movements and heart sounds | Ruptured uterus | Ultrasound may help diagnosis, but must not delay laparotomy | Call for surgical and anaesthetic help Treat shock if present Cross-match 4 units of blood and freeze-dried plasma if available Prepare theatre for laparotomy after patient is stable |
| Foul-smelling watery vaginal discharge Lower abdominal pain Premature labour or premature rupture of membranes Light vaginal bleeding | Fever Tender over the lower abdomen and uterus Possible fetal distress | Chorio-amnionitis | White blood cell count Blood culture Discharge for microscopy, culture and sensitivity | IV antibiotics before urgent delivery, whatever the gestational age: Ampicillin 2 g IV every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours |
| Purulent, foul-smelling lochia Lower abdominal pain Light vaginal bleeding | Fever Tender uterus Shock | Endometritis after birth (puerperal sepsis) | Raised white blood cell count Blood culture Lochia for microscopy, culture and sensitivity | Treat shock IV antibiotics: Ampicillin 2 g IV every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours |

(continued)

| Symptoms | Signs | Diagnosis | Investigations | Treatment |
|---|---|--|---|---|
| Lower abdominal pain Rare in late pregnancy, but may present postnatally | Swinging fever Swelling in adnexa or pouch of Douglas Tender uterus Ultrasound | Pelvic abscess | Raised white blood cell count Blood culture Pus for microscopy, culture and sensitivity | IV antibiotics: Ampicillin 2 g IV every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours Surgical drainage |
| Upper abdominal pain | Headache Visual disturbance Oedema | Severe pre-eclampsia with impending eclampsia | Raised blood pressure Protein in urine > ++ | Magnesium sulphate Urgent delivery of fetus |

* Light bleeding is defined as taking longer than 5 minutes for a clean pad or cloth to become soaked. Heavy bleeding is defined as taking less than 5 minutes for a clean pad or cloth to become soaked.

TABLE 2.4.B.2 Abdominal pain due to coincidental causes

| Symptoms | Signs | Diagnosis | Investigations | Treatment |
|---|--|-----------------------|--|---|
| Lower abdominal pain Nausea and/or vomiting Anorexia | Low-grade fever (> 37.5°C) Tenderness of the right iliac fossa, sometimes with rebound Tender in the right iliac fossa on rectal examination | Appendicitis | White blood cell count elevated Ultrasound if skilled | Appendicectomy |
| Severe abdominal pain Vomiting | High fever Abdominal distension Rigid abdomen Absent bowel sounds Shock (see above for signs) | Peritonitis | | Treat shock Consider immediate laparotomy: call surgeon and anaesthetist and prepare operating theatre IV antibiotics: Ampicillin 2 g IV every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours Nasogastric tube on open drainage Immediate laparotomy in operating theatre |
| Pain on passing urine Increased frequency of passing urine Nocturia | Rarely fever | Cystitis | Microscope urine Stick tests for infection (if available) Urine culture and sensitivity if available | Oral antibiotics |
| Pain in the lower abdomen or loin Nausea and/or vomiting Increased frequency of passing urine | High fever Tenderness in one of the loins over the kidney Normal bowel sounds | Pyelonephritis | Microscope urine Stick tests for infection (if available) Urine culture and sensitivity if possible | Ampicillin 2 g IV every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours |

2.4.C Vaginal bleeding in early pregnancy

In all cases a pregnancy test must be performed.

TABLE 2.4.C.1 Vaginal bleeding in early pregnancy

| Symptoms | Signs | Diagnosis | Treatment |
|--|--|---------------------------------|--|
| Light bleeding Cramping lower abdominal pain | Closed cervix | Threatened miscarriage | Wait and see |
| Light bleeding Abdominal pain, shoulder tip pain and/or rectal pain Feeling faint on standing up, or fainting | Shock Vaginal examination should be undertaken carefully (<i>see</i> Section 2.5.D.i) | Ectopic pregnancy | See Section 2.5.D.i |
| Heavy bleeding No history of products of conception passed Cramping lower abdominal pain | Dilated cervix Tender uterus that corresponds to dates Shock if bleeding is severe Severe anaemia if bleeding is prolonged | Inevitable miscarriage | Cross-match blood and freeze-dried plasma if available Treat shock if present Evacuate products of conception (ideally by manual vacuum aspiration) Give iron if the patient has anaemia |
| Light bleeding Mild cramping lower abdominal pain History of products of conception passed | Closed cervix Soft uterus that is smaller than expected for dates | Complete miscarriage | Check haemoglobin levels Give iron if the patient has anaemia |
| Heavy bleeding Nausea and/or vomiting Cramping lower abdominal pain Passage of some products of conception which look like grapes | Dilated cervix Soft uterus, larger than expected for dates | Molar pregnancy | Evacuate products of conception (ideally by manual vacuum aspiration). If symptoms persist and there is continued vaginal bleeding, repeat urine pregnancy test Measure HCG levels if possible Screen for pre-eclampsia (measure blood pressure, and urine for protein) Follow up for abnormal bleeding; if it occurs, perform a vaginal examination, ultrasound scan and measurement of HCG levels |
| A history of pregnancy and self-induced abortion may or may not be given Lower abdominal pain Prolonged light to heavy bleeding | Lower abdominal tenderness Foul-smelling vaginal discharge Pus coming from the cervix Fever Tender uterus with pain on moving the cervix Shock due to haemorrhage and/or sepsis | Induced abortion with infection | Treat shock if present IV antibiotics: Ampicillin 2 gram IV loading dose, then 1 gram IV every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours until the patient has been fever-free for 48 hours Manual vacuum aspiration (risk of uterine perforation): only when pulse and blood pressure are improving and after 24 hours of appropriate IV antibiotics and good urine output of > 30 mL/hour Correct DIC if there is a blood clotting disorder If the patient remains shocked after resuscitation and/or heavy vaginal bleeding continues, they will need earlier surgery After ensuring that there are no vaginal or cervical injuries, irrigate the vagina with sterile normal saline, Ringer-lactate or Hartmann's solution to remove any herbs or caustic substances that may have been used to induce the abortion |

(continued)

| Symptoms | Signs | Diagnosis | Treatment |
|---|--|---|--|
| A history of pregnancy and self-induced abortion may or may not be given Lower abdominal pain Prolonged light to heavy bleeding Severe abdominal pain Urinary or faecal incontinence. Faecal discharge from vagina | Severe abdominal tenderness with rigid abdomen and ileus if there is peritonitis Foul-smelling vaginal discharge Pus coming from the cervix Fever Tender uterus with pain on moving cervix Shock due to haemorrhage and/or sepsis | Induced abortion with injuries to genital tract and to bowel or bladder | Stabilise if shocked Laparotomy to repair injuries Manual vacuum aspiration (high risk of uterine perforation) after checking that there are no tears in the vagina or cervix which need repair Appropriate IV antibiotics as above |
| | | | |
| | | | |

Light bleeding is defined as taking longer than 5 minutes for a clean pad or cloth to become soaked. Heavy bleeding is defined as taking less than 5 minutes for a clean pad or cloth to become soaked.

2.4.D Vaginal bleeding in late pregnancy

TABLE 2.4.D.1 Vaginal bleeding in late pregnancy

| Symptoms | Clinical signs | Diagnosis | Treatment |
|---|---|---------------------|--|
| Severe constant abdominal pain Light or heavy vaginal bleeding Reduced fetal movements | Shock Tense and tender uterus on abdominal examination Fetal distress or absent fetal heart rate | Placental abruption | Call for surgical and anaesthetic help Left lateral tilt or recovery position IV fluid boluses for shock Cross-match 4 units of blood and freeze-dried plasma if available Deliver fetus as soon as possible if viable, either by inducing labour or by Caesarean section |
| Vaginal bleeding which can be light or very heavy Bleeding can be precipitated by intercourse or artificial rupture of membranes No pain | Soft uterus Presenting part may be higher than expected Fetus may be distressed, non-viable or uncompromised with normal movements and normal fetal heart rate pattern Ultrasound will show placenta praevia Do not undertake digital vaginal examination, as this may precipitate massive bleeding which can be fatal Shock may be present, depending on the severity of bleeding and its duration | Placenta praevia | Call for surgical and anaesthetic help Treat shock if present If preterm and not bleeding too heavily, give steroids, admit for bed rest, and only perform a Caesarean section if there is a further bleed Cross-match ideally 4 units of blood |
| Usually a change from intermittent labour contractions to constant pain Oxytocin may be being used to augment contractions Vaginal bleeding which may be light or heavy History of a previous Caesarean section or other surgery on the uterus | Shock (especially an increasing heart rate detected ideally on partograph) Abdominal distension Tender over uterus, with more easily palpable fetal parts Absent fetal movements and heart sounds | Ruptured uterus | Call for surgical and anaesthetic help Treat shock if present Cross-match ideally 4 units of blood Prepare theatre for laparotomy while resuscitating the patient |

(continued)

| Symptoms | Clinical signs | Diagnosis | Treatment |
|---|---|---|---|
| Heavy vaginal and other bleeding | Bleeding from sites in addition to the vagina Signs of other conditions that may be responsible, such as: <ul style="list-style-type: none">● placental abruption● pre-eclampsia or eclampsia (high blood pressure and proteinuria)● retained dead fetus● septicaemia, including intrauterine sepsis● incompatible blood transfusion● amniotic fluid embolism | Coagulation failure | Fresh blood transfusion Blood products such as platelets, fresh-frozen plasma and cryoprecipitate if available |
| Light vaginal bleeding Bleeding can be precipitated by intercourse or artificial rupture of membranes No pain | Fetal distress or death | Vasa praevia (placental blood vessels lying in the membranes and in front of the baby's head) | If diagnosed by ultrasound before labour, plan for Caesarean section |

2.4.E Vaginal bleeding after delivery

TABLE 2.4.E.1 Vaginal bleeding after delivery

| Symptoms | Signs | Possible diagnosis |
|--|---|---|
| Immediate heavy bleeding after birth | Uterus soft and not contracted | Atonic uterus |
| Immediate heavy bleeding after birth | Uterus contracted | Trauma to cervix, vagina or perineum |
| Bleeding which may be light if clot is blocking cervix | Placenta not delivered within 30 minutes of birth | Retained placenta |
| Bleeding which is usually light but continues for many hours | Portion of placenta missing Uterus contracted | Retained placental parts |
| Bleeding for > 24 hours | Portion of placenta missing Foul-smelling lochia may be present Fever may be present Severe anaemia | Retained placental parts with or without infection |
| Lower abdominal pain of varying intensity Immediate but usually light bleeding | Uterus not felt on abdominal palpation Inverted uterus may be seen at vulva Bradycardia may be present Shock | Inverted uterus |
| Usually during labour there has been a change from intermittent labour contractions to a constant pain which may become less severe after rupture has occurred Sometimes an oxytocin drip is in place Vaginal bleeding which may be light or heavy History of a previous Caesarean section or other surgery on the uterus | Shock Abdominal distension Tender over uterus | Ruptured uterus (more likely before delivery of the baby) |

2.4.F The diagnosis of breathing difficulties in pregnancy

All of the symptoms and signs may not be present for all of the diagnoses listed in Table 2.4.F.1, and it is difficult to distinguish between some of them; some symptoms

and signs will be a diagnosis of exclusion. It is therefore important to treat the treatable.

TABLE 2.4.F.1 Breathing difficulties in pregnancy

| Symptoms that may be present | Clinical signs that may be present | Diagnosis |
|---|--|---|
| Weakness Tiredness | Pale conjunctiva, nail beds, palms of hands and soles of feet | Severe anaemia |
| Weakness Tiredness Dyspnoea | Signs of severe anaemia Oedema of legs Basal lung crepitations Tachycardia Gallop rhythm Enlarged liver Elevated jugular venous pressure (JVP) | Heart failure due to severe anaemia |
| Dyspnoea | Heart murmur Irregular heart rhythm Oedema of face and legs Basal lung crepitations Tachycardia Gallop rhythm Enlarged liver Elevated JVP | Heart failure due to heart disease |
| Dyspnoea Cough Pleuritic chest pain | Fever Tachypnoea Respiratory distress Reduced air entry Bronchial breathing Pleural rub Rhonchi Crepitations | Acute lower respiratory tract infection (pneumonia) |
| Dyspnoea Cough | Respiratory distress Tachypnoea Wheezing Rhonchi Reduced air entry | Asthma |
| Dyspnoea | Hypertension Proteinuria Oedema of face and legs Basal lung crepitations Tachycardia Gallop rhythm Enlarged liver Elevated JVP | Pulmonary oedema due to hypertension and severe pre-eclampsia |
| Dyspnoea Swelling of the leg Pleuritic chest pain | Tachypnoea Haemoptysis Leg pain/swelling Cyanosis Shock Central chest pain Elevated JVP Pleural rub | Pulmonary embolus |

(continued)

| Symptoms that may be present | Clinical signs that may be present | Diagnosis |
|------------------------------|---|------------------------|
| Collapse Dyspnoea | Shock Apnoea Cardiac arrest Cyanosis Coagulopathy | Amniotic fluid embolus |

2.5

Life-threatening complications of pregnancy and delivery

2.5.A The pregnant woman or girl with shock during pregnancy and the puerperium

Introduction

The pregnant patient who is shocked due to hypovolaemia (the most common cause of shock; see below) will be pale, cold and clammy, have a rapid weak pulse, and may have a reduced conscious level, be confused or be unconscious. If the shock is due to sepsis, the patient's skin may become warm from vasodilatation.

Shock results from an acute failure of circulatory function. Maintenance of adequate tissue perfusion depends on the following:

- a pump (the heart): failure leads to cardiogenic shock
- the correct type and volume of fluid (blood): failure leads to hypovolaemic shock
- controlled vessels (arteries, veins and capillaries): failure leads to distributive shock
- unobstructed flow: failure leads to obstructive shock
- red blood cells: failure leads to dissociative shock.

The most common causes of shock are hypovolaemia from any cause, septicaemia, the effects of trauma and very severe anaemia.

Classification of causes of shock

Common causes are shown in bold type (see Table 2.5.A.1), and all causes are described in more detail in the relevant sections of this book.

Diagnostic pointers

During assessment and resuscitation, a focused history of the previous 24 hours and previous illnesses should be obtained. This may point to the likeliest working diagnosis for emergency treatment.

- A history of vomiting and/or diarrhoea points to **fluid loss**, either externally (e.g. **gastroenteritis**) or into the abdomen (e.g. appendicitis and peritonitis, early stages of gastroenteritis).
- A history of bleeding. This may be vaginal bleeding, or 'silent' bleeding into the abdominal cavity (as in ectopic pregnancy, placental abruption or ruptured uterus).
- Fever or a rash points to **septicaemia**.
- Urticaria, angioneurotic oedema or a history of allergen exposure points to **anaphylaxis**.
- Heart failure points to **severe anaemia** (usually with severe pallor), valve disease or cardiomyopathy.
- A history of sickle-cell disease or diarrhoeal illness and low haemoglobin levels points to **acute haemolysis**.
- **A history of major trauma points to blood loss, and, more rarely, tension pneumothorax, haemothorax, cardiac tamponade or spinal cord transection.**

TABLE 2.5.A.1 Causes of shock

| | |
|---|---|
| Cardiogenic | Arrhythmias Cardiomyopathy Heart failure Cardiac valvular disease Myocardial contusion |
| Hypovolaemic | Haemorrhage Gastroenteritis Volvulus Burns Peritonitis |
| Distributive (relative hypovolaemia) | Septicaemia Anaphylaxis Anaesthesia Spinal cord injury |
| Obstructive | Tension pneumothorax Haemopneumothorax Flail chest Cardiac tamponade Pulmonary embolism |
| Dissociative | Very severe anaemia Carbon monoxide poisoning |

- Severe **tachycardia** or signs of heart failure point to an **arrhythmia** or a cardiomyopathy.
- A history of polyuria, sighing respiration and a very high blood glucose level points to diabetes (see Section 2.7.D on **diabetic ketoacidosis**).
- A history of drug ingestion points to **poisoning**.

Physiology of shock

Shock is defined as an acute failure of circulatory function, leading to impaired delivery of nutrients and oxygen to, and impaired removal of waste products from, the body tissues.

Shock is a progressive syndrome, but its effects can be divided into the following progression.

Phase 1 (compensated) shock

TABLE 2.5.A.2 Compensated shock

| Physiology | Clinical effects |
|---|---|
| Sympathetic reflexes maintain cardiac output by: <ul style="list-style-type: none"> increased systemic arterial resistance decreased blood flow to non-essential organs increased heart rate constriction of the venous reservoir angiotensin and renin release leading to renal preservation of salt and water and reabsorption of intestinal fluid | Normal systolic blood pressure (diastolic blood pressure may be increased due to vasoconstriction) Tachycardia Cool skin and increased capillary refill time Decreased urine output (< 0.5 mL/kg/hour, or < 30 mL/hour in the mother) Confusion/agitation |

Phase 2 (uncompensated) shock

TABLE 2.5.A.3 Uncompensated shock

| Physiology | Clinical effects |
|---|---|
| Failure of compensatory mechanisms with decreased tissue perfusion leading to: <ul style="list-style-type: none"> increased anaerobic metabolism, leading to lactic acidosis acidosis impairs cardiac function and cellular homeostasis, leading to a further decline in cellular metabolic functions inflammatory mediators are released which further impair cell function and vital systems such as the coagulation cascade and platelet function | Hypotension Cold peripheries and markedly increased capillary refill time Acidotic breathing Absent urine output Impaired cerebral function |

Phase 3 (irreversible) shock

The diagnosis of irreversible shock is a retrospective one.

Severe damage to vital organs leads to inevitable death due to diminished energy stores which cannot be replenished even if circulatory function is restored. Therefore early recognition and effective treatment of shock are vital.

- (sometimes) decreased systemic resistance, warm extremities and a wide pulse pressure
- (sometimes) increased systemic resistance with cold extremities and a raised diastolic blood pressure
- hyperpyrexia and hyperventilation
- mental confusion.

All of these signs may be minimal. Mental confusion in particular needs to be looked for carefully, if septic shock is not to be overlooked at this stage. In the group with increased systemic resistance, decreased capillary return is a useful sign in these circumstances.

A pregnant patient may lose 1200–1500 mL of blood before showing obvious signs of shock (20% of circulating blood volume, 6–7 litres). Maternal signs of hypovolaemia are late.

Fetal distress may be the first sign of shock in pregnancy.

Graphs to indicate the progression of shock in relation to clinical signs

Stage 1

At first, with less than 1000 mL of blood loss, there are very few signs and symptoms. The patient may be slightly anxious, and the pulse and respiratory rate are slightly elevated but still within the normal range. Therefore, if this is the first recording taken, you may think it is normal for this particular patient, but it may in fact be abnormal for her (see Figure 2.5.A.1).

Early (compensated) septic shock

This is characterised by the following:

- raised cardiac output with tachycardia

Note that in the anaemic mother the signs may be worse and the risks may be greater earlier than this.

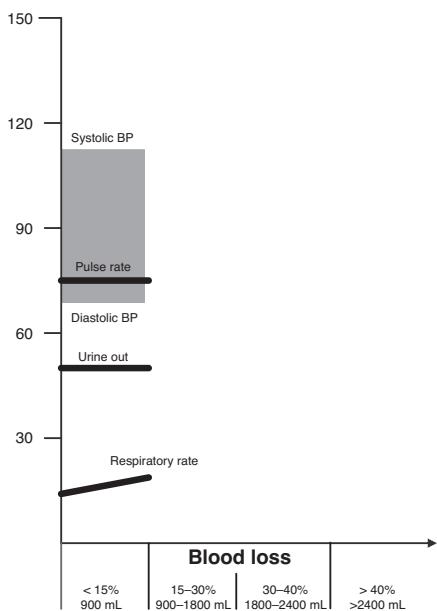


FIGURE 2.5.A.1 Stage 1 shock.

Stage 2

After further blood loss, the perfusion to organs is maintained by the body's stress response. This increases the diastolic pressure, with a resultant reduction in the pulse pressure, and the pulse rate continues to rise, reaching over 100 beats/minute (see Figure 2.5.A.2).

Meanwhile, urine is not being produced and the mother's respiratory rate starts to increase.

Note that in the anaemic mother the signs may be worse and the risks may be greater earlier than this.

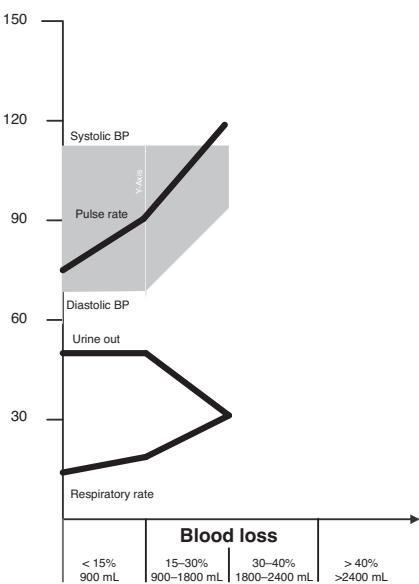


FIGURE 2.5.A.2 Stage 2 shock.

Stage 3

When 2000mL of blood have been lost, a drop in blood pressure is observed, along with other signs and symptoms of hypovolaemia. **It must be emphasised that**

hypotension, which is commonly used as an indicator of the severity of blood loss, is in fact a very late sign.

Generally, the pulse rate should be lower than the systolic blood pressure. If the pulse rate is higher than the systolic pressure, the patient is in grave danger (see Figure 2.5.A.3).

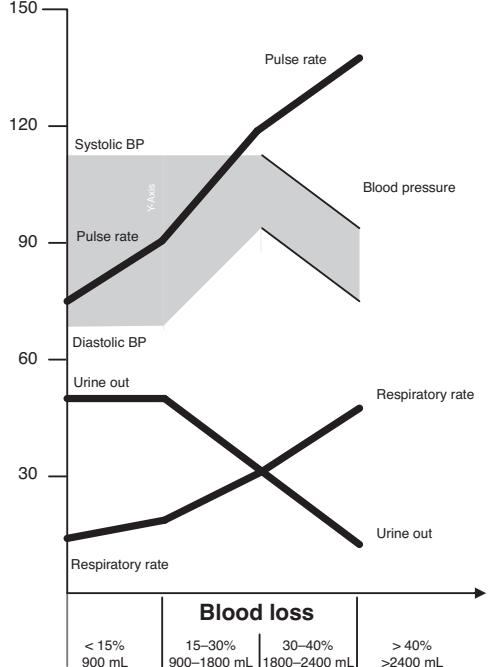


FIGURE 2.5.A.3 Stage 3 shock.

Note that in the anaemic mother the signs may be worse and the risks may be greater earlier than this.

Stage 4

If more than 2000mL of blood are lost, this is an uncompensated very late stage of hypovolaemia, which could very rapidly result in death if emergency measures are not initiated immediately (see Figure 2.5.A.4).

Note that in the anaemic mother the signs may be worse and the risks may be greater earlier than this.

In late (uncompensated) septic shock:

- hypotension occurs as a result of decreased vascular resistance, and even with a normal or raised cardiac output, shock develops
- the cardiac output may fall gradually over several hours, or precipitously within minutes
- as tissue hypoxia develops, plasma lactic acid levels increase
- survival depends on the maintenance of a hyperdynamic state.

Choice of fluid for volume replacement

Crystallloid or colloid fluids are appropriate for volume replacement in shock (see Section 2.8.B).

However, dextrose/glucose infusions (particularly hypotonic ones such as 5% glucose or 0.18% saline in 5% glucose) do not constitute appropriate fluid resuscitation, and can be dangerous because they lower serum sodium levels, which can result in seizures and brain swelling.

Compared with colloids, crystallloid fluids:

- diffuse more readily into the interstitial space

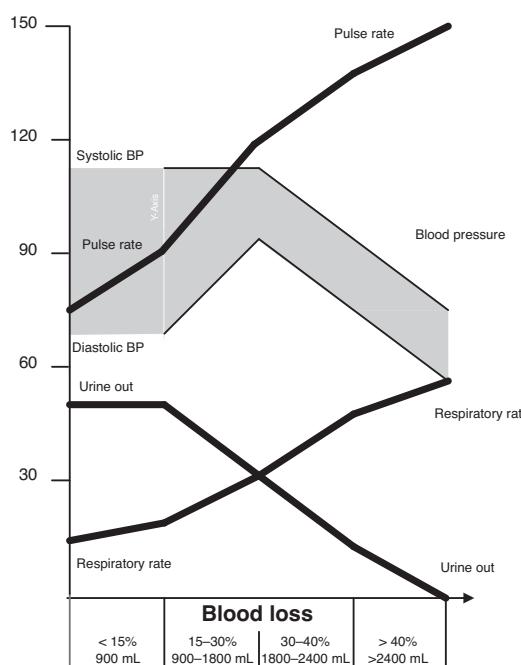


FIGURE 2.5.A.4 Stage 4 shock.

- may be associated with more peripheral oedema
- where capillary leak exists, allow more water to enter the interstitial space, because of the lower osmotic pressure
- need two to three times the volume of colloids to expand the vascular space
- have been reported to be associated with lower mortality.

Nevertheless, the use of both crystalloids and colloids is appropriate, although crystalloids (e.g. Ringer-lactate or Hartmann's solution or normal saline) are more likely to be available.

Choice of crystalloid

The fluid that was traditionally infused into the circulation for the management of shock was normal saline (0.9% sodium chloride). This fluid has increasingly been shown to be dangerous, especially in the sick patient. An infusion of normal saline causes a hyperchloraemic acidosis (a high chloride concentration leading to an acidosis) which, in the shocked patient, who is already acidotic, causes a deterioration in the health of cells in vital organs, even though perfusion of the cells has been improved by the increased circulating volume.

There are sodium-containing alternatives to normal saline that are safer as they approximate more closely to human serum/plasma in content (see Table 1.6.1), although they are slightly more expensive. We recommend the use of either of these alternatives – **Ringer-lactate and Hartmann's solution**, which are widely available – for all fluid replacement. Hospitals are advised to change their standard crystalloid from 0.9% ('normal') saline to Ringer-lactate or Hartmann's solutions as soon as possible.

As not all hospitals will have access to these solutions immediately, there may sometimes be no alternative but to start fluid replacement with normal saline. However, if more than 20 mL/kg needs to be given, then one of the safer alternatives should be used in very sick patients if at all possible.

Blood

If there is significant blood loss or pre-existing severe anaemia in the face of any blood loss, blood will be needed. Full cross-matching takes about 1 hour to perform. For urgent need, type-specific non-cross-matched blood (which is ABO- and rhesus-compatible, but has a higher incidence of transfusion reactions) takes about 15 minutes to prepare. In dire emergencies, O-negative blood must be given.

Fluids should be warmed, especially if they are needed in large volumes. In the absence of heaters, bags of fluid or blood can be warmed by placing them under the clothes next to the skin of a relative. Even this takes time, and another method is to pass the tubing of an IV set through a bowl containing warm water.

Primary assessment and resuscitation

Suspect or anticipate shock if at least one of the following is present:

- bleeding in early pregnancy (e.g. miscarriage, induced abortion, ectopic pregnancy or molar pregnancy)
- bleeding in late pregnancy or labour (e.g. placenta praevia, abruptio placentae, ruptured uterus)
- bleeding after childbirth (e.g. ruptured uterus, uterine atony, tears of genital tract, retained placenta or placental fragments)
- infection (e.g. induced or septic miscarriage/abortion, chorioamnionitis, endometritis, pyelonephritis)
- trauma (e.g. injury to the uterus or bowel during induced abortion, ruptured uterus, tears of the genital tract).

Primary assessment indicating shock

- Fast, weak pulse (≥ 100 –110 beats/minute).
- Pallor (especially of the inner eyelids, palms or around the mouth).
- Sweatiness or cold clammy skin.
- Rapid breathing (> 30 breaths/minute).
- Anxiety, reduced conscious level, confusion or unconsciousness.
- Low blood pressure (systolic pressure less than 90 mmHg is a late sign).
- Reduced urine output (< 30 mL/hour).

Resuscitation

If heavy bleeding is the suspected cause of shock, take simultaneous steps to stop the bleeding. These consist of uterotonic drugs such as oxytocin or misoprostol, uterine massage, bimanual compression, aortic compression and condom catheter, and anti-shock garment in postpartum haemorrhage. Urgent surgical intervention may be required (e.g. for ruptured ectopic pregnancy).

Airway

Try at the same time to stop bleeding by surgical or specific medical treatments as urgently as possible.

- Use an opening manoeuvre if the airway is not open or is partially obstructed. Keep the airway open. If there is improvement but the airway closes without active opening support, consider airway adjuncts to maintain the airway if the patient is unconscious (P or U on the AVPU scale).
- **Suction** if necessary.
- The airway may need to be maintained and protected by **intubation**, using experienced senior help (if available).

Breathing

- Provide a high concentration of oxygen through a face mask with a reservoir bag if there is adequate spontaneous respiration.
- For patients with inadequate ventilation, respiration should be supported with oxygen via a **bag-mask**, and experienced senior help should be summoned (if available).

Circulation

- Gain IV access.
 - Use a short, wide-bore (16- to 18-gauge) IV cannula if possible for IV access.
 - Access via the internal or external jugular veins is a good option if peripheral access is impossible. Long saphenous vein cut-down may also be considered, and the new intraosseous drill can be used if all else fails (see Section 8.4.B).
 - Applying pressure on the site of the bleeding can be valuable in many circumstances, including postpartum haemorrhage (see Section 2.5.D.iv) and external haemorrhage from major trauma.**
 - Try to obtain two vascular access sites to give large volumes quickly, and in case one line is lost.
 - A blood pressure cuff can be used to speed up infusions in emergency situations. Wrap the cuff around the blood/fluid bag and place it inside a non-compressible bag. (see Figure 2.5.A.5).
- Use the left lateral tilt position or recovery position to minimise aortic and vena caval compression, and to reduce the risk of aspiration in patients after 20 weeks' gestation.
- Elevate the legs by raising the foot of the bed.
- Consider using a non-pneumatic anti-shock garment (NASG).
- Give an initial rapid bolus of 500mL to 1 L of Ringer-lactate or Hartmann's solution or blood if the patient is haemorrhaging. A colloid at the same dose can also be given, if available.** It is essential that the bolus is given as rapidly as possible. In the absence of syringe pumps, it should be manually pushed in using a 20- to 50-mL syringe (using a three-way tap and link to an IV giving set).
- Further boluses of 500–1000 mL will usually be required in the first hour. Once more than 2 litres have been given IV, complications such as pulmonary or cerebral oedema may occur. Expert help, including CVP monitoring, is very valuable if it is available.

The concept of 'targeted crystalloid fluid-resuscitation' is important and requires urgent research into shock due to obstetric haemorrhage. Here the initial boluses of IV crystalloids required to treat shock would only be given to keep the vital organs (especially the brain, heart and kidneys) perfused before blood becomes available and, of most importance, surgery and specific medical treatments to stop the bleeding have started to take effect. The administration of too large a volume of IV crystalloids fluids may increase the blood pressure, damage clotting and disrupt early clot formation.

If this approach is used when giving boluses of crystalloid in shock due to bleeding (before blood is available and before procedures undertaken to stop haemorrhage are effective), only the amount necessary to keep the blood

pressure at a level sufficient to perfuse the vital organs is given. There is no clear evidence to indicate the precise blood pressure that should be achieved in a woman in shock due to haemorrhage. However, **adequate perfusion of vital organs** may best be indicated by **a radial pulse which can be palpated and an alert conscious level**. During pregnancy, the adequacy of the fetal heart rate may also be helpful.

Our personal practice, especially in low resource settings, is to start with IV boluses of 500mL of crystalloid and reassess after each bolus, always aiming to stop haemorrhage and obtain blood for transfusion as soon as possible. In situations where there is brisk active blood loss and delay in obtaining blood or effective intervention to halt the bleeding, several boluses of crystalloids may be required. The importance of undertaking measures to halt the bleeding and obtaining blood for transfusion rapidly cannot be overstated.

Tranexamic acid

If bleeding is the cause of shock, this inexpensive and safe drug can be helpful. The drug should be started as soon as possible after the onset of major haemorrhage, in order to be effective.

The loading dose is 1 gram over 10 minutes followed by an IV infusion of a further 1 gram over a period of 8 hours. The slow IV bolus dose is given by injecting 1 gram of tranexamic acid into a 100-mL bag of 0.9% saline and letting it run through over a period of about 10–20 minutes (the exact timing is not crucial). The 8-hour infusion is given by injecting 1 gram of tranexamic acid into a 500-mL bag of 0.9% saline and giving it over a period of 8 hours (approximately 60mL/hour).

Keep the patient warm but do not overheat.



FIGURE 2.5.A.5 Pressure bag over the bag of Ringer-lactate or Hartmann's solution to increase infusion rate.

Transfuse blood as soon as possible to replace blood loss.

Determine the cause of bleeding

- If bleeding occurs **before the first 24–28 weeks of pregnancy**, suspect miscarriage, induced abortion, ectopic pregnancy or molar pregnancy.
- If bleeding occurs **after the first 24–28 weeks or during labour, but before delivery**, suspect placenta praevia, abruptio placentae or ruptured uterus.
- If bleeding occurs **soon after childbirth**, suspect atonic uterus, retained placental fragments, ruptured uterus, tears of the genital tract or occasionally an inverted uterus.
- In all cases consider the possibility of a primary or secondary blood clotting disorder.

Cases where infection is the suspected cause of shock

- Collect appropriate samples (blood cultures, urine, pus, swabs) for microbial culture before starting antibiotics, if facilities are available but do not delay giving antibiotics because of specimen collection.
- Give a combination of antibiotics to cover aerobic and anaerobic infections, and continue until the patient has been fever-free for 48 hours:
 - benzyl penicillin 2.4 grams initially, then 1.2 grams IV 6-hourly or ampicillin 2 grams initially, then 1 g IV/IM every 6 hours *plus* gentamicin 80 mg IV/IM 8-hourly or 5 mg/kg body weight IV/IM once every 24 hours *plus* metronidazole 500 mg IV every 8 hours
 - or ceftriaxone 2–4 grams IV once daily or cefotaxime 2 grams 12-hourly IV *plus* metronidazole 500 mg IV every 8 hours.
- **If the patient is in shock, do not give antibiotics by mouth or IM, as they will not be absorbed.**
- Reassess the patient's condition for signs of improvement.

Cases where haemorrhage due to trauma is the cause of shock

- Try and stop haemorrhage and if appropriate prepare for surgical intervention.
- Give 500 mL IV crystalloid fluid resuscitation boluses and reassess circulation after each bolus until blood is available (see above).

General issues

Avoid giving IV boluses of 5% dextrose or dextrose saline (4%/0.18%), as they cause hyponatraemia, and may result in cerebral oedema and death.

An antibiotic such as cefotaxime or ceftriaxone should always be given IV when a diagnosis of septicaemia is made obvious by the presence of a purpuric rash (suspect meningococcal infection).

BOX 2.5.A.1 Whole blood clotting time

If laboratory clotting tests are not available:

- Transfer 2 mL of venous blood into a small dry clean plain glass test tube (approximately 10 mm × 75 mm).
- Hold the tube in your closed fist to keep it warm (+ 37°C).
- After 4 minutes, tip the tube slowly to see if a clot is forming. Then tip it again every minute until the blood clots and the tube can be turned upside down.
- **Failure of a clot to form after 7 minutes, or formation of a soft clot that breaks down easily, suggests a blood clotting disorder.**

Take blood for the following investigations (if available): full blood count (FBC), renal and liver function tests, blood culture, cross-matching, blood clotting, glucose stick test and glucose laboratory test.

- Catheterise and monitor urine output.
- If peritonitis is possible, add metronidazole IV.

Cases where a blood clotting disorder is present and fractionated blood products are not available

- Use fresh whole blood (straight from the donor if possible). In general, in obstetric emergencies, volume overload is not a problem.
- If volume overload is a concern, allow the unit of fresh whole blood to stand for 30 minutes. The red blood cells will drop to the bottom, and the fluid/plasma above them containing clotting factors can be drawn off with a syringe and needle, and plasma alone can be given.

Central venous access

This can be valuable provided that the healthcare workers present have the skills needed to do this safely as it is potentially hazardous. The catheter should be inserted in the intra-thoracic inferior vena cava or superior vena cava via the femoral, internal jugular or subclavian vein routes. However, **it is essential that resuscitation is not delayed by trying to insert a central venous catheter. If there is a clotting disorder, never use the subclavian route.**

A normal central venous pressure (CVP) is 4–10 cmH₂O, and optimising the CVP can improve cardiac output with less risk of inducing heart failure. Take great care if the CVP is > 12 cmH₂O, as cardiac failure may be induced by excessive IV fluids, especially if severe anaemia, malnutrition or a primary cardiac disorder is present.

Reassess ABC **on a regular basis**.

Reassess the response to fluids to determine whether the woman's condition is improving. Signs of improvement include the following:

- decreasing pulse rate (a rate of ≤ 100–110 beats/minute)
- increasing blood pressure (systolic pressure ≥ 90–100 mmHg)
- improving mental status (less confusion or anxiety)
- increasing urine output (≥ 30 mL/hour).

Continue monitoring to ensure that the pulse rate and blood pressure do not deteriorate after improvement, indicating the return of shock.

If the mother's condition improves, adjust IV fluids to 1 litre over 6 hours, and continue management for the underlying cause of shock.

If more than 3 litres have been given IV in a mother, and if shock is still present, call for anaesthetic assistance.

Correct any hypoglycaemia.

Inotropes

An IV infusion of dobutamine and/or dopamine at 5–20 micrograms/kg/minute should be considered, especially if a third bolus of fluid is required. Sometimes adrenaline by IV infusion at 0.05–2 micrograms/kg/minute may be required.

These infusions can initially be given **carefully** through a peripheral vein until central venous access is obtained.

Patients who require ventilation and inotropic support should be cared for in a high-dependency or intensive-care unit with invasive monitoring (if available). Seek early advice.

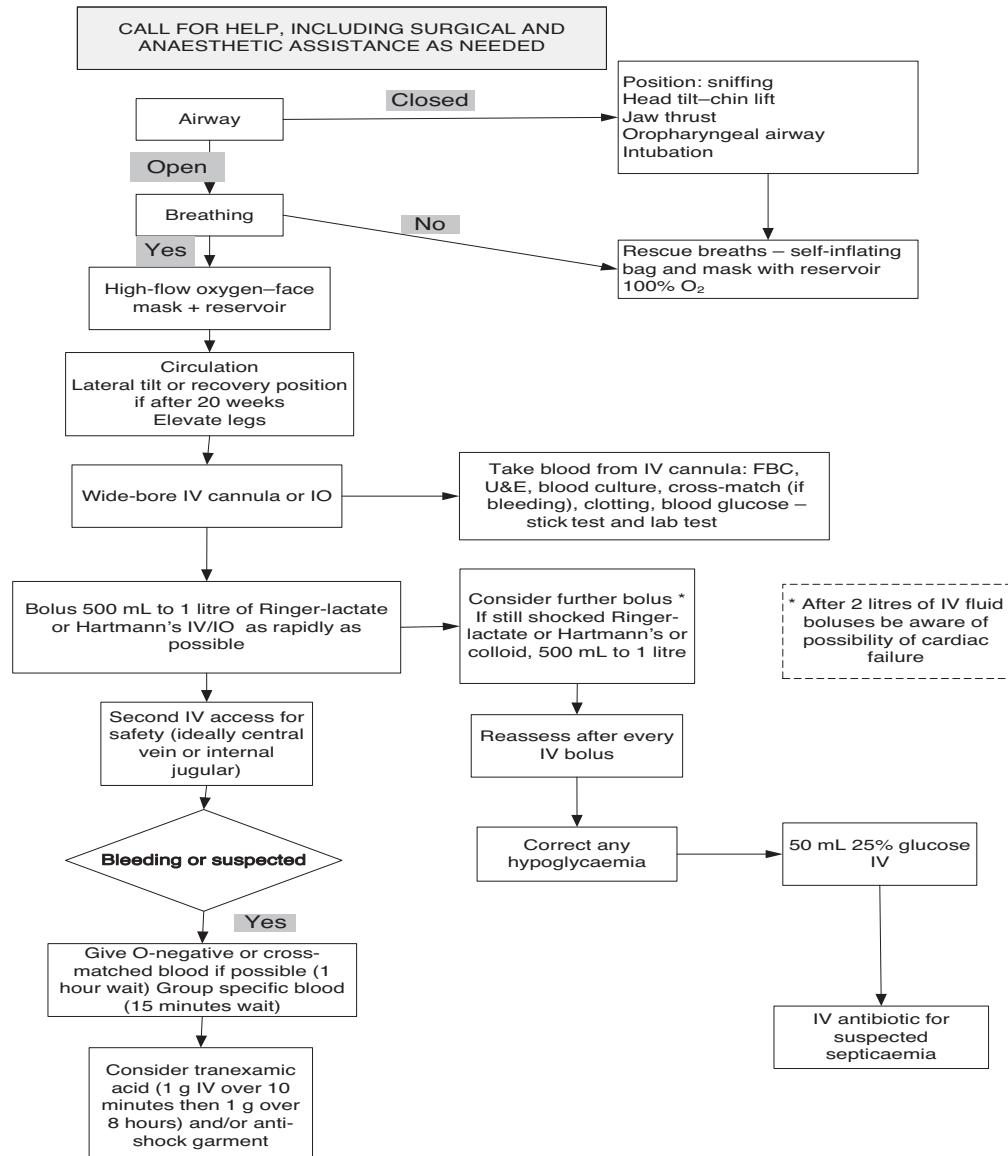


FIGURE 2.5.A.6 Shock in pregnancy or the puerperium: pathway of care. IV, intravenous; IO, intra-osseous; U&E, urea and electrolytes; PPH, postpartum haemorrhage.

2.5.B Severe anaemia, including sickle-cell disease

BOX 2.5.B.1 Minimum standards

- Oral and parenteral iron.
- Folic acid.
- Blood transfusion.
- Antimalarial drugs.
- Antihelmintic drugs.
- Haemoglobin measurements at healthcare facilities in the community.

mainly due to iron deficiency, associated with depleted iron stores before pregnancy and poor diet. Malaria is another major cause of anaemia in pregnancy. Anaemic women cope poorly with blood loss at delivery. Where amoebiasis and other hookworms are endemic, these may worsen the anaemia.

Prevention of anaemia

Oral iron supplementation is advised during all pregnancies. It is particularly important in the mother who is anaemic before pregnancy or who has a poor diet. The WHO recommends an iron supplement of 60mg/day for mothers with adequate iron stores, and 120mg/day for those women without adequate iron stores. Give ferrous

Introduction

In normal pregnancy there is an increased total blood volume and a marked increase in plasma volume, so the haemoglobin concentration falls. Pathological anaemia is

sulphate or ferrous fumarate 120 mg by mouth *plus* folic acid 400 micrograms by mouth once daily throughout pregnancy. Continue for 3 months postpartum. The mother may take the tablets after meals rather than in the morning if she prefers to do so.

In an endemic area, look for hookworm ova in the stools, and treat them if you find them. If a laboratory is not available to identify them, assume that they are present. Wait until around 16 weeks of pregnancy and then treat with mebendazole ('*Vermox*') 500 mg as a single treatment.

If the mother has a large spleen and is anaemic, this is probably caused by malaria, which should be treated.

In areas where malaria is endemic, institute intermittent preventive treatment (IPT) with antimalarial drugs (see Section 2.8.D).

Severe anaemia is present if haemoglobin levels are less than 5.0 g/dL or if there are signs of heart failure and haemoglobin levels are less than 7.5 g/dL. This condition is very dangerous for both mother and baby.

Haemoglobin can be measured using either small drops of capillary blood or a venous sample. A portable battery-operated haemacue (www.biomedcentral.com/content/pdf/1472-6890-11-5.pdf) or a paper chart method can be used in rural areas where clinics are held.

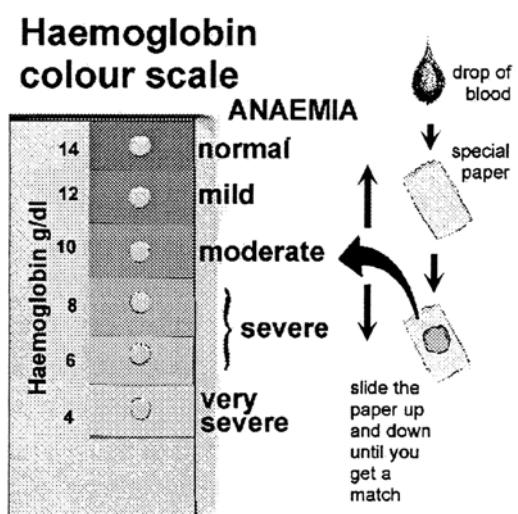


FIGURE 2.5.B.1 WHO test strip with colour scale for measuring haemoglobin in a rural area.

Presentation of severe anaemia

- The patient will be weak, with near white palms, soles and tongue, and **signs of heart failure** if the anaemia is severe (see below).
- In haemolysis, the urine may be **dark brown in colour** and there may be signs of jaundice.

Treatment of severe anaemia

If heart failure is not present, give ferrous sulphate 200 mg orally three times a day, vitamin C 1000 mg daily (this can increase haemoglobin levels by 1 gram/litre per week) and folic acid 5 mg once daily. If vitamin C is not available, iron tablets may be taken with orange juice to aid absorption.

Parenteral iron: parenteral administration produces a larger and more rapid rise in haemoglobin levels, and is more effective in replenishing ferritin levels, so might be

necessary for patients who cannot tolerate oral preparations or who are non-compliant, or if the anaemia is diagnosed late and rapid correction is required.

Parenteral iron is best given IV. Intramuscular injections are painful and may stain the skin. Do not give parenteral iron during the first trimester.

IV preparations: the side effects of intravenous iron preparations are less common with iron sucrose than with iron dextran. Side effects of iron dextran include arthralgia, myalgia, pyrexia, flushing and hypotension. Serious hypersensitivity is observed in approximately 1 in 200 patients with iron dextran (low-molecular-weight dextran) and 1 in 50 000 with iron sucrose.

Iron sucrose (Venofer®): 200 mg (elemental iron). For IV infusion, dilute 10 mL of iron sucrose (200 mg) in 100 mL of 0.9% saline and infuse immediately after dilution. The first 10 mL (20 mg) should be given slowly over 10 minutes and the remainder over 1 hour. No test dose is required for iron sucrose, as anaphylaxis is rare with this preparation. However, adrenaline must be available. A fall in blood pressure is possible if the iron infusion is given too quickly. IV infusions can be repeated weekly if the required rise in haemoglobin levels is not achieved, up to a maximum total dose of 1000 mg.

Do not overdose with iron, as this can affect the absorption of other essential elements from the diet and increase the oxidative stress of pregnancy.

Treat for malaria, give prophylaxis (see Section 2.8.D), and prevent future inoculations with impregnated bed nets.

Treat any chronic parasitaemia (e.g. hookworm, schistosomiasis).

Where hookworm is **endemic** (prevalence of 20% or more), give one of the following antihelmintic treatments:

- albendazole 400 mg by mouth once; **this must not be given in the first trimester** because it causes fetal anomalies
- or mebendazole 500 mg by mouth once or 100 mg twice a day for 3 days
- or levamisole 2.5 mg/kg body weight by mouth once daily for 3 days
- or pyrantel 10 mg/kg body weight by mouth once daily for 3 days.

Where hookworm is **highly endemic** (prevalence of 50% or more), repeat the antihelmintic treatment 12 weeks after the first dose.

Treatment of severe anaemia where there is heart failure

Give a high concentration of oxygen, bed rest and sit the patient upright (with lateral tilt as well if she is more than 20 weeks pregnant).

- Consider transfusion with packed cells if the haemoglobin concentration is less than 5.0 g/dL (with IV furosemide of 40 mg for each unit of packed cells). If blood cannot be centrifuged, let the bag hang until the cells have settled. Infuse the cells slowly and dispose of the remaining serum (see Section 1.7 on blood transfusion).
- Partial exchange transfusion may be helpful. Use a cannula in a large vein in the antecubital fossa, withdraw 20 mL of the patient's anaemic blood and infuse 40 mL of new blood (ideally packed red blood cells) over 5 minutes and repeat 5–10 times.

If labour occurs when the patient is severely anaemic:

- Deliver with the patient sitting up.
- Cross-match blood and have it available in case of postpartum haemorrhage (PPH).
- Avoid a prolonged second stage as this increases the risk of PPH.
- If there are signs of heart failure or maternal exhaustion shorten the second stage with a ventouse if possible.
- Manage the third stage actively (give oxytocin), and suture any tears without delay.
- **The mother is in great danger for at least 48 hours after delivery. Prescribe iron and folate during the puerperium.**

Sickle-cell anaemia in pregnancy

Sickle-cell anaemia is a disease in which the patient's red cells form sharp points when they lack sufficient oxygen. These pointed red cells are destroyed by the body, and as a result the patient becomes anaemic. Sickle-cell anaemia is harmful to pregnant mothers. It causes miscarriage and perinatal deaths. It also causes painful crises, which may be life-threatening. Infections, especially urinary and chest infections, are also more common.

BOX 2.5.B.2 Minimum standards

- A multidisciplinary team that includes an obstetrician, a midwife and a haematologist.
- Blood pressure and urinalysis monitoring.
- A facility for haemoglobin estimation and electrophoresis, and other laboratory tests.
- Analgesia, including paracetamol, NSAIDs and morphine.
- Blood transfusion.
- Oxygen.
- Penicillin prophylaxis.
- **Pneumococcal (PCV and Pneumovax), hepatitis B and Haemophilus influenzae vaccines.**
- Ultrasound scanning.

Before pregnancy

Ideally, women with sickle-cell disease (SCD) should be seen before pregnancy so that they can be told about how pregnancy and SCD can interact, and how to achieve the best outcomes. This is also an opportunity to screen for end-organ damage or manage existing problems, and perhaps to discuss contraception. These activities could be undertaken in the context of a regular specialist sickle-cell review.

Women should be encouraged to have their partner tested for haemoglobinopathy before becoming pregnant, so that the risk of having a child with SCD can be assessed. Prenatal diagnosis and possible termination of pregnancy may need to be discussed with the couple.

A history of previous Caesarean section and uterine curettage should be obtained because of the increased risk of placenta praevia.

An adequate nutritional assessment should be undertaken. The patient's pre-pregnant weight, height, and optimal weight gain in pregnancy should be recorded.

Women who are planning to conceive should be told about:

- the role of dehydration (from nausea and vomiting),

cold, hypoxia, overexertion and stress in the genesis of sickle-cell crises

- the increased risk of worsened anaemia, crises, acute chest syndrome (ACS) and infection (especially urinary tract infection) during pregnancy
- potential effects on the baby, such as prematurity, growth restriction and fetal distress. The rate of complications may depend on the type of SCD that is present
- the increased risk of induction of labour and Caesarean section
- the chance of their baby being affected by SCD
- the outcome of pregnancy in SCD is usually favourable. Smith *et al* (1996) reported that 99% (283 of 286) of pregnancies delivered after 28 weeks' gestation and resulted in live births, a rate that compares favourably with the rate of 99.29% for live births to African-American women in the same country (see Further reading at end of the section).

Tests for chronic disease complications and other relevant issues

These include:

- echocardiogram: used to screen for pulmonary hypertension that is associated with increased mortality. A tricuspid regurgitant jet velocity of more than 2.5 m/second is associated with a high risk of pulmonary hypertension
- blood pressure and urinalysis: identifies women with hypertension and/or proteinuria
- full blood count with a reticulocyte index
- haemoglobin electrophoresis
- serum iron, total iron binding capacity (TIBC) and ferritin levels
- renal and liver function tests: performed annually to identify sickle nephropathy and/or deranged hepatic function
- red cell antibodies: may detect an increased risk of haemolytic disease of the newborn
- measurement of antibodies to hepatitis A, B and C, and HIV
- rubella antibody titre
- tuberculin skin test
- pap smear, cervical smear, and gonococcus culture and screening for other sexually transmitted diseases; bacterial vaginosis testing should also be performed
- retinal screening (if an ophthalmologist is available); proliferative retinopathy is common in patients with SCD
- T2-star (T2*) cardiac magnetic resonance imaging: this screens for iron overload in the multiply transfused who have a high ferritin level; aggressive iron chelation before conception is advisable in iron-loaded women.

Medication and vaccination

- Penicillin (or erythromycin) prophylaxis: there is limited evidence of its effectiveness in pregnant women with SCD, although some authorities recommend it.
- Folic acid (5 mg daily) is useful both before and throughout pregnancy.
- Hydroxycarbamide (hydroxyurea) is helpful in severe SCD, but it is teratogenic in animals. Women on this medication should use contraception and stop hydroxycarbamide 3 months before attempting to conceive. If they become pregnant, the medication should be stopped and an ultrasound scan performed to look for structural abnormality. Termination is not indicated just

- because of exposure to hydroxycarbamide, as it is still possible to deliver an unaffected baby.
- Angiotensin-converting enzyme inhibitors or angiotensin-receptor blockers are used in patients with SCD with significant proteinuria (a protein:creatinine ratio of more than 50mg/mmol), but they are not safe in pregnancy and should be discontinued prior to conception.
 - Chelation therapy (e.g. desferrioxamine) should be stopped prior to conception.
 - Vaccination against the following is recommended before pregnancy (if not previously given): *Haemophilus influenzae* type b, conjugated meningococcal C, and pneumococcus, hepatitis B and influenza.

Antenatal care

Antenatal care should ideally be delivered by a multidisciplinary team that includes an obstetrician and a midwife with experience of high-risk antenatal care, and a haematologist with an interest in SCD.

Discussion about pregnancy, SCD and vaccination should cover the points listed under 'Before pregnancy' above. Providing information and education about SCD, improving the mother's nutritional status, malaria prevention and early detection of bacterial infection have a positive impact on SCD-related morbidity and mortality in Africa.

SCD may increase the risk of pre-eclampsia, so it is advisable to give low-dose aspirin (75 mg daily) from 12 weeks' gestation (unless there is an allergy). Because of the effects on fetal development, **non-steroidal anti-inflammatory drugs (NSAIDs) should only be given between 12 and 28 weeks' gestation.**

Iron supplements should only be given if there is laboratory evidence of deficiency (haemoglobin level less than 11 g/dL). Live attenuated vaccines should not be given until after delivery.

The woman's partner should be offered testing for haemoglobinopathy. If the partner is a sickle-carrier or has SCD, the risks of delivering an infant with SCD should be discussed. This should ideally occur within 10 weeks of conception, so that prenatal diagnosis and discussion about termination can be offered. Factors to be considered include coping skills for caring for a child with a serious illness, personal and cultural values with regard to childbearing, religious beliefs, the need and desire to have children, feelings and attitudes about abortion, and beliefs about self-determination versus fate as determinants of adverse events.

Pregnant women with SCD are likely to have an increased risk of venous thromboembolism, and their management should be tailored. Graduated **compression stockings** are an option. For hospital admissions, low-molecular-weight heparin is recommended (see Section 2.5.H).

Blood pressure and proteinuria assessment should occur at each visit because of the increased risk of pregnancy-induced hypertension in SCD. Any pre-existing proteinuria or renal impairment should be monitored more frequently. Women should be observed closely if their blood pressure rises above 125/75 mmHg, if their systolic blood pressure increases by 30 mmHg, or if their diastolic blood pressure increases by 15 mmHg, in association with oedema and proteinuria in the second trimester.

Urinalysis for protein should be performed at each antenatal visit, and midstream urine sent for culture and

sensitivity if symptoms of urinary tract infection are present and routinely if resources allow microscopy.

- Ultrasound scanning should ideally occur as follows:
- Women should be offered a viability scan at 7–9 weeks' gestation.
 - They should be offered the routine first-trimester scan (at 11–14 weeks' gestation) and a detailed anomaly scan at 20 weeks' gestation. In addition, they should be offered serial fetal biometry scans (growth scans) every 4 weeks from 24 weeks' gestation.

Transfusion in women with SCD who are pregnant

- Routine transfusions are not required.
- Red cell units should ideally be matched for Rhesus (C, c, D, E, e) and Kell type.
- Ideally, cytomegalovirus seronegative units should be used.
- Decisions about transfusion should be made by an experienced haematologist (if available) and an obstetrician. One approach is to consider initiation of transfusions for women who have complications such as pre-eclampsia, severe anaemia, or increasing frequency of pain episodes.
- Each woman should have an individualised care plan that takes into account her previous sickle-cell and pregnancy history.
- Treatment of acute painful crisis is the same as that for non-pregnant patients, with hydration, oxygen and analgesics, although doses of the latter may be higher. Reassurance should be given that morphine use during pregnancy does not jeopardise the baby's health. However, if large doses of morphine are needed in late pregnancy, the newborn may require opioid weaning.

Intrapartum care

No randomised controlled trials are available to guide the timing of delivery. If there is a normally growing fetus, offer elective birth through induction of labour, or by elective Caesarean section if indicated for other reasons, between 38 and 40 weeks' gestation. In low resource settings the risks of induction and the uncertainty about due date must be balanced against the potential increased risk of late pregnancy complications such as abruption and pre-eclampsia in SCD. SCD is not a contraindication to attempting vaginal delivery, or vaginal birth after previous Caesarean section.

A 'group and save' for possible transfusion is acceptable for delivery unless there are atypical antibodies, when a cross-match should be requested (to reduce delays).

In women who have hip replacements it is important to discuss suitable positions for delivery.

During labour the following measures are recommended:

- Inform the multidisciplinary team (the senior midwife in charge, senior obstetrician, anaesthetist and haematologist) when labour is confirmed.
- Maintain warmth and hydration.
- Maintain continuous intrapartum electronic fetal heart rate monitoring if available, as there is an increased risk of fetal distress which may necessitate operative delivery. There is also an increased rate of stillbirth, placental abruption and compromised placental reserve.
- Intravenous fluids should be administered if oral hydration is inadequate. A fluid balance chart should be kept.

Changes during the intrapartum period:

- There is an increased frequency of sickle-cell crises and ACS.
- Cardiac function can be compromised because of chronic hypoxaemia and anaemia.
- There is an increased risk of painful crises with protracted labour (more than 12 hours). If the woman is well hydrated and labour is progressing, the labour should be carefully supervised. Caesarean section should be considered if labour is not progressing well and delivery is not imminent.
- There is an increased oxygen demand. Use of pulse oximetry to detect hypoxia is appropriate. If the oxygen saturation is 94% or less, oxygen should be given by nasal cannula.

Routine antibiotic prophylaxis in labour is not supported by evidence, but hourly observations of vital signs should be performed. A raised temperature ($> 37.5^{\circ}\text{C}$) requires investigation. The clinician should have a low threshold for commencing broad-spectrum antibiotics.

Women should be offered anaesthetic assessment in the third trimester of pregnancy, as general anaesthesia should be avoided where possible. Regional (epidural) anaesthesia during labour where available may reduce the need for both general anaesthesia for delivery and high doses of morphine with lower body sickle pain. Regional analgesia (spinal) is recommended for Caesarean section.

Avoid pethidine because of the risk of seizures.
Morphine is the most appropriate drug.

Postpartum care

- If the baby is at high risk of SCD (based on parental haemoglobinopathy results), early testing for SCD should be offered.
- Maintain maternal oxygen saturation above 94% and adequate hydration based on fluid balance until discharge.
- Low-molecular-weight heparin (or unfractionated heparin if former not available) should be administered while

the woman is in hospital and for 7 days post-discharge following vaginal delivery, or for a period of 6 weeks following Caesarean section.

- Anti-thrombotic stockings are recommended in the puerperium.
- The risk of sickle-cell crisis is increased. Hydration and oxygenation should be maintained and early mobilisation encouraged. Crises should be managed as for non-pregnant women. NSAIDs can be given in the post-partum period and during breastfeeding. Breastfeeding should be encouraged.
- Postpartum contraceptive advice should be given. Progestogen-containing contraceptives, injectable contraceptives and the levonorgestrel intrauterine system are safe and effective in SCD. Oestrogen-containing contraceptives should be used as second-line agents.
- Barrier methods are as safe and effective in women with SCD as in the general population.

Further reading

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2.5.C Septic abortion or miscarriage

Introduction

Septic abortion is defined as abortion complicated by infection. Sepsis may result from infection if organisms rise from the lower genital tract following either spontaneous miscarriage or induced abortion. Sepsis is more likely to occur if there are retained products of conception and evacuation has been delayed. Sepsis is a frequent complication of unsafe abortion involving instrumentation.

Diagnosis

Consider the possibility of septic abortion in any woman or girl with a history of termination of pregnancy or attempted termination. Presentation is typically with some of the following symptoms and signs: lower abdominal pain, prolonged

vaginal bleeding, tender uterus, foul-smelling vaginal discharge, purulent cervical discharge, fever and malaise.

Treatment

If septic shock is present, this will be shown by some of the following signs and symptoms:

- fast, weak pulse ($\geq 100\text{--}110$ beats/minute)
- pallor (especially of the inner eyelid, palms or around the mouth)
- sweatiness with cold or warm (vasodilated) skin
- rapid breathing (> 30 breaths/minute)
- anxiety, confusion or unconsciousness
- low blood pressure (systolic pressure $< 90\text{ mmHg}$ is a late sign)
- reduced urine output ($< 30\text{ mL/hour}$).

Resuscitation then proceeds as described below.

Airway

- Use an opening manoeuvre if the airway is not open or is partially obstructed. Keep the airway open. If there is improvement but the airway closes without active opening support, consider airway adjuncts to maintain the airway if the patient is unconscious (P or U on the AVPU scale).
- Suction if necessary.
- The airway may need to be maintained and protected by intubation, using experienced senior help (if available).

Breathing

- Provide a high concentration of **oxygen** through a face mask with a reservoir bag if there is adequate spontaneous respiration.
- For patients with inadequate ventilation, respiration should be supported with oxygen via a **bag-mask**, and experienced senior help summoned (if available).

Circulation

- Gain IV access.
 - Use a short, wide-bore (16- to 18-gauge) IV cannula if possible for IV access.
 - The internal jugular and external jugular veins are good options for access if peripheral access is impossible. Long saphenous vein cut-down may also be considered.
 - Try to obtain two vascular access sites to give large volumes quickly, and in case one line is lost.
- Elevate the legs by raising the foot of the bed.
- Give an initial rapid IV/IO bolus of 500mL to 1 litre of Ringer-lactate or Hartmann's solution. It is essential that the bolus is given as rapidly as possible.
- Further boluses of 500–1000mL will usually be required during the first hour. Once more than 2 litres have been

given IV, complications such as pulmonary or cerebral oedema may occur. If available, expert help, an anaesthetist, and the use of inotropes, sodium bicarbonate, and intermittent positive pressure ventilation (IPPV) with positive end-expiratory pressure (PEEP) are all potentially valuable.

- A fresh blood transfusion may also be important.

Antibiotics after taking specimens for culture if facilities are available (blood cultures, high vaginal swab and urine)

All patients, whether shocked or not, must be given the following antibiotics without delay:

- **ampicillin 2 grams IV every 6 hours**
- **plus gentamicin 80mg IV/IM 8-hourly or 5mg/kg body weight IV/IM every 24 hours**
- **plus metronidazole 500mg IV every 8 hours.**

All of these should be continued until the woman has been fever-free for 48 hours.

Patients who do not appear to be shocked on first examination must still be frequently observed for the early signs of shock during the first 6–12 hours. The frequency of observations can then be reduced.

Start antibiotics as soon as possible and ideally before attempting manual vacuum aspiration (MVA).

The woman or girl may also need the following:

- MVA to remove infected products of conception. This is preferable to curettage, because perforation may already have occurred, or could easily do so because of the friable nature of the uterine wall
- hysterectomy after stabilisation if the infection cannot be controlled.

Further reading

Surviving Sepsis Campaign: www.survivingsepsis.org/GUIDELINES/Pages/default.aspx

2.5.D Obstetric haemorrhage

2.5.D.i Ruptured ectopic pregnancy

Introduction

An ectopic pregnancy is defined as the implantation of the fertilised ovum outside the uterus, usually within the Fallopian tube.

When it is a few weeks old it ruptures the tube, resulting in bleeding into the peritoneal cavity.

If the fetus is expelled ('tubal abortion') it leaves from the fimbrial end of the Fallopian tube with blood collecting as a haematoma, usually at about 8 week's gestation.

If the Fallopian tube ruptures, there is generally severe abdominal pain, with or without shock, depending on the amount of bleeding. Rupture usually occurs from 8 weeks' gestation onwards, but the timing can vary depending on the exact site of the pregnancy and the rate of growth of the pregnancy tissue. As a result rupture is possible before 8 weeks and beyond 12 weeks' gestation.

Cause of ectopic pregnancy

This is not known, but associated factors include the following:

- pelvic inflammatory disease leading to salpingitis (especially as a result of gonococcus, chlamydia or TB infection)
- if pregnancy occurs with an intrauterine contraceptive device in place (a rare occurrence)
- previous tubal surgery resulting in tubal ligation or tubal re-anastomosis
- previous ectopic pregnancy
- previous intra-abdominal infection (peritonitis).

Sites of implantation

Implantation in the Fallopian tube is most common (over 90% of cases), usually at the ampulla. Less common but

more dangerous is implantation at the interstitial end. The fetus can also rarely implant on the bowel, pelvic peritoneum, cervix or ovary.

Clinical presentation: symptoms and signs

- Abdominal pain that is lower abdominal (which tends to be unilateral), cramping or stabbing, due to distension of the tube and peritoneal irritation from blood in the abdominal cavity. Rupture results in generalized abdominal pain, often associated with distention, guarding and rebound tenderness (peritonism).
- Shoulder tip pain, caused by blood irritating the diaphragm.
- Rectal pain or perineal discomfort caused by the presence of blood in the pouch of Douglas.
- Diarrhoea is an atypical symptom and can rarely be the main presenting complaint.
- Hypovolaemic shock occurs as soon as sufficient blood has been lost. Often there will be fainting or a feeling of faintness that requires the patient to lie down.
- A fast weak pulse (heart rate ≥ 100 beats/minute).
- Hypotension (a late sign after much blood has been lost: systolic pressure < 90 mmHg).
- Vaginal bleeding, which can mimic a normal menses (75%):
 - usually dark, and not heavy
 - may be irregular.
- Signs and symptoms of early pregnancy are unusual. They include tiredness, nausea and/or vomiting (especially in the early morning), breast swelling and urinary frequency.
- Anaemia if there is chronic slower bleeding.

In all women and girls of reproductive age with diarrhoea and/or dizziness or fainting, do a pregnancy test and consider the possibility of ectopic pregnancy.

Abdominal examination reveals muscle guarding and rebound tenderness and probably fever. The differential diagnosis is appendicitis. There may be abdominal distension with shifting dullness if there is free blood in the abdomen.

Pelvic examination: **caution must be exercised when performing a bimanual vaginal examination if an ectopic pregnancy is possible, because of the risk of rupture during and due to the examination.** Vaginal examination may show general pelvic tenderness, sometimes with a mass in the fornix, or increased tenderness on one side. There may be cervical excitation, bluish discolouration of the vagina and cervix and/or slight uterine enlargement.

Diagnosis

Consider this diagnosis in particular if any anaemia, shock or abdominal pain is greater than expected for the amount of vaginal bleeding. Check whether the woman or girl has any risk factors for an ectopic pregnancy.

Differential diagnosis: threatened miscarriage, acute or chronic pelvic inflammatory disease (PID), torsion or rupture of an ovarian cyst, acute appendicitis or peritonitis.

Tip test: Tilt the head down. If there is blood in the peritoneal cavity it will irritate the diaphragm; this is manifested

as shoulder tip pain. This test is useful if it gives a positive result, but a negative result does not exclude haemorrhage.

Do a pregnancy test in all potentially fertile women and girls with abdominal pain, fainting or shock. If they are unable to provide a urine specimen, consider using a urinary catheter to obtain one.

Ultrasound examination

If there is a positive pregnancy test but no intrauterine pregnancy is seen on the ultrasound scan, an ectopic pregnancy is likely. The likelihood of ectopic pregnancy increases if free fluid and/or an echogenic mass is seen.

Culdocentesis is not recommended, as it may delay surgery and introduce infection.

Primary assessment and resuscitation of shocked patients

Call for help. A surgeon and anaesthetist must be urgently requested, and the operating theatre must be prepared.

Airway

- Use an opening manoeuvre if the airway is not open or is partially obstructed. If there is an improvement, use airway adjuncts to support the airway or ask an assistant to hold it open.
- Suction if necessary.
- The airway may need to be maintained and protected by intubation using experienced senior help (if available).

Breathing

- Provide a high concentration of oxygen through a face mask with reservoir bag for patients with adequate spontaneous respiration.
- For patients with inadequate ventilation or depressed conscious level (P or U on the AVPU scale), respiration should be supported with oxygen by bag-valve-mask inflations and experienced senior help obtained, including an anaesthetist.

Circulation

- Elevate the legs and consider using a non-pneumatic anti-shock garment.
- Gain IV access.
- Use a short wide-bore IV cannula if possible (14- to 16-G).
- External jugular vein access is a good option if peripheral access is impossible. Long saphenous vein cut-down may also be considered, and, if the operator is adequately trained, central venous access ideally via the internal jugular vein can be extremely helpful, or the intraosseous route if this is not possible (see Section 8.4.B).
- Try to obtain two vascular access sites in order to give large volumes quickly, and in case one line is lost.
- Take blood for cross-matching of 4–6 units, full blood count, renal function tests (if available) and blood clotting.
- Give 500mL to 1 litre of Ringer-lactate or Hartmann's solution by rapid bolus while awaiting blood for transfusion.
- Remember that young healthy women and girls can lose a lot of blood before they become shocked, especially if it is a slow leakage rather than a sudden large loss of blood.

The concept of **targeted crystalloid fluid resuscitation** is important in management. Here the initial boluses of IV crystalloids required to treat shock would only be given to keep the vital organs (especially the brain, heart and kidneys) perfused before blood and, most important of all, surgery have become available.

The administration of too large a volume of IV crystalloid fluids by increasing blood pressure and damaging the coagulation system could increase bleeding by disrupting early clot formation.

If this approach is adopted when giving boluses of crystalloid to patients who are in shock due to bleeding, before blood becomes available and here, of most importance, surgical intervention, only the amount needed to keep the blood pressure at a level sufficient to perfuse the vital organs would be given. There is no clear evidence to indicate the precise blood pressure that should be achieved in a woman in shock due to a ruptured and bleeding ectopic pregnancy. However, **adequate perfusion of vital organs may best be indicated by a radial pulse that can be palpated and an alert conscious level.**

Our personal practice is to start with IV boluses of 500 mL of crystalloid or ideally blood and reassess after each bolus always aiming for urgent surgical intervention and blood transfusion. Several boluses of crystalloids may be required before these actions are possible.

Disability

Conscious level on AVPU scale.

Central venous access

This is valuable if skilled staff are available to undertake it. Ideally it should be achieved using a multi-lumen catheter coated with heparin, if available, with the catheter placed in the intra-thoracic inferior vena cava (IVC) or superior vena cava (SVC).

A normal central venous pressure (CVP) (see Section 2.7.A for details of measurement) is +4 to +10 cmH₂O, and optimising the CVP can improve cardiac output with less risk of inducing heart failure. Take great care if the CVP is greater than 12 cmH₂O, as cardiac failure may be induced by excessive IV fluids, especially if severe anaemia, malnutrition or primary cardiac disorders are present.

2.5.D. ii Miscarriage

Types of miscarriage

Consider miscarriage or induced abortion in any woman or girl of reproductive age if more than 1 month has elapsed since her last menstrual period, and one or more of the following is present: bleeding, lower abdominal pain, partial expulsion of products of conception, dilated cervix, or smaller uterus than expected for gestation.

Spontaneous miscarriage

This is the loss of a pregnancy before fetal viability (28 weeks' gestation in low-resource settings). It occurs in at least 15% of pregnancies.

The stages of spontaneous miscarriage may include the following:

- **threatened miscarriage:** pregnancy may continue

Emergency treatment

If the diagnosis is ruptured ectopic pregnancy with shock, order blood for transfusion and immediately prepare the operating theatre. Obtain a surgeon urgently, and proceed to urgent laparotomy while resuscitation is under way. Do not wait for blood.

At laparotomy, perform salpingectomy. Repair of the tube carries a major risk of future ectopic pregnancy, and should not be undertaken in resource-limited settings.

Autotransfusion

If blood is unquestionably fresh and free from infection, it can be collected after the abdomen has been opened and transfused.

When the woman is on the operating table prior to surgery and the abdomen is distended with blood, it is sometimes possible to insert a needle through the abdominal wall and collect the blood in a donor set.

Alternatively, open the abdomen and proceed as follows:

- Scoop the blood into a basin and strain it through gauze to remove all clots.
- Clean the top portion of a blood donor bag (containing anticoagulant) with antiseptic solution and open it with a sterile blade.
- Pour the mother's blood into the bag and infuse it through a filtered set in the usual way.
- If a donor bag with anticoagulant is not available, add 10mL of 0.3 molar sodium citrate to each 90mL of blood.

Advice post salpingectomy for ruptured ectopic pregnancy

- If the other tube was macroscopically normal there is good chance of further successful pregnancy.
- The risk of a recurrent ectopic is 10% or more; that is 10 times the background risk therefore an early ultrasound scan is recommended (if available) as soon as a new pregnancy is suspected.
- Offer family planning advice.
- Consider treatment of pelvic inflammatory disease for the patient and her partner if there was intra-operative evidence of pelvic infection and no clear history of previous treatment.

- **inevitable miscarriage:** pregnancy will not continue and will proceed to incomplete or complete miscarriage
- **incomplete miscarriage:** products of conception are partially expelled.
- **complete miscarriage:** products of conception are completely expelled.
- **missed miscarriage:** is not associated with symptoms but found incidentally on routine ultrasound scan or when ultrasound is performed to investigate a pregnancy that is not growing as anticipated. The time from fetal demise to expulsion from the uterus varies widely and it is not uncommon for a miscarriage to remain *in situ* for many weeks.

Miscarriages can be complicated by infection (see Section 2.5.C).

Threatened miscarriage

Here there is light vaginal bleeding and sometimes cramping lower abdominal pain. On examination there is a soft uterus corresponding in size to the date of the last menstrual period, and the cervix is closed.

Ideally in the presence of bleeding the viability of the pregnancy should be assessed by sonicaid/Pinnard stethoscope (if gestation permits) or by ultrasound. However, if the bleeding is light and self-limiting and ultrasound is not easily available then a conservative approach can initially be followed. Advise the woman to avoid strenuous exercise and sexual intercourse but bed rest is not necessary. Follow her up in the antenatal clinic. If the bleeding continues, assess for fetal viability and if the equipment is available perform an ultrasound scan. There is no medication that can prevent progression to a complete miscarriage.

Inevitable miscarriage

This can be diagnosed clinically by the findings of an open internal cervical os and/or the passage of products of conception per vagina. If in doubt the diagnosis should be confirmed by ultrasound.

Incomplete miscarriage

Here there is a history of significant bleeding (greater than menstruation), often with passage of clots and fetal tissue and varying degrees of lower abdominal pain secondary to uterine contraction. Bleeding can vary in severity and the cervix may be open or closed. Often the bleeding has reduced and almost stopped in which case, a complete miscarriage is an important differential diagnosis.

Diagnose by visualisation or palpation of products of conception in or through the cervical os, or by visualisation of retained products of conception on ultrasound.

Management of miscarriage

There are three broad methods for managing miscarriage:

- 1 Expectant: No medical or surgical intervention is made but the patient is monitored for spontaneous resolution. This relies on ready access to emergency treatment and careful follow-up, and is therefore not commonly used in resource poor settings.
- 2 Medical: Medication is used to expedite or induce expulsion of the retained products of conception. In resource poor settings this is generally used only for later mid-trimester miscarriages (below).
- 3 Surgical: The uterus is surgically evacuated of the products of conception.

Surgical Management

If pregnancy is less than 16 weeks this is the preferred management method where access to care and follow-up are restricted.

If the pregnancy is 12 to 16 weeks gestation with an unfavourable cervix that is likely to be difficult to dilate, then consideration should be given to:

- 1 'ripening' the cervix with misoprostol 200 to 600 micrograms around 3 to 24 hours prior to the procedure
- 2 Using medical induction as for gestations of 16 weeks and over (below).
- 3 Expectant management – especially if the patient appears to be contracting and is otherwise stable
- 4 Performing the surgery under optimal conditions: in an operating theatre with local anaesthetic, the availability

of a general anaesthetic, and with an experienced practitioner available.

If the cervix is open and/or some products have already been expelled a sponge forceps can be used to remove products of conception if they are visibly protruding through the cervix. A manual evacuation of the uterus can then be performed to ensure evacuation is complete.

- Manual vacuum aspiration (MVA) (see Figures 2.5.D.ii.1, 2.5.D.ii.2 and 2.5.D.ii.3) is the preferred method of evacuation. **Evacuation by curettage should only be used if MVA is not available.**
- If evacuation is not immediately possible and there is significant bleeding, give ergometrine 200–500 micrograms IM or misoprostol 200 micrograms orally, sublingually or rectally.
- Proceed to evacuation as soon as possible.

If the pregnancy is more than 16 weeks; a late miscarriage:

A detailed account of how this can be managed is given on pages 182–3.

In summary management, as above, can be divided into Expectant, Medical and Surgical approaches.

Expectant management is most appropriate when the miscarriage is progressing on its own.

Medical management includes oxytocin, mifepristone and misoprostol.

Surgical management for retained placental tissue either by Manual Vacuum Aspiration/curettage or, after 24 weeks, manual removal of the placenta is sometimes required. It is very important that this complication, which can cause chronic vaginal bleeding, is recognised.

Safe evacuation of retained products

- 1 Explain the procedure and the reasons for undertaking it, and obtain consent.
- 2 This must be a surgically aseptic procedure, with the use of sterile gloves and gown. Apply antiseptic solution (such as 0.5% chlorhexidine) to the vagina and cervix (especially the os) by first inserting a high-level disinfected or sterile speculum into the vagina and then using a sterile or high-level disinfected sponge forceps with a cotton or gauze swab and giving three applications of antiseptic.
- 3 Where possible perform the procedure in the operating theatre. This is especially indicated if there is a risk of heavy bleeding (e.g. molar pregnancy, suspected coagulation disorder), if the procedure is poorly tolerated by the patient or if the cervical os is difficult to dilate or difficult to access.
- 4 Even when bleeding is not heavy, give oxytocin 10 units IM or ergometrine 200 micrograms IM before MVA to make the uterus firmer and reduce the risk of perforation.
- 5 Prepare the MVA syringe by closing the pinch valve and pulling back on the plunger until its arms lock. In the case of large amounts of retained products (e.g. molar pregnancy), prepare two or three syringes.
- 6 Bimanually examine the uterus to assess whether it is anteverted or retroverted prior to instrumentation and to access its size.
- 7 Provide an oral analgesic, paracetamol 1 gram, and if the cervix is not dilated sufficiently to pass the MVA

- catheter, prepare 20mL of 0.5% lignocaine (**without adrenaline**) with a 3.5 cm long 22- or 25-gauge needle to perform a paracervical nerve block.
- 8 Using a Cusco's or Sims' speculum or vaginal retractor, visualise the cervix. You will need an adequate light source.
 - 9 Inject 1 mL of 0.5% lignocaine into the anterior or posterior lip of the cervix, whichever has been exposed, if a tenaculum is to be used.
 - 10 Apply either a tenaculum or sponge (ring) forceps (the latter do not require administration of local anaesthetic, and are less likely to tear the cervix in incomplete miscarriage) to the lip of the cervix.
 - 11 If the cervix is insufficiently dilated for the MVA catheter to be passed, perform a paracervical nerve block following slight traction applied to the cervical lip to identify the junction between the cervix and the vaginal wall where injections of lignocaine are to be made. Inject 2 mL of lignocaine just under the epithelium (no deeper than 3 mm) at 3, 5, 7 and 9 o'clock positions. **Ensure that the needle is not in a vein with each injection by drawing back the needle before injection, as IV injection of lignocaine is dangerous and can cause convulsions and cardiac arrest.** Wait 2 minutes and check that the cervix is anaesthetised by pinching it gently with forceps. If the pinch is felt, wait for another 2 minutes.
 - 12 Grasp the lip of the cervix with the sponge forceps and apply gentle traction. Cervical dilatation with Hegar dilators is only needed where the cervical os is not dilated and is firm. Slowly introduce the dilators (the smallest one first) into the cavity, checking carefully whether the uterus is anteverted or retroverted, until the resistance felt on passage through the closed internal os is released and the dilator is felt to pass through it into the uterine cavity. Usually a dilatation of 10–12 mm is sufficient. Ensure that the cervix is not torn or a false passage created by the dilators.



FIGURE 2.5.D.II.1 Manual vacuum aspiration kit including cannulae of different sizes.

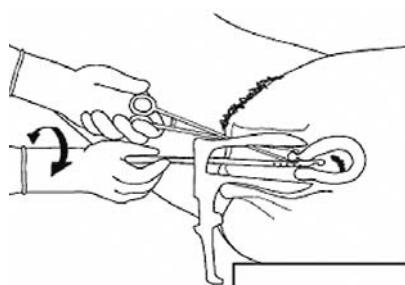


FIGURE 2.5.D.II.2 Inserting the MVA cannula.

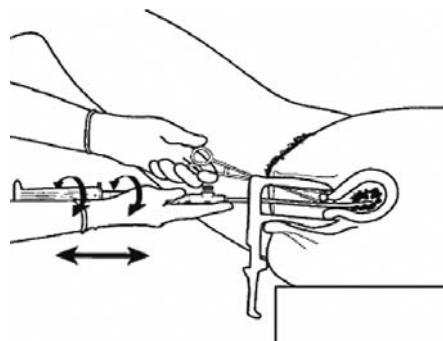


FIGURE 2.5.D.II.3 Evacuating the uterine contents.

- 13 Pass the MVA cannula gently with a rotating movement through the cervix into the uterine cavity just beyond the internal os.

Slowly push the cannula into the uterus until it touches the fundus. Measure the depth by dots visible on the cannula and then withdraw the cannula by about 0.5 cm. Note the depth of the cavity and do not pass instruments beyond this. The risk of uterine perforation is higher in cases complicated by sepsis, or in a postpartum uterus with retained products of conception (see Section 2.5.D.iv). Also be aware that as it is evacuated the uterus generally contracts and thus the cavity will be smaller by the end of the procedure. Attach the prepared MVA syringe to the cannula and release the pinch valves, allowing the vacuum to transfer to the cannula and the inside of the uterus.

Evacuate the uterine contents by gently rotating the syringe from 10 to 12 o'clock and moving the cannula back and forth within the uterus. Do not allow the cannula at this stage to be withdrawn past the cervical os into the vagina, as the vacuum will be lost. If the vacuum is lost or the syringe is more than half full, empty it and then re-establish the vacuum. Do not hold the syringe by the plunger arms while the vacuum is present, as they may become unlocked and the plunger will then slip back into the syringe, pushing materials back into the uterus.

- 14 To ensure that all products of conception have been removed, check that red or pink foam but no tissue is seen in the cannula. The uterus will have a 'gritty' feel when the cavity is empty, and haemostasis should be achieved. The uterus may contract around the cannula. Always examine the syringe contents after the procedure. An absence of products of conception in a patient with signs of pregnancy or a positive pregnancy test and continued bleeding suggests three possibilities. Either the miscarriage was complete before evacuation, or the products are still in the uterus (in which case evacuation needs to be repeated), or there is an ectopic pregnancy. Be very careful about the third possibility.

- 15 If MVA is not available and a curette is used, undertake the procedure up to Step 11 above. Apply the curette with firm but controlled movements in all four quadrants of the uterus (anterior wall, left lateral, posterior wall and right lateral). The uterus will have a 'gritty' feel when the cavity is empty, and haemostasis should be achieved. If there is ongoing bleeding ensure that the cavity is empty with additional gentle curettage.

- 16 IV antibiotics should be given as a single dose unless

- there are signs of sepsis, in which case a full course of antibiotics should be given (see Section 2.5.C). All patients should be treated prophylactically for *Chlamydia trachomatis* with either azithromycin 1 g orally stat or doxycycline 100 mg orally twice daily for 7 days.
- 17 Anti-D immunoglobulin prophylaxis, if available and affordable, should be given to women with a Rhesus-negative blood group. In well-resourced countries, a dose of 250 IU of anti-D immunoglobulin is given before 20 weeks' gestation, and 500 IU after 20 weeks' gestation.
 - 18 Give paracetamol, 500 mg to 1 gram orally, if needed for pain.
 - 19 If an unsafe induced abortion is suspected, examine the woman for signs of infection and uterine, vaginal, bladder or bowel injury, and thoroughly irrigate the vagina with sterile Ringer-lactate or Hartmann's solution to remove any herbs, local medications or caustic substances before MVA is undertaken (see Section 2.5.C).

Follow-up and management after a miscarriage, especially where evacuation has occurred

Uncomplicated evacuations may not require follow-up. The patient should be encouraged to eat and drink and be mobile. She should be aware of the potential complications of miscarriage that include: retained tissue (sometimes requiring repeat evacuation), infection and haemorrhage. She should be advised to seek help if there are any symptoms suggestive of these complications, such as ongoing bleeding beyond 2 weeks, very heavy bleeding at any time, severe abdominal pain, offensive-smelling vaginal secretions, fever or malaise. Rigors or fainting potentially indicate severe complications, and the woman must return immediately to the hospital if these symptoms occur. Family planning must be discussed, and the woman advised to avoid pregnancy for at least 3 months.

In the case of mid-trimester miscarriages (>12 weeks' gestation), consideration should be given to the cause of the miscarriage as it is less common at this time and more likely to be secondary to a treatable factor. As a minimum, malaria (where endemic), syphilis and urinary tract infection should be excluded or treated.

Uterine perforation

Uterine perforation may occur following evacuation of the uterus in either a medical or non-clinical setting. The risk of complications, such as infection, perforation, and damage to visceral organs such as bladder and bowel, is high where procedures are performed in non-clinical settings, and in such cases a laparotomy will be required along with high-dose intravenous antibiotics (see Section 2.5.C).

In most perforations where only the uterus has been damaged, the hole will heal spontaneously. Keep the woman under close observation for at least 48 hours.

Symptoms and signs of perforation when it has occurred in a non-medical setting

These include severe abdominal pain, vaginal bleeding, weakness, and dizziness or fainting. On examination of the abdomen there will be guarding, rebound tenderness or a rigid abdominal wall. Frequently there will be signs of septic shock (see Section 2.5.A).

Complete miscarriage

Evacuation of the uterus is not needed. Observe closely for evidence of bleeding, and follow up the woman in the clinic.

Miscarriage beyond 16 weeks' gestation

Spontaneous miscarriage will generally result in expulsion of the complete fetus (this is also usually the case between 12 and 16 weeks' gestation) and placenta. These may be expelled together within the gestational sac or separately after rupture of the fetal membranes.

The patient may present with bleeding, pain, loss of liquor or a history of having already expelled the fetus before arrival. The examination may reveal an effacing and/or dilated cervix, bulging membranes, or fetal parts. The cervix may also be closed and the patient relatively asymptomatic despite a finding of fetal death on ultrasound. Ultrasound may reveal fetal cardiac activity despite evidence of an inevitable miscarriage.

Management of late miscarriage can be divided into Expectant and Medical management with Surgical management reserved for retained placental tissue after fetal expulsion and the rare cases where life-threatening haemorrhage occurs and delivery is not rapidly achievable by any other means.

If there are no signs of labour and especially if the cervix is unfavourable then the use of mifepristone is beneficial, but not essential if unavailable.

Expectant management

This is best reserved for patients where the delivery/mis-
carriage process is clearly ongoing and is likely to occur spontaneously without medical intervention. If the delivery is urgent due to the maternal condition, the patient must be monitored closely to ensure the labour is progressing so that it can be medically augmented promptly if required.

Medical management

If spontaneous delivery is not expected or delayed then delivery can be expedited medically. If chorioamnionitis is suspected then delivery is urgent and induction should be started without delay and the patient treated appropriately with antibiotics and other measures as indicated during the process.

The patient needs to be assessed for evidence of infection, bleeding or other associated disorders and treated accordingly.

The following investigations should be performed as a minimum: blood group and cross match, Hb, malaria RDT +/− malaria smear, urine analysis for possible infection.

If there are no signs of labour and especially if the cervix is unfavourable, then the use of mifepristone is beneficial if available but can be omitted. If the delivery is urgent then either the interval between mifepristone and misoprostol treatment can be reduced or they can be administered together.

- 1 Give mifepristone 200 micrograms orally.
- 2 Observe the patient in hospital for a period of 36 to 48 hours.
- 3 Obtain intravenous access and give misoprostol 100 micrograms vaginally or orally every 3 hours up to a total of 5 doses. Oral administration is advised following initial vaginal installation of the first dose of misoprostol and assessment, especially, in the presence of ruptured

- membranes, to reduce the risk of ascending infection. A sterile technique must be followed whenever vaginal assessments are performed.
- 4 Review by a doctor if delivery has not occurred within 3 hours of the final dose.

Note: The dose of misoprostol should be reduced to 100 microgram beyond 27 weeks' gestation and to 50 microgram in women at higher risk of perforation e.g. grand-multiparae and after previous Caesarean section.

If mifepristone or misoprostol are not available, infuse oxytocin, 40 units in 1 litre of IV fluid (Ringer-lactate or Hartmann's solution) over 4 hours until expulsion of the products of conception occurs.

Following delivery, oxytocin 10IU intramuscular should be given and the patient monitored for bleeding.

If the placenta is not expelled with or immediately following the fetus, retained tissue is likely even if the placenta is eventually expelled. Have a low threshold for exploration and evacuation.

Where gestation is around 24 weeks it may be safer to remove the placenta manually as after a term pregnancy. If not possible then MVA/curettage can be used.

Abortion

This is the deliberate termination of pregnancy before the fetus is viable.

- **Unsafe abortion** is a procedure performed by individuals who lack the necessary skills and/or in an environment that does not meet minimal medical standards. It may be attempted by 'medically' inducing the abortion or by 'surgically' expelling or removing products. The terms medical and surgical are used loosely here as 'medicines' used include highly toxic herbs as well as over-the counter medicines taken in overdose.

Likewise 'surgical' is used to describe anything from unskilled use of routine surgical instruments to self-insertion of sticks or other objects into the uterus to disturb the pregnancy. Unsurprisingly, complications following unsafe abortion are common and unsafe abortion is a major contributor to maternal mortality.

- **Septic abortion** is abortion complicated by infection. Sepsis may result from ascending infection from the lower genital tract, and is more likely to occur if there are retained products of conception and evacuation has been delayed. It is a frequent complication of unsafe abortion involving instrumentation.

Molar pregnancy/gestational trophoblastic disease

This is relatively uncommon. Gestational trophoblastic

disease refers to molar pregnancy (complete and partial moles), choriocarcinoma and placental site trophoblastic tumour.

Complete and partial molar pregnancies are distinguished by the presence of a fetus in the partial group. Complete moles usually result from duplication of a single sperm following fertilisation of an empty ovum. There is no evidence of fetal tissue. Partial moles usually result from dispermic fertilisation of an ovum. There is generally evidence of a fetus or fetal red cells. Only complete molar pregnancy is likely to progress to choriocarcinoma.

Signs of pregnancy are exaggerated. The uterus increases in size more rapidly than normal, vomiting is often but not always severe and constant, there may be pre-eclampsia in the early part of the second trimester, and β HCG levels are very high. The symptoms and signs that are typically present include heavy bleeding, a dilated cervix, uterus larger than dates and softer than normal, and partial expulsion of products of conception that resemble grapes. MVA is required to evacuate the uterus (with anti-D prophylaxis in Rhesus-negative women if available and affordable). Diagnosis in low-resource settings is very difficult, and requires good-quality ultrasound and ability to monitor blood β HCG levels before dilatation and curettage. The products of conception should be examined visually and ideally histologically.

Management of molar pregnancy

This is difficult and requires referral to hospital, ideally with expert facilities if these are available.

MVA will usually be required. There is a higher risk of bleeding, and therefore it is essential to cross-match blood prior to MVA.

Follow-up β HCG measurements, regular ultrasound and possibly chemotherapy will be needed (see below).

Chest X-ray and ideally liver function tests will also be required.

The woman should be strongly advised not to become pregnant within the next year, and family planning advice is particularly important.

Choriocarcinoma, a malignant condition, is the most serious form of mole. It may follow a normal pregnancy and be manifested as continuing vaginal bleeding. Metastasis may occur to the lungs and other organs, and specialist care will be required, including chemotherapy.

Further reading

World Health Organization (2012) *Safe Abortion: technical and policy guidance for health systems*, 2nd edn. http://apps.who.int/iris/bitstream/10665/70914/1/9789241548434_eng.pdf

2.5.D.iii Antepartum haemorrhage

Introduction

Antepartum haemorrhage (APH) is defined as bleeding from the uterus or vagina occurring after potential viability from 24–28 weeks' gestation. The main causes of APH are placenta praevia, placental abruption, and bleeding from cervical or vaginal lesions.

Bleeding from the cervix is common but is not usually heavy. It may be due to rapid cervical dilatation, cervical

ectropion or polyps. Ectropions and polyps may become more vascular and friable in pregnancy, predisposing to bleeding. Endo-cervical and vaginal infections such as *Chlamydia*, *Neisseria*, *Trichomonas* and *Candida* can give rise to bleeding. Cervical carcinoma is another cause of APH.

Speculum examination should be performed in order to visualise the cervix and help to assess the likely cause

TABLE 2.5.D.III.1 Causes of major (> 500 mL) or massive (> 1500 mL) antepartum haemorrhage

| Symptoms | Clinical signs | Diagnosis | Treatment |
|--|--|---|---|
| Severe constant abdominal pain Light or heavy vaginal bleeding (or non-visible bleeding in concealed abruption) Reduced or absent fetal movements Dizziness Shortness of breath Confusion | Shock Tense and tender uterus on abdominal examination Fetal distress or absent fetal heart rate | Placental abruption | Call for surgical and anaesthetic help Oxygen Left lateral tilt or recovery position IV fluid boluses for shock + blood Cross-match 4 units of blood and freeze-dried plasma if available; transfuse prior to delivery if possible, to try to correct any clotting abnormality Deliver the fetus as soon as possible if it is viable, either by inducing labour or by Caesarean section |
| Vaginal bleeding that may be light or very heavy Bleeding can be precipitated by intercourse or vaginal examination No pain | Soft uterus Presenting part may be higher than expected. Malpresentation is more common Fetus may be distressed, non-viable or uncompromised with normal movements and normal fetal heart rate pattern Ultrasound will show placenta praevia Do not undertake digital vaginal examination, as this can puncture the placenta and precipitate massive bleeding which may be fatal Shock may be present, depending on how heavy the bleeding is and for how long it has been occurring | Placenta praevia | Call for surgical and anaesthetic help Treat shock if present, including the lateral tilt or recovery position (see above) Do not undertake digital vaginal examination, as this can puncture the placenta and precipitate massive bleeding which may be fatal If preterm and not bleeding too heavily, give steroids, admit for bed rest and only go for Caesarean section if there is a further bleed Cross-match ideally 4 units of blood |
| Continuous abdominal pain Vaginal bleeding that may be light or heavy History of a previous Caesarean section or other surgery on the uterus | Shock (especially an increasing heart rate) Tense, distended and tender abdomen Easily palpable fetal parts Absent fetal movements and heart sounds Malpresentation – transverse lie Signs of cephalo-pelvic disproportion Scar from previous surgery Haematuria | Ruptured uterus | Call for surgical and anaesthetic help Treat shock if present Cross-match ideally 4 units of blood Prepare operating theatre for laparotomy while resuscitating patient Stop oxytocin infusion if <i>in situ</i> |
| Heavy vaginal and other bleeding | Bleeding from sites in addition to the vagina Signs of other conditions that may be responsible, such as: <ul style="list-style-type: none">• placental abruption• pre-eclampsia or eclampsia (high blood pressure and proteinuria)• retained dead fetus• septicaemia, including intrauterine sepsis• incompatible blood transfusion• amniotic fluid embolism | Coagulation failure | Fresh blood transfusion Blood products such as platelets, fresh-frozen plasma and cryoprecipitate if available Antibiotics if appropriate |
| Vaginal bleeding that is light Bleeding can be precipitated by intercourse or artificial rupture of membranes No pain | Fetal distress or death | Vasa praevia (placental blood vessels lying in the membranes and in front of the baby's head) | If diagnosed by ultrasound before labour, plan for Caesarean section |

of bleeding, as well as to aid evaluation of the severity of bleeding.

Bleeding from the vagina or vulva may result from local trauma or infection. Vulval bleeding may be due to vulval varices, and may be heavy.

Diagnosis

Important points in history taking include the following:

- Is the bleeding provoked or unprovoked?
 - Bleeding due to placenta praevia is likely to be unprovoked. However, bleeding may be precipitated by intercourse or vaginal examination.
 - Abruptio is more likely after abdominal trauma.
 - Intercourse may cause bleeding from cervical or vaginal lesions.
- Is the bleeding painful or painless?
 - Bleeding due to placenta praevia is usually painless.
 - Bleeding due to placental abruption is initially painless, but as it continues contractions will occur and eventually become tonic with constant severe pain and a woody feel to the uterus.
- Is it fresh or old blood?
- Is the bleeding light or heavy?

Management of APH

This can be summarised as follows:

- ABC.
- Monitor vital signs.
- Gain IV access and give fluid resuscitation.
- Send blood for urgent haemoglobin, grouping and cross-matching, as well as Kleihauer test (if available).
- Catheterise the patient.
- Perform an abdominal examination: assess uterine tone, tenderness, presence of contractions, auscultation of the fetal heart.
- Do a speculum examination: assess for vaginal and cervical lesions, and severity of bleeding. If the placental site is unknown ideally an ultrasound scan should be performed first. If not possible, caution must be taken as bleeding from a placenta praevia may be exacerbated by vaginal assessment.
- Listen to the fetal heart.

Insert a venous cannula if any of the following are present: active bleeding, contractions, tenderness or increased tone of the uterus. If the patient is shocked, proceed to assessment and resuscitation (see below).

Investigations: haemoglobin, platelet count, clotting tests, urea and electrolytes, liver function tests. Cross-match 4 units if there is major ($> 500 \text{ mL}$) or massive ($> 1500 \text{ mL}$) haemorrhage or if the bleeding is rapid; group and save if there is loss of $< 500 \text{ mL}$ and the bleeding is not ongoing. Perform a Kleihauer test, if available, if the woman is Rhesus negative or if there is major abdominal trauma.

Management of the different causes of APH

Placenta praevia

Placenta praevia is an abnormally situated placenta in the lower uterine segment. It presents with painless bleeding,

often with no precipitating factor. Bleeding may be heavy and is bright red.

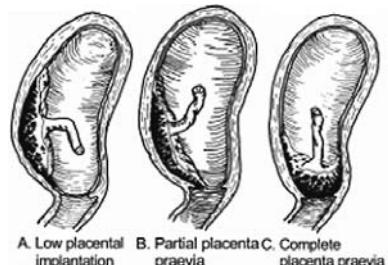


FIGURE 2.5.D.III.1 Increasing levels of low implanted placentas.

Prevention and protection

- Early detection of placenta praevia is very important to prevent serious bleeding.
- **Any bleeding during pregnancy must be investigated by an ultrasound scan.**
- Mothers with placenta praevia should have immediate access to an obstetric unit with facilities for Caesarean section.
- Mothers over 28 weeks pregnant with a placenta praevia and bleeding should stay in hospital until delivery by Caesarean section, or live very near to an obstetric unit that can perform Caesarean section.

Never allow a digital vaginal examination to be undertaken on a patient with known or suspected placenta praevia, as it can precipitate massive vaginal bleeding.

Careful speculum examination can help to exclude bleeding from the cervix or vagina but if placenta praevia is known to be present then undertake with extreme caution, ideally in the operating theatre.

Placental abruption

- Placental abruption refers to the premature separation of a normally situated placenta. The bleeding may be concealed or revealed, or mixed. It may be partial or complete (if complete, the fetus will be dead).
- The characteristic initial symptom is painless bleeding, which can be concealed or be associated with vaginal bleeding. As abruption becomes worse, contractions will occur and eventually become tonic with constant severe pain and a woody feel to the uterus. At this stage there will usually be shock, severe abdominal pain, and tenderness over the uterus. In early bleeding the uterus may still be soft to touch, but as the bleeding progresses it has a hard 'woody' feel due to uterine contraction. It may be difficult to palpate the fetal parts, the uterus may be large for dates and there may be signs of fetal distress or intrauterine fetal death. It is possible for large bleeds to be asymptomatic and even small bleeds can occasionally result in fetal death.
- Disseminated intravascular coagulation (DIC) is a common complication. A large placental abruption can occur without any visible vaginal blood loss (concealed haemorrhage).
- Remember that blood loss is invariably underestimated. Young healthy women will compensate and maintain their blood pressure until they lose around 20% of their circulating volume.

- The main risk factor for placental abruption is a previous abruption. Increased maternal age, maternal hypertension and trauma also increase the risk.

Ruptured uterus

Uterine rupture is full-thickness separation of the uterine muscle and the overlying visceral peritoneum, sometimes associated with extrusion of the fetus, placenta or both into the abdominal cavity.

- Bleeding from a ruptured uterus can occur either before (rare) or after the onset of labour, although the vast majority occur during labour itself.
- Risk factors for rupture include, obstructed labour due to cephalo-pelvic disproportion, multiparity (especially grand-multiparity), previous uterine surgery (including myomectomy and Caesarean section), and use of uterotronics (including misoprostol and oxytocin).
- A previous Caesarean section scar may rupture during labour. However, obstructed labour even without a uterine scar, particularly in a woman of high parity, may also cause uterine rupture.
- Excessive doses of oxytocin during labour can precipitate uterine rupture and oxytocin should be used with particular caution in multiparous women, especially if it is being used to augment rather than induce labour. Any mother who is receiving this drug during labour should be assessed closely for contraindications before its administration, and should not be left alone.
- **Extra careful consideration must be given to the administration of oxytocin in labour to a woman with a uterine scar, because of the increased risk of uterine rupture. This applies to women with previous myomectomy as well as to those with a previous Caesarean section.**
- In any setting, including resource limited settings, women with uterine scars should only receive oxytocin before delivery when a high level of supervision is available.
- Ideally, always use a burette in-line giving set to administer IV oxytocin, to avoid over-dosage.
- Rupture of the uterus can also occur following violence or major trauma.

Symptoms and signs

- Characteristically there is pain and tenderness over the uterus, with blood loss vaginally and cessation of contractions.
- Uterine rupture usually presents with shock, which is partly due to blood loss and partly due to increased vagal nerve stimulation (so there may be a slow pulse rather than a fast one). The baby is usually dead or has severe fetal distress.
- There may be a change in the nature of the pain in labour, from severe intermittent pain to a constant pain.
- Vaginal bleeding may or may not be present. Bleeding from a ruptured uterus can fail to drain vaginally due to an impacted fetal head, and usually the majority of bleeding is intra-abdominal in this situation.
- Maternal shock can be made worse by dehydration, exhaustion and acidosis if prolonged obstructed labour has preceded the rupture.
- The abdomen is tender to palpation, and the fetal parts can be too easily palpable.
- On vaginal examination, the presenting part may be

high or impacted; the fetal head may have retreated into the uterus.

- There may be a marked maternal bradycardia (< 60 beats/minute) due to increased vagal tone.
- The main differential diagnosis is placental abruption.

Management

- 1 Suspect uterine rupture in any patient with risk factors such as previous Caesarean section.
- 2 Primary assessment, resuscitation and emergency treatment for shock (see below).
- 3 Call the obstetrician and anaesthetist.
- 4 Obtain consent and prepare the operating theatre.
- 5 Perform urgent laparotomy.
- 6 Give prophylactic IV antibiotics (ampicillin, gentamicin and metronidazole).

For a discussion of the dangers of oxytocin during labour, and its management and contraindications, see above (and see Section 2.5.F).

Vasa praevia

- This is an uncommon but life-threatening condition for the fetus or neonate. In vasa praevia, fetal blood vessels run over or close to the cervix beneath the presenting part, unprotected by Wharton's jelly or placental tissue. These vessels are vulnerable to laceration and compression, most commonly at the time of delivery.
- Fetal or neonatal death can occur due to exsanguination or asphyxiation.
- Antenatal diagnosis can be made only by skilled ultrasound examination. Caesarean section is then needed to reduce the high mortality rate.

Failure of blood clotting

This may be due to a pre-existing coagulation problem, or to complications of the pregnancy causing excessive bleeding and disseminated intravascular coagulation (DIC) (consumption of the clotting factors).

Obstetric causes include the following:

- placental abruption
- pre-eclampsia or eclampsia
- retained dead fetus
- septicaemia, including intrauterine sepsis
- incompatible blood transfusion
- amniotic fluid embolism.

Primary assessment and resuscitation and secondary assessment and emergency treatment for bleeding in pregnancy

In any patient with vaginal bleeding and known or possible placenta praevia, a vaginal assessment should be avoided and performed with extreme caution if deemed to be essential. Ideally an ultrasound should be used to confirm the placental site.

The aims are as follows:

- to prevent shock and disseminated intravascular coagulation
- to achieve intact fetal survival if viability is possible in the circumstances.

Call for experienced obstetric and anaesthetic assistance (if available) and ensure that the operating theatre is ready

Airway

- Open the airway using chin lift or jaw thrust techniques if it is closed or partially obstructed. If there is an improvement, keep the airway open using either an assistant or an oropharyngeal airway if the patient is unconscious and this is tolerated without gagging.
- Suction if necessary.
- The airway may need to be secured by intubation using experienced senior help (if available).

Breathing

- Normal respiratory rates in a pregnant mother at rest are 15–20 breaths/minute. Tachypnoea can be due to acidosis.
- Provide high-flow oxygen by face mask with reservoir bag for adequate spontaneous respiration regardless of SaO_2 . This increases fetal oxygen delivery as well as improving maternal tissue oxygenation.
- If ventilation is inadequate, especially when there is a depressed conscious level (P or U on the AVPU scale), airway and breathing should be supported by bag-valve-mask inflations with high-flow oxygen, and experienced senior help should be called, including an anaesthetist if available.

Circulation

- Normal heart rates in a pregnant mother at rest are 60–90 beats/minute.
- Normal blood pressure in a pregnant mother at rest is 95/60–135/85 mmHg.
- Remember to put the patient in the left lateral tilt position and elevate the legs.
- Monitor the heart rate and blood pressure, and reassess regularly. Aim to keep the heart rate at ≤ 110 beats/minute and the systolic blood pressure at ≥ 100 mmHg.

Recognise the signs of hypovolaemia. These include the following:

- tachycardia
- tachypnoea
- cold, pale, sweaty and possibly cyanosed skin
- alteration of mental state: confusion or unconsciousness
- fall in urine output to less than 30 mL/hour
- narrowed pulse pressure
- hypotension (this is a late sign).

Healthy women and girls who are pregnant can maintain a normal blood pressure when large volumes of blood are lost. Most, but not all, will demonstrate tachycardia if they are bleeding significantly, but bradycardia may also be observed.

Remember that young healthy women can lose a lot of blood before they become shocked, especially if it is a slow trickle rather than a sudden large loss.

Restore circulating volume

- Put the mother in the left lateral tilt or recovery position to minimise the effects of compression of the inferior vena cava or aorta. Lateral tilt can be achieved by using a pillow, blanket or rolled up towel. A wedge may be

used during obstetric procedures. Assistants can also manually displace the uterus.



FIGURE 2.5.D.III.2 Manual displacement of uterus and left lateral tilt.

- Gain IV access and take blood for full blood count, cross-matching and blood clotting measurement. If IV access is not possible, consider intra-osseous needle insertion (see Section 8.4.B).
 - Use a short wide-bore IV cannula if possible, either 14G (usually orange) or 16G (usually grey).
 - External jugular vein access is a good option if peripheral access is impossible. Long saphenous vein cut-down may also be considered. If adequately trained personnel are available, central venous access, ideally via the internal jugular vein, can be extremely helpful. If access is not possible, consider intra-osseous needle insertion (see Section 8.4.B).
 - Try to obtain two vascular access sites to give large volumes quickly, and in case one line is lost. Do not waste time, and as soon as the first IV cannula is in place, give an IV fluid bolus.
 - Take blood for cross-matching (ideally 4–6 units), full blood count, renal function tests (if available), and blood clotting.
- Elevate the legs.
- Give an initial IV bolus of 500 mL to 1 litre of Ringer-lactate or Hartmann's solution as fast as possible using a three-way tap and 20- to 50-mL syringes to push in as rapidly as possible. If reassessment of the circulation shows little or no improvement, then a further 500 mL should be given and followed by blood transfusion as soon as this is available. (A normal adult has a circulatory blood volume of 5 litres, and during pregnancy this increases by 40% to 7 litres.)
- Apply an anti-shock garment (if available) to help maintain adequate central circulation.

Tranexamic acid can be of benefit in patients with continued bleeding. The loading dose is 1 gram over 10 minutes followed by an IV infusion of a further 1 gram over 8 hours. The slow IV bolus dose is given by injecting 1 gram of tranexamic acid into a 100-mL bag of 0.9% saline and letting it run through over about 10–20 minutes (the exact timing is not crucial). The 8-hour infusion is given by injecting 1 gram of tranexamic acid into a 500-mL bag of 0.9% saline and giving it over 8 hours (approximately 60mL/hour).

- Ensure adequate transfusion; the best way to resuscitate the fetus is to resuscitate the mother. Inadequate

- transfusion is common, especially in cases of placental abruption.
- A central venous pressure (CVP) line can aid the decision as to whether more fluid is needed. However, insertion should not delay initial resuscitation, and must be undertaken by a competent person. If peripheral access is inadequate, this route may be used for volume replacement. If DIC is established, CVP insertion is more hazardous and the subclavian vein should be avoided, because it is not externally compressible.
 - If shock is accompanied by a bradycardia of less than 60 beats/minute (e.g. in a patient with a ruptured uterus), give atropine 500–600 micrograms as an IV injection.

Blood products

- Fresh whole blood is preferable for managing obstetric haemorrhage.
- Use cross-matched blood where available except in an immediately life-threatening emergency, when group-specific blood should be used, as cross-matching may take up to an hour.
- The patient's blood group should be established during pregnancy, to facilitate the provision of blood when it is needed.
- All large-volume infusions should be warmed. In

particular, do not infuse cold fluid through a CVP line. The patient should also be kept warm, as hypothermia will exacerbate poor peripheral perfusion, acidosis and coagulation abnormalities. Any benefits of blood filters may be outweighed by their deleterious effect on the speed of transfusion. A good way of warming blood is to place the cold bag under the clothes of a relative next to their skin until the blood is warmed.

- Hand-inflated pressure bags are effective for giving blood and other fluids quickly (see Figure 2.5.A.5 on p. 170).

Identify and treat any blood clotting disorders.

- Assess bedside clotting: coagulopathy is defined as failure of a clot to form after 7 minutes, or formation of a soft clot that breaks easily (see Section 7.5 for details of whole blood clotting time measurement). Suspect and aggressively treat blood clotting disorders using warmed fresh blood, platelets (if the platelet count is $< 50\,000 \times 10^9$), fresh-frozen plasma (15 mL/kg) and cryoprecipitate as appropriate and if available.
- Freeze-dried plasma is being used in the military in adverse conditions, as it is shelf stable for 2 years and easily reconstituted with sterile water within minutes. It would be a very useful addition to the emergency stores

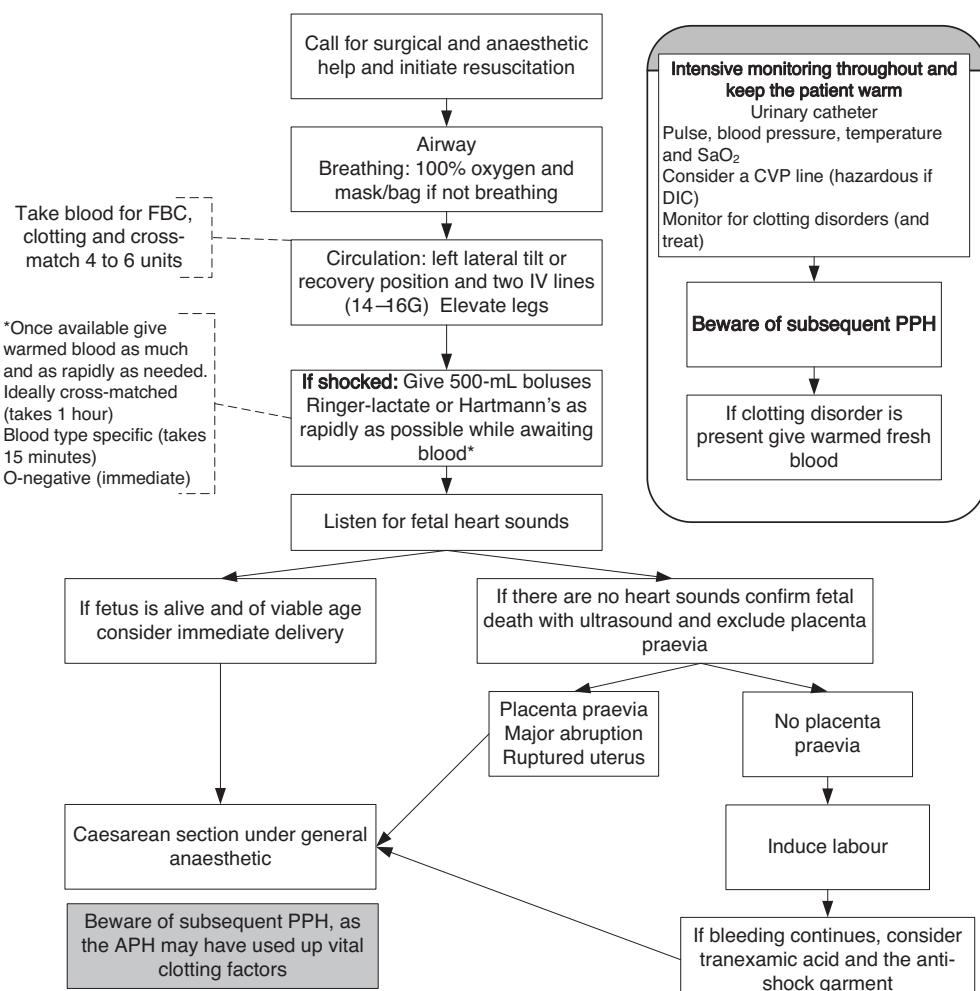


FIGURE 2.5.D.III.3 Pathway of care for massive antepartum haemorrhage (APH). FBC, full blood count; CVP, central venous pressure; DIC, disseminated intravascular coagulation; PPH, postpartum haemorrhage.

- in resource-limited countries where the use of fresh or frozen plasma presents major storage problems.
- Urinary catheterisation is needed for measurement of hourly urine output. Aim for a rate of more than 30 mL/hour.

When the patient is stable, move her to a place where there is adequate space, light and equipment to continue resuscitation and treatment.

Fetal assessment

When the mother has been resuscitated:

- listen for fetal heart sounds
- if significant haemorrhage has occurred and the fetus is considered viable after birth in the prevailing circumstances, consider immediate delivery **only if this is safe for the mother.**

Anaesthetic issues

Cardiovascular instability is a relative contraindication to spinal anaesthesia.

- Rapid sequence induction agents with minimal peripheral vasodilator action, such as ketamine 1–2 mg/kg, should be considered.
- Adrenaline and atropine should be readily available in case cardiovascular collapse occurs on induction. Ventilation with high oxygen concentrations may be needed until the bleeding is controlled.
- Volatile agents have been associated with increased blood loss due to their relaxant effects on uterine muscle. Anaesthesia should be maintained with IV agents (usually ketamine) if uterine atony is a problem.
- If spinal anaesthesia is used, compensatory lower limb vasoconstriction is abolished, so profound hypotension may occur.

Delivery options

- Diagnose and treat the source of bleeding.
- Perform Caesarean section for major abruption or placenta praevia.
- Induce labour if the fetus is dead, there is no placenta praevia, the mother is stable and there is no significant ongoing blood loss.
 - Urine output should be monitored hourly and Caesarean section considered if labour does not become established fairly quickly. The longer the dead fetus remains *in utero*, the greater the likelihood of development of DIC.
- Expect and be prepared for massive postpartum haemorrhage, whether the baby is delivered vaginally or by Caesarean section.** In cases of severe APH that require surgery, discuss the possibility of hysterectomy.

It is often APH that weakens and PPH that kills, because APH uses up the clotting factors and platelets, leaving the woman in danger if PPH follows soon afterwards.

If no safe operating theatre facilities for Caesarean section are present, give oxygen, transfuse fresh blood and transfer the patient as soon as she is safe and stable. Ensure that IV fluids are in place, catheterise the patient, and ensure that she is nil by mouth.

Monitoring

Essential monitoring should include pulse rate and volume, blood pressure, respiratory rate, oxygenation (SaO_2 if available), temperature and fluid balance (with a urinary catheter). Regular checks of the haematocrit, clotting studies and blood gases will help to guide resuscitation.

Monitor blood glucose levels and treat any hypoglycaemia.

2.5.D.iv Postpartum haemorrhage

Introduction

The definition of a postpartum haemorrhage (PPH) is blood loss of more than 500 mL from a vaginal birth and more than 1 litre after a Caesarean section. It is common, occurring in 1–3% of all pregnancies. **Globally it causes 25–50% of maternal deaths, and is the leading cause of death in low-resource settings.**

Estimates of blood loss are inaccurate and tend to be low, often around half the actual loss. Blood is mixed with amniotic fluid and sometimes with urine. It is also dispersed on sponges, towels and linen, in buckets and on the floor.

The importance of any given volume of blood loss varies depending on the mother's haemoglobin level. A mother with a normal haemoglobin level will tolerate blood loss that would be fatal for an anaemic woman. This is why it is essential to ensure that every woman who reaches labour has an adequate haemoglobin level.

Even healthy non-anaemic women can have catastrophic blood loss.

Bleeding may occur at a slow rate over several hours, in which case the condition may not be recognised until the mother is shocked. Previously healthy women can compensate for substantial blood loss until a relatively late stage.

Risk assessment in the antenatal period does not necessarily predict women who will have PPH. However, identification and treatment of anaemia antenatally will allow women to better withstand life-threatening PPH.

Prevention of PPH

Active management of the third stage of labour

This is essential for prevention of PPH, and it consists of four possible interventions:

- a prophylactic uterotonic drug after delivery, after checking that there is not a second twin present.
- early cord clamping and cutting
- controlled cord traction
- uterine massage after delivery of the placenta.

Prophylactic uterotonic drug after delivery

This is the most important intervention. Oxytocin 10IU IM or, especially if the mother is shocked, 5IU by slow (over 1–2 minutes) IV injection is the first choice because it causes uterine contractions to prevent atony rapidly and with minimal adverse effects. Atony is the most common cause of PPH (around 80% of cases). Where oxytocin is

unavailable or does not work, other uterotonic drugs should be used, including:

- ergometrine 200 or 500 micrograms IM or misoprostol 600 micrograms sublingually or orally if the mother is fully conscious
- misoprostol 800 micrograms rectally if the mother is drowsy or unconscious.

All uterotonic drugs should be given within 1 minute of the complete birth of the fetus, to aid separation of the placenta by enhancing uterine contractions and reducing the risk of bleeding from an atonic (relaxed) uterus. **It is essential that, before giving such drugs, you are certain there is not another fetus in the uterus.**

Ensure that both oxytocin and ergometrine are protected from heat damage by paying close attention to the cold chain and their storage, otherwise they may not be effective. Ideally oxytocin should be stored in a fridge, but it can be kept at 15–30°C for 3 months. Oxytocin must never be frozen. Ergometrine should always be stored in a fridge at 2–8°C. Misoprostol can be stored at ambient temperature.

Remember that ergometrine is contraindicated in heart disease, hypertension, pre-eclampsia and eclampsia, as it raises the blood pressure by vasoconstriction, which increases the risk of cerebrovascular accidents.

Early cord clamping and cutting

This is not an essential part of the active management of the third stage of labour, and it is no longer recommended unless the infant needs resuscitation.

Controlled cord traction

This is optional where delivery is undertaken by a skilled birth attendant, but contraindicated if a skilled attendant is not available. Details are given in Section 2.3.

Strong uterine massage

This should always be undertaken immediately after delivery of the placenta until the uterus is contracted and remains so. Check the state of contraction of the uterus every 15 minutes for 2 hours, and repeat the massage if at any time the uterus becomes soft and relaxed.

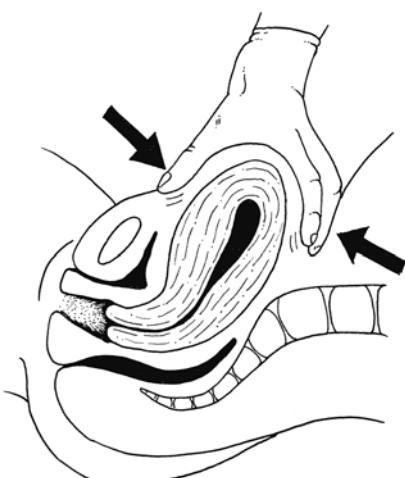


FIGURE 2.5.D.IV.1 Strong massage applied to cause uterus to contract.

The third stage

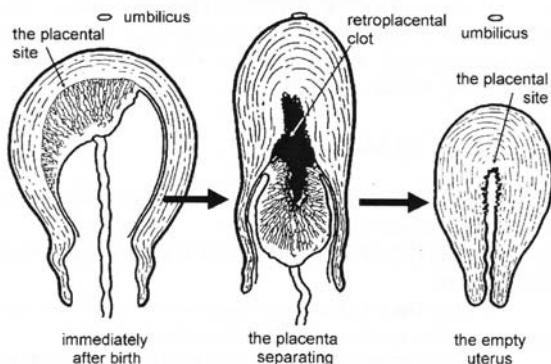


FIGURE 2.5.D.IV.2 The third stage.

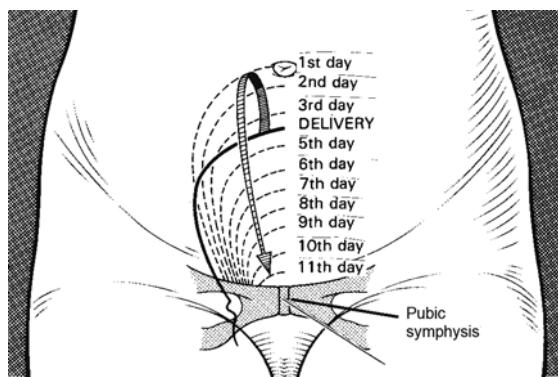


FIGURE 2.5.D.IV.3 The uterus during the puerperium.

In order to prevent PPH during or after Caesarean section, the use of oxytocin plus cord traction is recommended in preference to manual removal of the placenta.

How to manage the third stage of labour if uterotonic drugs are not available

Unfortunately it is not uncommon for hospitals to run out of uterotonic drugs. In this avoidable and dangerous situation, expectant and/or physiological management should be undertaken.

- 1 Place the baby on the mother's breast.
- 2 Leave the cord alone.
- 3 Observe for the following signs of placental separation:
 - a small gush of blood
 - a lengthening of the cord at the introitus
 - the mother feeling uncomfortable, feeling a contraction and wanting to 'bear down'.

Most placentas separate within 1 hour of birth. If this does not happen, seek help.

- 4 Deliver the placenta.
 - Sit the mother upright.
 - Encourage her to bear down with a contraction (only after placental separation).
 - Catch the placenta. If membranes are dragging behind it, gently twist a few turns and with slight traction and an up-and-down movement deliver the placenta plus membranes.

Controlled cord traction should not be undertaken prior to

TABLE 2.5.D.IV.1 Diagnosis of causes of PPH

| Symptoms | Signs | Possible diagnosis |
|---|---|---|
| Immediate heavy bleeding after birth | Uterus soft and not contracted | Atonic uterus |
| Immediate heavy bleeding after birth | Uterus contracted | Trauma to cervix, vagina or perineum |
| Bleeding which may be light if clot is blocking cervix | Placenta not delivered within 30 minutes of birth | Retained placenta |
| Bleeding which is usually light but continues for many hours | Portion of placenta missing Uterus contracted | Retained placental parts |
| Bleeding for more than 24 hours | Portion of placenta missing Foul-smelling lochia may be present Fever may be present Severe anaemia | Retained placental parts with or without infection |
| Lower abdominal pain of varying intensity Immediate but usually light bleeding | Uterus not felt on abdominal palpation Inverted uterus may be seen at vulva Bradycardia may be present Shock | Inverted uterus |
| Usually during labour there has been a change from intermittent labour contractions to a constant pain which may become less after rupture has occurred Sometimes an oxytocin drip is in place Vaginal bleeding which may be light or heavy History of a previous Caesarean section or other operation on the uterus | Shock Abdominal distension Tenderness over uterus | Ruptured uterus (more likely before delivery of the baby) |

the separation of the placenta in the absence of uterotonic drugs.

Monitoring after the placenta has been delivered by active or expectant management

- 1 Monitor the blood pressure, pulse and state of the uterus (i.e. whether it is contracted) every 15 minutes for 2 hours after delivery of the placenta.
- 2 Examine the placenta for completeness.

Causes of PPH

Primary PPH

This occurs within 24 hours of birth, and in around 80% of cases is due to uterine atony.

Remember the 4 T's: Tone, Tissue, Trauma, Thrombin.

- **Tone:** atonic uterus – failure to contract after birth.
- **Tissue:** retained placenta or placental fragments.
- **Trauma:** ruptured uterus, or trauma to the cervix, vagina or perineum.
- **Thrombin:** clotting defects, notably disseminated intravascular coagulation (DIC).

Remember also the following:

- **Haemorrhage may be concealed within the uterus or within the abdominal cavity.**
- **A ruptured uterus** can cause concealed bleeding, as can bleeding following Caesarean section.
- **An inverted uterus is associated with PPH.**
- **Any degree of PPH is dangerous if there has been severe anaemia before delivery.**

Secondary PPH

Secondary PPH (occurring from 24 hours or more after delivery up to 6 weeks after birth) is commonly associated with retained products of conception that undergo necrosis, become infected and prevent involution (sustained contraction) of the uterus. A **fever** suggests an infective component.

See p. 198 for details of the management of this problem.

Factors that predispose to PPH

These include the following:

- previous APH
- retained products of conception
- trauma to the uterus or birth canal (e.g. from instrumental delivery)
- uterine over-distension (e.g. due to multiple pregnancy or polyhydramnios)
- grand multiparity
- prolonged labour.

Management of PPH

First call for help (this must include a surgeon and an anaesthetist), palpate the uterus and massage it strongly and immediately, as it is most likely that an atonic uterus is the cause (see Figure 2.5.D.iv.1 and below).

Airway and breathing

- Ensure that the airway is open and remains so.
- Provide **high-flow oxygen** through a face mask with reservoir bag if there is adequate spontaneous respiration.

- Give 100% oxygen (using a mask with reservoir and high flow rate).
- For patients with inadequate ventilation or depressed conscious level (P or U on the AVPU scale), respiration should be supported with oxygen via a **bag-valve-mask**, and experienced senior help should be summoned (if available).

Circulation

Primary assessment denoting shock

- Fast, weak pulse ($\geq 100\text{--}110$ beats/minute). Normal heart rates in a pregnant mother at rest are 60–90 beats/minute. Tachycardia is an early sign of shock.
- Low-volume (weak) pulse.
- Pallor (especially of the inner eyelid, palms or around the mouth).
- Sweatiness or cold clammy skin.
- Prolonged capillary refill time (> 3 seconds).
- Rapid breathing (> 30 breaths/minute). Normal respiratory rates at rest are 15–20 breaths/minute; tachypnoea can be due to acidosis.
- Low blood pressure (systolic pressure $< 90\text{ mmHg}$) is a **very late sign**. Healthy women and girls can maintain a normal or even high blood pressure while losing large volumes of blood.
- Nausea with or without vomiting.
- Anxiety, confusion or unconsciousness.
- Reduced urine output ($< 30\text{ mL/hour}$). Urinary catheterisation is needed for measurement of hourly urine output if the patient is shocked (normal output is $> 30\text{ mL/hour}$).

Procedures for stopping haemorrhage must be started immediately and then undertaken in parallel with IV fluid resuscitation.

Measures to stop further haemorrhage due to uterine atony

Rubbing up a contraction

Poor contraction of the uterus after delivery is the commonest cause of PPH. **Rub up a contraction of the uterus (do not just pinch the skin).**

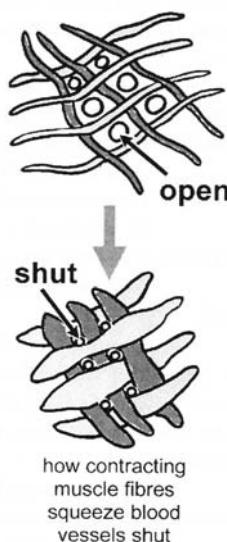


FIGURE 2.5.D.IV.4 Contraction of uterine muscle fibres squeezes blood vessels shut.

As the muscle fibres are stimulated to contract, they compress the blood vessels running between the muscle fibres and help to stop bleeding.

Abdominal massage of the uterus

If the uterus is atonic, a contraction may be rubbed up by abdominal massage.

- Massage the fundus in a circular motion with the cupped palm of your hand until it is contracted.
- When it is well contracted, place your fingers behind the fundus and push down in one swift action to expel clots.

Uterotonic drugs

These drugs make the uterus contract.

Give 10IU of oxytocin IM or 5IU IV slowly, especially if the patient is already shocked, and repeat after 5 minutes if they are still bleeding and/or the uterus is not contracted. This is the drug of first choice.

Oxytocin starts to work 2–3 minutes after IV injection, but has a relatively short duration of action, and an infusion will be needed to maintain a contracted uterus. Following an oxytocin bolus, give an IV infusion of oxytocin 40IU in 500 mL (60 drops/minute with a standard IV giving set where 20 drops = 1 mL) or 1 litre (120 drops/minute) of Ringer-lactate or Hartmann's solution over 4 hours.

Side effects include hypotension (due to vasodilatation when given as a rapid IV bolus) and fluid retention.

If the mother does not have eclampsia, pre-eclampsia or hypertension, **ergometrine** 200 to 500 micrograms IM in addition may help uterine contraction. If the first dose of oxytocin does not stop bleeding within a few minutes, give **misoprostol** (which, unlike oxytocin and ergometrine, does not need to be kept in a refrigerator). It is given rectally as 4 × 200 microgram tablets or pessaries (800 micrograms in total) or, if the patient is conscious, orally as 3 × 200 microgram tablets or 2 × 200 micrograms of powder sublingually.

Ergometrine, either as part of Syntometrine (oxytocin 5IU and ergometrine 500 micrograms IM) or alone, is contraindicated in pre-eclampsia, as its hypertensive action increases the risk of convulsions and cerebrovascular accidents.

Urinary catheterisation

This may help the uterus to contract.

Bimanual uterine compression

If heavy PPH continues despite uterine massage, and with the placenta already delivered, this procedure can be very effective. If the placenta is still in place priority should be given to removing it as soon as possible.

- You must wear sterile or disinfected gloves (ideally long versions up to the elbow).
- Introduce your right hand into the vagina, clench your fist with the back of your hand positioned posteriorly and your knuckles in the anterior fornix.
- Place your other hand on the abdomen behind the uterus and squeeze the uterus firmly between both hands.
- Continue compression until the bleeding stops (i.e. there is no bleeding when compression is released), and the uterus is contracted.

Although this procedure is painful, it is highly effective and can significantly reduce or even successfully treat uterine

haemorrhage. Therefore, if the bleeding is profuse, and the number of staff attending the patient allows, it is a good idea for one member of the team to commence bimanual compression while uterotonic drugs are prepared and given, and initial fluid resuscitation commenced.

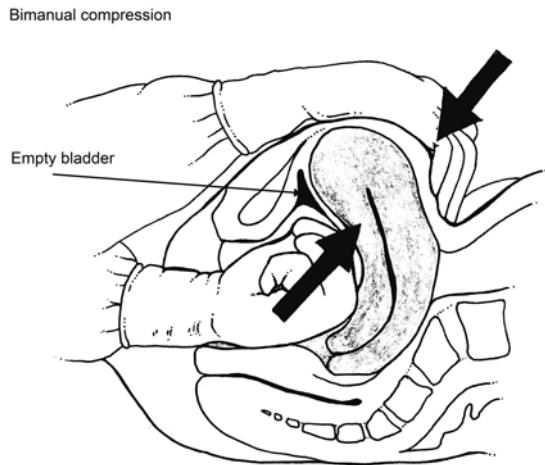


FIGURE 2.5.D.IV.5 Bimanual compression.

Aortic compression

If bleeding still persists, apply aortic compression.

- Apply downward pressure with a closed fist (with your thumb outside the fist) over the abdominal aorta directly through the abdominal wall.
- The point of compression is just above the umbilicus and slightly to the left.
- Aortic pulsations can be felt through the anterior abdominal wall in the immediate postpartum period. Press the aorta down on to the vertebral column.
- With your other hand, palpate the femoral pulse with four fingers parallel to and just below the inguinal ligament to check the adequacy of compression.
- **If the pulse is palpable during compression, the pressure exerted by the fist is inadequate.**
- **If the femoral pulse is not palpable, the pressure exerted is adequate.**



FIGURE 2.5.D.IV.6 Aortic compression.

Continue until the bleeding stops. If it does not stop, continue to exert pressure while transferring the mother to a facility where expert help is available.

Uterine tamponade

Uterine packing with a hydrostatic balloon such as a Rusch balloon or condom over a simple in-out urinary catheter can

help to control haemorrhage from an atonic uterus that does not respond to the above measures. The uterus may also be packed with a sterile pack or gauze, although it is important to ensure any gauze used is tied together, counted carefully, and extended into the vagina to facilitate removal.

A condom catheter, which is inserted into the uterus as a sterile procedure and filled with 250–500 mL of sterile Ringer-lactate or Hartmann's solution or 0.9% saline to create a uterine wall tamponade, is an effective way of stopping uterine bleeding that is continuing despite the use of uterotonic drugs and procedures (see Figure 2.5.D.iv.7). **It is important to check that the balloon is fully inside the uterus as it is inflated, and to take measures to ensure that it does not become displaced into the vagina.** This can be done by packing the vagina with a pack or gauze swab.



FIGURE 2.5.D.IV.7 Condom catheter inflated with sterile IV fluid.

Leave the balloon in position until the bleeding has stopped for up to 24 hours (the exact time needed is unclear). Before removing it, ensure that at least 1 unit of cross-matched blood for possible transfusion is available, with the possibility of making more available if required. Theatre staff and an anaesthetist should be warned in case bleeding occurs when the catheter is removed. One approach is to remove 50 mL every 30 minutes until it is fully emptied. Observe the patient closely for 4 hours after removal of the catheter, looking at vaginal blood loss and vital signs. IV antibiotics should be given when the catheter is put in place, and should be continued for 48 hours.

An alternative new approach (the EgAr device from The Gambia) useful in low resource settings involves inflating a condom with air rather than IV fluids (see Figure 2.5.D.iv.8). It includes the following components:

- a firm type of urinary catheter (used for temporary insertion and drainage of urine) rather than an indwelling Foley catheter, which is easily constricted
- a latex male condom from a sterile and unbroken pack
- the inflator (with its tube) of an aneroid blood pressure machine
- a surgical suture (preferably black silk) for tying the condom to the catheter
- a piece of sterile thread for tying the end of the condom after inflation to stop the escape of air

- sterile gauze to pack the vagina and maintain the inflated condom in the uterine cavity.



FIGURE 2.5.D.IV.8 Condom catheter inflated with air.

Using a sterile procedure throughout, the catheter is inserted into the condom, with the end part of the condom touching the tip of the catheter. The lower part of the condom is tied to the catheter using suture thread and inserted into the uterine cavity. The condom is then held in place inside the uterine cavity using the non-dominant hand, the lower end of the catheter is connected to the inflator of the blood pressure machine (with the valve closed), and the condom is then inflated with air until the bleeding is either arrested or greatly reduced. Pneumatic pressure is rapidly achieved after a few inflations. The uterus gradually increases in size (this can be seen abdominally) as the condom is being inflated, and the woman should experience no more than slight discomfort. Excessive inflation of the condom must be avoided, and pain indicates that too much air is being forced into the condom. If this happens, the volume of air can be easily reduced by loosening the valve of the inflator.

Compared with inflating the condom with fluid (assuming that IV fluid is available, which is not always the case), this technique is much faster and easier, and good control is achieved by using the valve on the inflator.

Fluid resuscitation

The aim of fluid resuscitation is to maintain perfusion of vital organs (the brain, heart and kidneys) during the manoeuvres described above.

- Elevate the patient's legs (raise the foot of the bed).**
- Try to obtain two vascular access sites in order to give large volumes quickly, and in case one line is lost. Insert a wide-bore IV cannula (ideally two) (14- to 16G) and send blood for a full blood count, cross-matching (4–6 units) and clotting. If peripheral veins are difficult to access, the external jugular vein or long saphenous vein cut-down are good alternatives. If a skilled person is available, an internal jugular vein central line can be helpful, especially if the central venous pressure can be measured.
- If venous access is not possible, consider inserting an intra-osseous line using the newly available drill system (see Section 8.4.B).
- Give 500 mL of O-negative blood if it is immediately available. If not, standard practice is to give an initial **rapid** IV bolus of 1 litre of Ringer-lactate or Hartmann's solution (or of 0.9% saline if the former are not available) while waiting for blood for transfusion. It is essential that the IV bolus is given as rapidly as possible, with the aid of pressure bags or manual pressure. A blood

pressure cuff that is wrapped around the fluid bag and inflated can be used to speed up infusions (see Figure 2.5.D.iv.9). An alternative is to push the boluses in using a 20- to 50-mL syringe (with a three-way tap linked to the IV giving set).

- As soon as it is available give 1 unit of blood (500 mL) as rapidly as possible,** and repeat as required. Fresh blood is particularly useful for combating the coagulopathy that occurs in major blood loss if specific coagulation components such as platelets are unavailable. Remember that blood loss is usually underestimated.
- Further 500- to 1000-mL boluses of IV crystalloid or blood, if available, will usually be required in the first hour. Once more than 2 litres have been given IV, complications such as pulmonary oedema may sometimes occur, so be alert for circulatory overload.

The concept of **targeted crystalloid fluid resuscitation** may be relevant here and requires urgent research. If this approach is adopted the initial boluses of IV crystalloids required to treat shock would only be given to keep the vital organs (especially the brain, heart and kidneys) perfused before blood becomes available and, most important of all, before specific treatments to stop the bleeding have started to take effect. Giving too much IV crystalloid fluid may theoretically increase bleeding by disrupting early clot formation and damaging the coagulation system. There is no clear evidence to indicate the precise blood pressure or clinical signs that should be achieved in a woman in shock due to PPH. **Adequate perfusion of vital organs may be indicated by a radial pulse that can be palpated and a fully alert conscious level.**

Until bleeding has been stopped and blood is available for transfusion, our personal practice, especially in low resource settings, is therefore to start with IV boluses of 500mL of crystalloid and reassess after each bolus.

- Keep the patient warm but do not overheat them, as this will cause peripheral vasodilatation and reduce the



FIGURE 2.5.D.IV.9 Pressure bag over bag containing Ringer-lactate or Hartmann's solution.

- blood supply to vital centres. Hypothermia will exacerbate poor peripheral perfusion, acidosis and coagulation abnormalities.
- 8 If there is evidence of a blood-clotting problem, give fresh-frozen plasma and/or other clotting factors (if available).
 - 9 Further IV fluid administration should be guided by the response of the pulse rate, blood pressure and capillary refill time, and later by the hourly urine output. Aim for a pulse rate of $\leq 100\text{--}110$ beats/minute and a systolic blood pressure that is $\geq 90\text{--}100\text{ mmHg}$ and stable.

Blood products

Fresh whole blood is the ideal choice if it is available. Full cross-matching of blood may take up to an hour and is often unavailable in resource poor settings. In an emergency, group-specific blood should be used. The patient's blood group should have been established during pregnancy, as this facilitates the provision of blood when it is needed. O-Rhesus-negative blood can be transfused in acute emergencies.

All large-volume infusions of blood should be warmed. A good way of warming blood is to place each bag of blood or fluid under a relative's clothes next to their skin. Do not infuse cold fluid directly through a central venous line.

New potentially valuable treatments for PPH Tranexamic acid

If there is continuing bleeding, especially if it has been caused by genital tract trauma, this inexpensive and safe drug can be helpful. Recent evidence has shown that tranexamic acid can reduce mortality from major haemorrhage in major trauma in adults. The drug should be started as soon as possible, and within the first 3 hours after the onset of major haemorrhage, in order to be effective.

The loading dose is 1 gram over 10 minutes followed by an IV infusion of a further 1 gram over 8 hours.

The slow IV bolus dose is given by injecting 1 gram of tranexamic acid into a 100-mL bag of 0.9% saline and letting it run through over a period of about 10–20 minutes (the exact timing is not crucial).

The 8-hour infusion is given by injecting 1 gram of tranexamic acid into a 500-mL bag of 0.9% saline and giving it over a period of 8 hours (i.e. approximately 60 mL/hour). If there is a gap between the initial bolus and the subsequent infusion this probably does not matter too much, but ideally one should follow the other.

The non-pneumatic anti-shock garment (NASG)

This compression garment is made from neoprene, a stretchable material that recoils and applies pressure through the skin. It feels like a tight diving wet-suit to wear, and consists of five segments that compress the legs (segments 1, 2 and 3), the pelvis (segment 4) and the abdomen (segment 5) (see Figures 2.5.D.iv.10 and 2.5.D.iv.11). The abdominal segment includes a foam compression ball that presses on the area of the uterus. The segments are held in place by Velcro. It is a very promising, potentially life-saving technique for low-resource settings.

Preliminary pre- and post-intervention trials have shown that the NASG significantly reduces shock, blood loss, the need for emergency hysterectomy, and maternal mortality and severe morbidity associated with PPH and other



FIGURE 2.5.D.IV.10 NASG garment before it is placed on the patient. Reproduced with permission from Miller S, Martin HB, Morris JL. Anti-shock garment in postpartum haemorrhage. *Best Pract Res Clin Obstet Gynaecol.* 2008; **22**(6): 1057–74. © Elsevier

causes of obstetric haemorrhage. Randomised controlled trials by the World Health Organization and others are currently under way in Zambia and Zimbabwe.

The NASG is reported to reduce shock by compressing blood vessels in the lower parts of the body, thereby diverting up to 30% of total blood volume to the heart, lungs, brain and possibly the kidneys. There is evidence that, through the applied pressures of 25–50 mmHg, it decreases blood flow in the pelvis and, in PPH, blood loss from the atonic uterus.

It is particularly promising in settings where there can be delays in transfer to facilities where comprehensive emergency obstetric care is available, and where blood transfusion and surgery can be undertaken. In such settings, even in hospitals, blood transfusion is frequently delayed for between 1 and 3 hours, with O-negative blood rarely available and supplies of stored blood precarious. The NASG, by stabilising the patient, gives time for blood transfusion to become established and other treatments to be given, as well as very probably reducing the amount of blood that subsequently needs to be transfused.



FIGURE 2.5.D.IV.11 NASG garment on a patient. Reproduced with permission from Miller S, Martin HB, Morris JL. Anti-shock garment in postpartum haemorrhage. *Best Pract Res Clin Obstet Gynaecol.* 2008; **22**(6): 1057–74. © Elsevier

As reported by the International Federation of Gynecology and Obstetrics (FIGO), 'The NASG is not a definitive treatment – the woman will still need to have the source of bleeding found and definitive therapy performed.' We would qualify this statement and substitute the word

'may' for 'will', as sometimes the bleeding, particularly in PPH, may be reduced during the application of the NASG, and advanced treatments such as surgery may not then be required.

The NASG is applied in sequence from the lower legs up to the abdominal compression segment (segment 5). With experience it can be applied by one person in 2 minutes, although it takes from 5 to 10 minutes if the healthcare worker is alone and unused to applying it. Help from others present, such as porters or relatives, can be valuable. In PPH due to uterine atony, it is particularly important that someone is massaging the uterus and giving the other treatments outlined above when the NASG is being applied. After the garment is in place the legs no longer need to be elevated and the uterus can still be externally massaged by placing one hand underneath the pelvic segment of the NASG. Vaginal examinations and repair of cervical or vaginal tears can be performed while the NASG is in place. The pelvic and abdominal segments can be opened for surgery such as emergency hysterectomy or B-Lynch sutures.

The NASG can be applied in addition to all the other measures for PPH described above when signs of shock first appear (see Section 2.5.A). The only contraindication to its use is known heart disease. The aim with all treatments is for a pulse rate of ≤ 100 –110 beat/minute and a systolic blood pressure that is ≥ 90 –100 mmHg and stable in a woman who is fully alert and has a urine output of ≥ 30 mL/hour.

The NASG is removed segment by segment when bleeding has been reduced to safe levels and the patient's cardiovascular stability has been maintained for at least 2 hours (systolic blood pressure ≥ 90 –100 mmHg, heart rate ≤ 100 –110 beats/minute and haemoglobin concentration of ≥ 7 g/dL). Removal begins at the ankles with 15-minute gaps between each segment that is opened, and clinical measurements being made before each segment is removed. If the systolic blood pressure drops by ≥ 20 mmHg and/or the heart rate increases by ≥ 20 beats/minute, reapply that segment of the NASG and consider additional treatments such as further blood transfusion.

Between patients, the NASG can be laundered in the same way as for bloodstained sheets. First soak the garment in 0.5% chloride solution for 15 minutes. Then wash and scrub it with a soft brush in soapy water. Finally rinse it in clean water and leave it to air-dry. Fold and store the garment when it is completely dry.

Each NASG can be used 50–100 times, and at present costs US\$150–200.

Stopping bleeding due to trauma to the perineum, cervix or vagina

If the bleeding continues despite all of the measures described above, examine the perineum, vagina and cervix with a sterile speculum. Postpartum bleeding with a contracted uterus is usually due to a cervical or vaginal tear. Trauma to the lower genital tract is the second most frequent cause of PPH, and may coexist with an atonic uterus.

Examine the mother carefully and repair any tears. Bleeding from trauma can be substantial and may be fatal, especially if there is pre-existing severe anaemia. Suture packs, a torch, a Sims' speculum and sutures must always be immediately available on the PPH emergency trolley.

Initially stop the bleeding with sterile packing until a surgeon is able to repair the wounds.

It is essential to ensure that the uterus is contracted even when a traumatic cause is present.

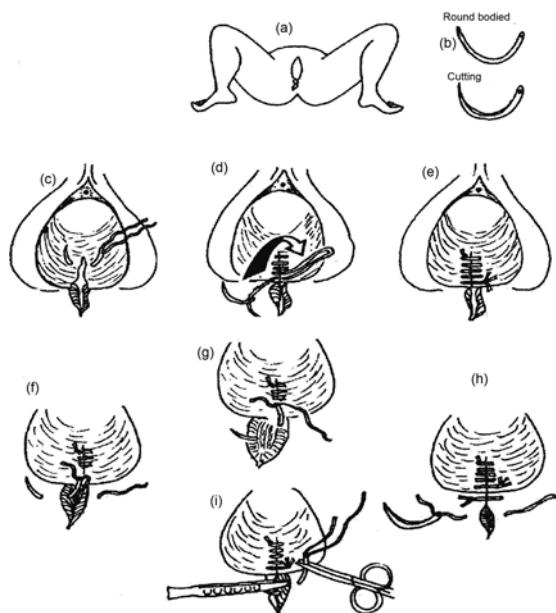


FIGURE 2.5.D.IV.12 Repairing a perineal tear.

Repairing a perineal tear

Get a good light, and start at the top of the tear. If difficult ask for help if available.

- 1 Anything except very minor tears should be repaired in the lithotomy or similar position as it provides a better view and is more comfortable for the surgeon/midwife.
- 2 Use a cutting needle on the skin and a round-bodied needle on other tissues.
- 3 Put the first stitch in above the highest point of the tear (apex). This is usually within the vagina.
- 4 When you get to the junction between the vaginal mucosa and the skin, put a needle through the loop and tie a knot.
- 5 Continue by applying stitches into the muscle and fascia to close any dead space (gaping of the vaginal skin) and again tie a knot once done.
- 6 Next close the skin by placing the needle in through the skin on one side, and then in through the sub-cutaneous tissues and out through the skin on the other side. If using interrupted sutures, the stitches are usually inserted $\sim 1/2$ cm from the skin edges and ~ 1 cm apart from each other. Tie a knot after each stitch to oppose the skin.

Repairing a bleeding cervical tear

Place the patient in the lithotomy position and explain the procedure to the patient.

Get a good light and if at all possible an assistant.

Search all round the patient's cervix, if the cervix is not easily visible grasp it with a sponge holding forceps (or similar) and pull it into view. In order to visualise the entire cervix it is often necessary to follow the cervix round from anterior to posterior by pulling each segment down with the sponge holding forceps. Ideally two forceps are used and the next segment picked up with one set of forceps while traction is maintained with the other ('walking the cervix').

Once the cervical tear is identified start suturing it at its highest point (the apex).

If you cannot insert sutures, control the bleeding with a vaginal pack and transfer the patient.

Stopping bleeding due to retained placenta or retained products of conception

Examine the placenta and ensure that it is complete.

Retained placenta

A retained placenta is defined as occurring:

- 1 after active management of the third stage of labour (see Section 2.3), if the placenta is not delivered within 30 minutes of the birth
- 2 after expectant management of the third stage of labour, if the placenta is not delivered within 60 minutes of the birth.

Risk factors include a full bladder, a previous retained placenta, high parity, uterine fibroids, a history of previous uterine surgery and placenta praevia. The placenta may become trapped in the cervix or lower uterus. There may be no bleeding with a retained placenta, especially if there is abnormal adherence (placenta accreta).

A retained placenta occurs in around 2% of deliveries.

Management of retained placenta

If there is a clinically significant PPH, the placenta must be removed urgently. Call for help (including an anaesthetist and an obstetrician), insert a venous cannula, take blood for haemoglobin and cross-matching as for PPH, and ensure that the operating theatre is ready.

Massage the uterus, and if there is atony it should be managed as described for PPH above. However, although oxytocin should be used as necessary, **do not give ergometrine because it causes tonic uterine contraction, which may delay expulsion.**

Cause 1: The placenta is separated but trapped in the lower part of the uterus or cervix

If the placenta is undelivered after 30 minutes of oxytocin stimulation, and the uterus is contracted and the placenta separated (usually indicated by the gushing of blood and rising of the uterus into the abdomen as a firm, more movable structure as with a normal placental separation and delivery), attempt controlled cord traction. During this procedure, and at all times, keep one hand on the abdomen to support the uterus and prevent its inversion.

Avoid forceful cord traction and fundal pressure, as they may cause uterine inversion.

This situation usually responds to firm and persistent traction on the cord with the other hand countering this on the uterus to prevent inversion. Ensure that the bladder is empty. Ask the mother to empty her bladder, otherwise catheterise the bladder if necessary. If you can see the placenta, ask the mother to push it out; an upright position may help. Undertake a sterile vaginal examination and if you can feel the placenta in the vagina or cervix, remove it.

Cause 2: The placenta has failed to separate from the uterus

If controlled cord traction plus uterotonic drugs are

unsuccessful, manual removal of the placenta is likely to be required (see below).

If the cord has broken from the placenta, it is still possible for the placenta to be pushed out by contractions and by the mother.

Cause 3: The placenta is morbidly attached to the uterus

Very adherent tissue may be **placenta accreta**, a situation that is more likely to occur after a previous Caesarean section. Efforts to extract a placenta that does not separate easily may result in heavy bleeding or uterine perforation, which usually requires hysterectomy.

Therefore, if there is any suspicion of a morbidly adherent placenta the patient should ideally be referred to a hospital with operating facilities and a surgical team (if available). See pages below for more details on management.

Where there is significant haemorrhage, uterine and vaginal packing with gauze or balloon tamponade/condom catheter can halt the bleeding and eventually allow residual placenta to disintegrate and resorb/expel on its own. Hysterectomy will be needed if bleeding cannot be stopped by the measures described above.

If **bleeding continues**, assess clotting status using a bedside clotting test. Failure of a clot to form after 7 minutes, or formation of a soft clot that breaks down easily, suggests coagulopathy.

If there are **signs of infection** (fever with foul-smelling vaginal discharge), give antibiotics as for endometritis.

Manual removal of the placenta

This is a painful procedure associated with a high risk of infection unless it is undertaken using full sterile procedures. In many low-resource settings, manual removal of the placenta is undertaken without analgesia or anaesthesia, and often not even in the operating theatre.

Unless it is performed as an emergency for major PPH, we consider that manual removal of the placenta should be undertaken in an operating theatre with preceding morphine or ketamine in the presence of an anaesthetist. Elbow-length sterile gloves should be used. Provided that active PPH is not occurring, **the mother should first be adequately resuscitated with IV fluids/blood and oxygen.** The pulse rate, blood pressure, oxygen saturation and urine output should be closely monitored. Ideally, facilities for blood transfusion and, if necessary, emergency hysterectomy should be available.

After the placenta has been removed, massage the uterus to encourage tonic uterine contraction. An IV infusion of oxytocin 40 units in 500mL or 1 litre of Ringer-lactate or

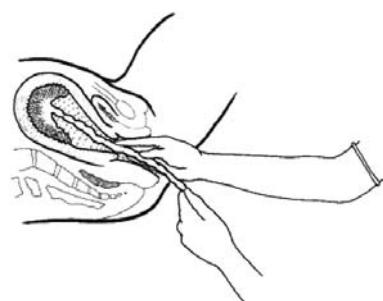


FIGURE 2.5.D.IV.13 Introducing one hand into the vagina along the cord.

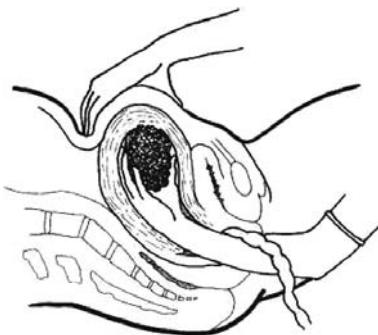


FIGURE 2.5.D.IV.14 Supporting the fundus while detaching the placenta. Reach the placenta from the implantation site by keeping the fingers tightly together and using the edge of the hand to gradually make a space between the placenta and the uterine wall



FIGURE 2.5.D.IV.15 Withdrawing the hand plus the placenta from the uterus.

Hartmann's solution should be administered over 4 hours to ensure continued uterine contraction.

A single dose of prophylactic antibiotics should be given just before all manual removals (2 grams of ampicillin IV or IM plus 80 mg of gentamicin IM/IV).

Treatment of PPH that continues despite all of the above interventions

Reassess the patient and determine whether bleeding is continuing and whether there is a clotting disorder. Assess the clotting status using a bedside clotting test. Failure of a clot to form after 7 minutes, or formation of a soft clot that breaks down easily, suggests coagulopathy.

If bleeding continues, re-examine the patient and ensure that the oxytocin IV infusion is running correctly (40 units of oxytocin in 500 mL of Ringer-lactate or Hartmann's solution over 4 hours).

- Exclude the following:
- inverted uterus
- retained products of conception
- damage to the genital tract: check for bleeding from the cervix, vaginal walls and perineum.

If the above measures fail to control PPH, **do not wait too long**.

The following operative interventions are available:

- B-Lynch sutures
- hysterectomy, which may be life-saving, and should be considered early in order to reduce the risk of life-threatening coagulopathy.

Check the haemoglobin levels or haematocrit after resuscitation and when the patient is stable. Consider administering oral iron if the patient is anaemic.

Treatment of secondary PPH

This is particularly dangerous in low-resource settings. Severe and life-threatening anaemia can develop rapidly, and frequently the woman is admitted in shock and urgently requiring blood transfusion. Severe life-threatening septic shock can also develop.

Assess vital signs and temperature, and if the patient is shocked proceed as described above for massive PPH.

Assess the uterine size, and perform a speculum and vaginal examination and note the degree of bleeding, whether the blood is offensive, whether the cervix is still open, and whether there is cervical and uterine tenderness. Take a high vaginal swab for bacteriology (if available) before antibiotics are given.

Insert an IV line and take blood for haemoglobin, blood cultures, cross-matching and blood clotting (or clotting/bleeding time if unavailable) (as DIC may occur).

Urgently start 7 days of treatment with IV antibiotics, as the bleeding is often secondary to infection. This is especially likely if there is foul-smelling lochia, a fever, or there has been prolonged rupture of membranes prior to delivery.

- Give IV ampicillin 2 grams IV every 6 hours
 - plus gentamicin 80mg IV or IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours
 - plus metronidazole 500 mg IV every 8 hours.
- Alternatively, give ceftriaxone 2 grams IV or IM once daily plus metronidazole 500 mg IV every 8 hours.

Provide blood transfusion (ideally fresh blood) if the haemoglobin level is < 5 g/dL, or if it is < 7.5 g/dL with symptoms suggesting early cardiac failure or shock or if there is brisk ongoing blood loss.

Examine for suspected retained placental fragments, but beware of the high risk of uterine perforation. Feel inside the uterus using elbow-length sterile gloves, and try to remove any retained products manually or using ovum forceps. **Be very careful not to perforate the uterus.** Placental tissue that sticks to the uterus may be placenta accreta, which may result in heavy bleeding (see below for management). If the cervical os has already started to close, this approach might not be possible. If a curette is used, it should be blunt, and great care should be taken as the uterus will be soft and easy to perforate. A vacuum aspirator (as used for treating miscarriage) or digital curettage may be safer options. Laparotomy is occasionally needed to deal with the continued bleeding from an infected or ruptured uterine incision or infected placental bed.



FIGURE 2.5.D.IV.16 Evacuating the uterus.

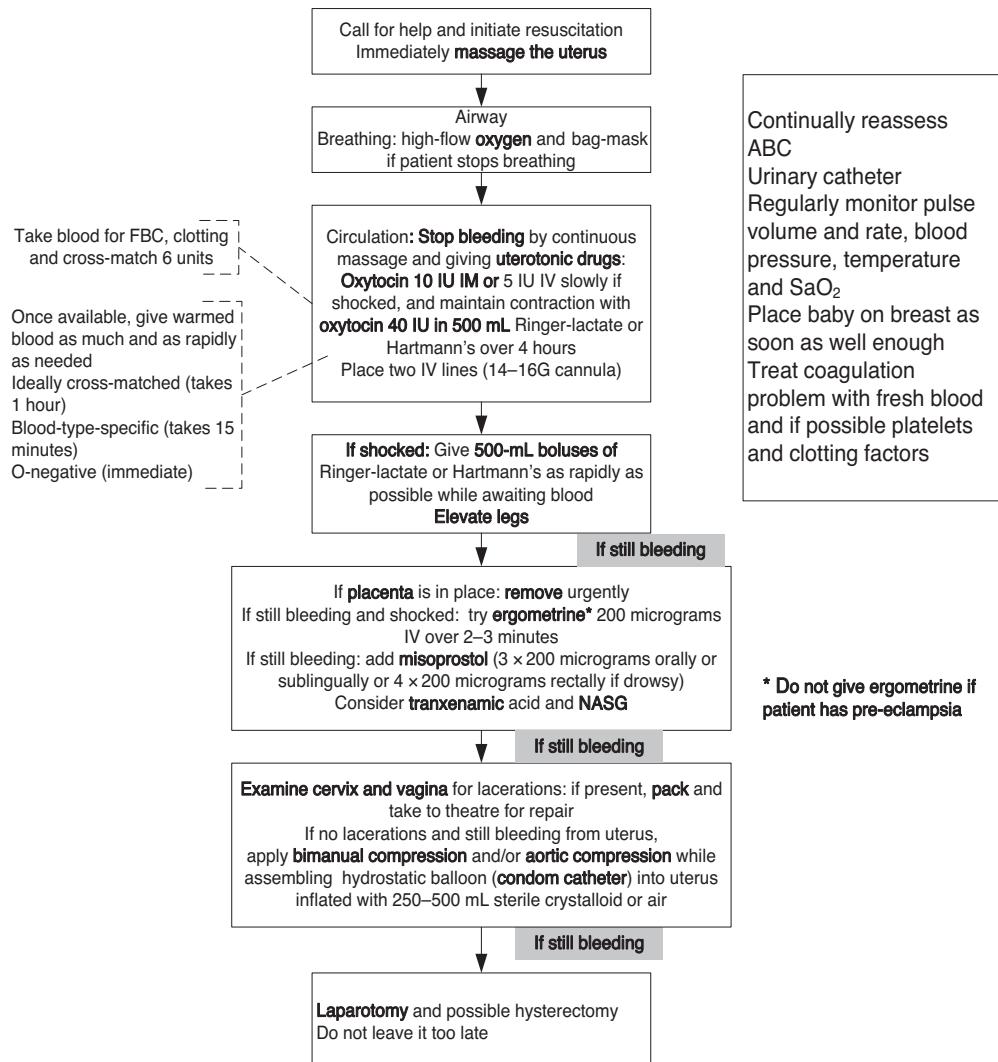


FIGURE 2.5.D.IV.17 Pathway of care for massive postpartum haemorrhage (PPH). Aim for a contracted and empty uterus. FBC, full blood count; NASG, non-pneumatic anti-shock garment; ABC, airway, breathing and circulation.

Management of placenta accreta

This serious complication is caused by the placenta being morbidly adherent to deeper layers in the uterine muscle or even external to the uterus. It is more common after a previous Caesarean section and in the presence of a placenta praevia. After Caesarean section an attempt should be made to assess the site of the placenta with ultrasound to determine whether it is likely to overlie the previous scar.

If the patient undergoes a new Caesarean section, or has a retained placenta, the procedure should be carried out by the most experienced practitioner possible and preparations made for major haemorrhage, i.e. experienced anaesthetic assistance, good intravenous access, cross matched blood and availability of the non-pneumatic anti-shock garment.

An option is to allow the placenta to be left *in situ* where it may separate and expel itself over time. This risks haemorrhage, infection and DIC and in these cases the mother must be made aware of these risks. She must be observed carefully for signs of infection, given prophylactic antibiotics (single dose of ampicillin 2 g IV/IM plus gentamicin 5 mg/kg body weight IV/IM) and warned about what to expect when the placenta is eventually expelled. She must have

rapid access to emergency care and be monitored as an inpatient.

Alternatively, an attempt to remove the placenta can be made. Haemorrhage, as discussed, should be anticipated and the procedure performed in theatre with adequate intravenous access, monitoring, cross-matched blood available and the most experienced anaesthetic and surgical personnel possible.

An alternative option is an immediate hysterectomy in order to prevent later complications and the necessity for very close post-partum monitoring. The decision will need to be based on the patient's wishes, the resources available and the doctor's abilities. If there is no facility for emergency hysterectomy, the patient should be transferred to a facility where this is available.

Bleeding due to inverted uterus

See Section 2.6.H.

Anaesthetic issues when managing PPH

Cardiovascular instability is a relative contraindication to regional blockade.

Rapid sequence induction agents with minimal

peripheral vasodilator action, such as ketamine, should be considered (see Section 1.24). Adrenaline and atropine should be readily available in case cardiovascular collapse occurs on induction. Ventilation with high concentrations of oxygen may be needed until the bleeding is controlled.

Volatile agents have been associated with increased blood loss due to their relaxant effects on uterine muscle. Anaesthesia should be maintained with IV agents (ketamine or etomidate) if uterine atony is contributing to haemorrhage.

Disseminated intravascular coagulation (DIC)

Suspect and aggressively treat coagulopathy using warmed fresh blood, platelets, fresh-frozen plasma and cryoprecipitate as appropriate and available. DIC is more likely to occur if there has been a previous antepartum haemorrhage.

Sheehan's syndrome

Very rarely, massive PPH can cause pituitary infarction (also called Sheehan's syndrome). This presents initially as failure of breastfeeding, and later as no return of menstrual bleeding, as well as fatigue, low blood pressure and loss of pubic and axillary hair. Treatment is with replacement hormones,

including oestrogen, progesterone, thyroid and adrenal hormones. Specialist endocrinological advice is necessary.

Monitoring

Once the bleeding has been controlled, frequent observations of respiratory rate, pulse rate, blood pressure, urinary output and oxygen saturation (if available) are vital both to detect problems and to monitor the response to treatment. At least 48 hours of close observations are required.

Further reading

A Textbook of Postpartum Hemorrhage: a comprehensive guide to evaluation, management and surgical intervention.

www.sapienspublishing.com/pph_pdf/PPH.pdf

Videos on techniques used to treat PPH: www.glowm.com

FIGO Safe Motherhood and Newborn Health (SMNH)

Committee (2012) FIGO Guidelines: prevention and treatment of postpartum hemorrhage in low-resource settings.

www.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf

World Health Organization (2012) WHO recommendations for the prevention and treatment of postpartum haemorrhage. http://apps.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf

2.5.E Hypertension, pre-eclampsia and eclampsia

BOX 2.5.E.1 Minimum standards

- Blood pressure machine
- Urine protein testing sticks
- Magnesium sulphate
- Antihypertensive drugs (labetalol, hydralazine, methyldopa and nifedipine)
- Bag-valve-masks, oxygen and oropharyngeal airway
- Suction
- Patella hammer
- Pulse oximeter

Introduction

Hypertension in pregnancy occurs when the systolic blood pressure is ≥ 140 mmHg and/or the diastolic blood pressure is ≥ 90 mmHg. If the blood pressure is elevated, confirm this by making repeated measurements (see below).

Severe hypertension (systolic pressure ≥ 170 mmHg and/or diastolic blood pressure ≥ 110 mmHg) must be treated, because a systolic or diastolic blood pressure at or above these levels is associated with a risk of cerebral haemorrhage, hypertensive encephalopathy and placental abruption.

Measuring blood pressure and looking for hypertension

When you measure the blood pressure of a woman, she should be rested and seated at a 45-degree angle with the machine on the bed beside her. Do not prop it up on her abdomen. Also do not lie her down, as this causes compression of the central veins. Open the cuff out flat, and make sure that you place the centre of the inner bladder

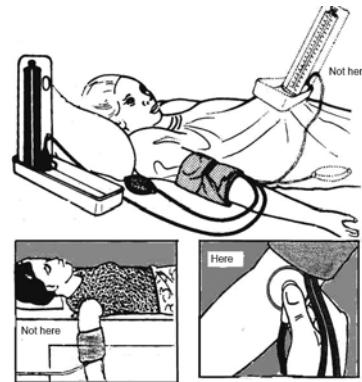


FIGURE 2.5.E.1 Measuring blood pressure.

on the artery. A falsely high reading will be obtained if the cuff's bladder does not encircle at least 80% of the circumference of the arm.

If the blood pressure is consistently higher in one arm, this arm should be used for all subsequent measurements. Some automated blood pressure machines under-measure systolic blood pressure.

The systolic pressure is the onset of the first sound (Korotkov 1). The diastolic pressure is the complete disappearance of sounds (Korotkov 5). The normal systolic blood pressure in pregnancy is in the range 95–135 mmHg. The normal diastolic blood pressure is in the range 60–85 mmHg. Diastolic blood pressure measures peripheral resistance and does not vary with the woman's emotional state to the same degree that systolic pressure does. The blood pressure normally falls during the second trimester of pregnancy, reaching its lowest value by the end of the

second trimester, and returning to pre-pregnancy levels at term.

If the systolic pressure is ≥ 140 mmHg and/or the diastolic blood pressure is ≥ 90 mmHg on two consecutive readings taken ≥ 4 hours apart, hypertension should be diagnosed.

In addition to a blood pressure of $\geq 140/90$ mmHg, any increase in systolic pressure of ≥ 30 mmHg or in diastolic pressure of ≥ 15 mmHg over recent previous measurements requires close monitoring, even if the pressures do not reach 140 mmHg systolic or 90 mmHg diastolic.

The categories of hypertension in pregnancy

These can be classified as follows.

Pre-eclampsia

This is hypertension (blood pressure of $\geq 140/90$ mmHg) that develops after 20 weeks' gestation, always in association with proteinuria (≥ 0.3 grams in a 24-hour specimen). This level correlates with $\geq 1+$ on dipstick testing.

Pre-eclampsia is a multi-system disorder.

Other conditions cause proteinuria, and false-positive results are possible (e.g. due to contamination with normal vaginal discharge or amniotic fluid). Urinary infection may also produce proteinuria, but rarely $\geq 2+$ on dipstick testing. Blood in the urine due to catheter trauma, schistosomiasis or contamination with vaginal blood may also give false-positive results.

Random urine sampling, such as the dipstick test for protein, is a useful screening tool. A change from negative to positive during pregnancy is a warning sign. If **dipsticks are not available**, a sample of urine can be heated to boiling point in a clean test tube. Add a drop of 2% acetic acid to check for persistent precipitates that can be quantified as a percentage of protein in the sample. Only clean-catch midstream specimens should be used. Catheterisation for this purpose is not justified, due to the risk of urinary tract infection.



FIGURE 2.5.E.2 Testing for proteinuria without reagents/sticks.

Eclampsia is fitting associated with the syndrome of pre-eclampsia. Seizures can occur without any previous signs or symptoms.

The diagnosis of pre-eclampsia is made when there is hypertension after 20 weeks' gestation associated with significant proteinuria (≥ 0.3 grams/24 hours) (see above).

It is associated with a risk of developing one or more of the following:

- significant proteinuria (≥ 0.3 grams/24 hours) (see above)

- renal involvement (serum/plasma creatinine > 90 micro-mol/litre with or without oliguria)
- haematological involvement (low platelet count, haemolysis, DIC)
- liver involvement (raised transaminases, epigastric or right upper quadrant abdominal pain)
- neurological involvement (headache, persistent visual disturbances including photophobia, scotomata, blindness and retinal vasospasm, hyper-reflexia with sustained clonus, stroke)
- pulmonary oedema
- intrauterine growth retardation
- placental abruption.

HELLP is a syndrome that consists of **Haemolysis**, **Elevated Liver enzymes** and **Low Platelets**. It may complicate pre-eclampsia, sometimes with only mild or borderline hypertension and marginally abnormal proteinuria.

Pre-eclampsia and eclampsia are still one of the main causes of maternal mortality and morbidity in low-resource countries. In one study it was reported that 38% of eclamptic fits occur antenatally, 18% occur in the intrapartum period, and the remaining 44% occur postpartum, usually in the first 48 hours after delivery. Sometimes the first fit occurs postnatally.

Oedema occurs with the same frequency in women with and without pre-eclampsia. However, if oedema develops suddenly and is widespread, always screen for pre-eclampsia. Test for oedema by pressing with your finger for 1 minute over the bony part of the mother's tibia. If there is a dent when you take your finger away, oedema is present. If the mother has been lying down, look for oedema over the sacrum. Oedema can also make a finger ring tight. Oedema of the face is more likely to represent a sign accompanying pre-eclampsia.

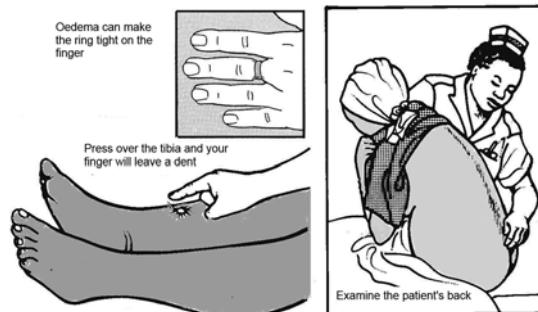


FIGURE 2.5.E.3 Testing for oedema of the ankles and lower back.

Gestational hypertension

This is hypertension that develops only after 20 weeks' gestation but with no other features of pre-eclampsia, and which resolves within 3 months after birth. Patients who present early in pregnancy (after 20 weeks) and with severe hypertension are more likely to develop pre-eclampsia.

Chronic hypertension

- 1 Essential hypertension (also called primary hypertension) occurs before 20 weeks' gestation, without cause (see below).
- 2 Hypertension may also be secondary to other medical conditions such as chronic renal disease, endocrine disorders or diabetes mellitus.

It is important to control the hypertension in these cases, keeping the blood pressure below 150/100 mmHg, but not permitting the diastolic pressure to go below 80 mmHg.

Pre-eclampsia in a woman with chronic hypertension and gestational hypertension

Women with hypertension in pregnancy are at increased risk of developing superimposed pre-eclampsia and should be monitored more frequently for the presence of proteinuria and systemic features of pre-eclampsia from 20 weeks' gestation onwards but especially in the third trimester.

Pre-eclampsia

Risk factors

These include the following:

- first pregnancy
- multiple pregnancy
- family history of pre-eclampsia
- chronic hypertension (see above)
- renal disease
- hypertension/pre-eclampsia during a previous pregnancy
- diabetes mellitus
- molar pregnancy.

For those at high risk of recurrence, a systematic review of 59 trials involving 37 560 women found that low doses of aspirin reduced the risk of pre-eclampsia by about a sixth (17%), with a similar lowering of the risk of the baby dying (14%), and a small lowering of the risk of the baby being born too early (8%). Doses up to 75 mg appear to be safe and high risk women are advised to start taking it from 12 weeks' gestation and to continue until delivery of the baby.

Investigations

These include the following:

- urine dipstick test for protein and microscopy to exclude infection
- haemoglobin levels and platelet count
- urea and electrolytes, and creatinine
- liver function tests
- lactate dehydrogenase (LDH) and uric acid
- fetal growth assessment by ultrasound scan.

If there are signs of DIC, clotting studies should be undertaken (whole blood clotting time in low-resource settings; see below).

If there is severe hypertension in early pregnancy, investigations (if available) for the rarer causes such as molar pregnancy, autoimmune disorders, phaeochromocytoma, etc. may be indicated.

Management of pre-eclampsia and gestational hypertension

Pre-eclampsia progresses during pregnancy, and the only definitive treatment is delivery. If the patient is at term (i.e. after 36 weeks) then, after stabilisation of the mother, the baby should be delivered as soon as possible.

There is no evidence that bed rest improves the outcome for the mother or the fetus. Heavy physical labour is clearly inappropriate. However, women in low-income settings are commonly seen working in this way despite being in advanced pregnancy.

Mild cases can be cared for without hospital admission, but there need to be regular (at least weekly) checks on blood pressure and urine, and the family must be made aware of the warning signs of severe pre-eclampsia or eclampsia (see below).

If there is severe pre-eclampsia or eclampsia, if the blood pressure cannot be adequately controlled, or if there is pulmonary oedema, deteriorating renal or liver function, placental abruption or evidence of falling platelet counts or DIC, delivery is urgent but must always take place after stabilisation. In cases before 36 weeks' gestation, an injection of dexamethasone or betamethasone 12 mg IM, two doses 12 hours apart or 6 mg IM, four doses 12 hours apart, improves the likelihood of avoiding neonatal respiratory failure (see Section 3.1).

Stabilisation involves correction of severe hypertension, control of fluid intake and output, correction of blood-clotting disorders (in low-resource settings with fresh blood transfusion) and prevention or control of eclampsia (see below).

Antihypertensive drugs for pre-eclampsia

Mild pre-eclampsia does not require antihypertensive drugs.

If the systolic blood pressure is 150–160 mmHg and/or the diastolic blood pressure is 95–105 mmHg, treatment with oral antihypertensive drugs should be started.

Systolic pressure of ≥ 170 mmHg and/or diastolic pressure of ≥ 110 mmHg must be urgently treated with antihypertensive drugs. **However, it is essential that the blood pressure is not lowered too rapidly, as this can seriously affect the woman's cerebral circulation and the circulation to the placenta and fetus.** Aim for a systolic blood pressure of 150 mmHg.

Oral antihypertensive drug treatment

Methyldopa

This drug acts directly on the central nervous system and takes 24 hours to work. The dose is 250 mg three times a day initially, increasing every 2 days up to 750 mg three times a day. Side effects include dry mouth, postural hypotension, sedation and depression. Methyldopa is contraindicated in patients with depression or liver disease.

The simultaneous administration of oral iron and oral methyldopa can lead to a drug interaction that can result in clinically significant increases in blood pressure (> 15 mmHg increase in systolic pressure and > 10 mmHg increase in diastolic pressure).

Labetalol

This is a beta-blocker with mild alpha-blocking effects. The dose is 100–400 mg three times a day. Side effects include bradycardia, bronchospasm, weakness, scalp tingling (only for 24–48 hours), nausea and headache. Labetalol is contraindicated in patients with asthma.

Hydralazine

This is a vasodilator. The dose is initially 25 mg twice a day, increasing gradually to 50 mg three times a day. Side effects include uncontrolled hypotension, flushing, tachycardia, palpitations, headache and (uncommonly) a lupus syndrome.

Treatment of severe hypertension

It is vital that severe hypertension is controlled at any gestation, both before and after delivery.

Antihypertensive drugs should be given urgently to all patients with a systolic blood pressure of $\geq 170\text{ mmHg}$ and/or a diastolic blood pressure of $\geq 110\text{ mmHg}$.

Without urgent treatment there is a risk of cerebral haemorrhage, eclampsia and pulmonary oedema.

The aim should be a gradual and sustained reduction in blood pressure with one or more of the drugs described below.

Blood pressure should not be allowed to fall below 140/80 mmHg before delivery.

Hydralazine

This is the most widely available antihypertensive drug in low-resource settings. Give 5 mg IV slowly over a period of 5 minutes (it acts within 5 minutes). Repeat the BP after every 15 minutes and treat with further doses of 5 mg until the **diastolic** blood pressure is 90–100 mmHg and the systolic BP is 140–160. Repeat the hydralazine hourly as needed, or give hydralazine 12.5 mg IM every 2 hours as needed.

Alternatively, give hydralazine IV infusion, 20 mg in 200 mL of 5% dextrose at 0.5 mL (10 drops) per minute (20 drops = 1 mL for a standard giving set), and stop the drip when the diastolic blood pressure is $\leq 90\text{ mmHg}$. Hydralazine may cause an increase in the maternal heart rate.

Side effects include uncontrolled hypotension, flushing, tachycardia, palpitations, headache and (uncommonly) a lupus syndrome.

Labetalol

Intravenous labetalol is preferable to hydralazine if the maternal pulse rate exceeds 120 beats/minute.

The labetalol dosage is 10 mg IV. If the response is inadequate (i.e. if diastolic blood pressure remains above 110 mmHg) after 10 minutes, give a further dose of labetalol 20 mg IV. Increase the dose to 40 mg and then 80 mg if a satisfactory response is not obtained after 10 minutes of each dose.

Alternatively, use an IV infusion of 200 mg in 200 mL of Ringer-lactate solution at 40 mg/hour, increasing the dose at 30-minute intervals as required to a maximum of 160 mg/hour.

Side effects include bradycardia, bronchospasm, weakness, scalp tingling (only for 24–48 hours), nausea and headache. **Labetalol is contraindicated in patients with asthma, as it may cause severe bronchospasm.**

Nifedipine

The slow release/modified action version of the tablets must always be used in this situation. Nifedipine is a calcium antagonist that can be administered as an initial 10 mg oral dose (onset of action within 10–20 minutes), with a repeat dose of 10 mg if there is an inadequate response after 30 minutes. Subsequent oral doses are 20 mg twice a day. Side effects include severe headaches associated with flushing and tachycardia. Oedema, weakness and constipation may also occur. Nifedipine is contraindicated in patients with aortic stenosis. It may inhibit labour.

Give prophylactic magnesium sulphate if hypertension is accompanied by proteinuria and/or if protein testing is

not available by symptoms which suggest that eclampsia may occur (see below).

Eclampsia or severe pre-eclampsia

Although pre-eclampsia and eclampsia are most common in the primigravida, they can occur in multiparous patients.

Symptoms and signs of impending eclampsia

These include the following:

- headache, visual disturbances, epigastric pain and vomiting
- rapidly developing generalised (especially facial) oedema
- pulmonary oedema
- right upper quadrant tenderness
- recently developed hypertension $\geq 170/110\text{ mmHg}$ with proteinuria $> 1\text{ gram}/24\text{ hours}$ or a rapid rise in blood pressure
- clonus and increased tendon reflexes
- HELLP syndrome.

Any headache or epigastric pain occurring in the second half of pregnancy should be investigated for pre-eclampsia (measure the blood pressure and test the urine for protein).

Differential diagnosis (see Table 2.5.E.1)

- A seizure:
 - in a patient with known epilepsy (see Section 5.16.E)
 - in severe malaria (see Section 2.8.D)
 - in head injury (see Section 2.7.E)
 - in meningitis/encephalitis (see Section 2.7.E).
- Intoxication (local anaesthetic overdose).
- Amniotic fluid embolus (see Section 2.5.I).

Maintain a high index of suspicion of pre-eclampsia or eclampsia even in those with malaria, migraine or epilepsy, as the conditions may coexist.

A small proportion of mothers with eclampsia have a normal blood pressure. Treat all convulsions as eclampsia until another diagnosis is confirmed.

Convulsions with signs of pre-eclampsia indicate eclampsia.

Convulsions due to eclampsia:

- can occur regardless of the severity of hypertension
- are difficult to predict, but rarely occur without increased tendon reflexes, headache or visual changes
- are tonic-clonic and resemble grand mal convulsions of epilepsy
- may recur frequently, as in status epilepticus, and may be fatal
- will not be observed if the woman is alone
- may be followed by coma that lasts for minutes or hours depending on the frequency of convulsions
- occur after childbirth in about 44% of cases, usually but not always within the first 24 hours after birth. The longer the gap between delivery and a fit, the more likely the diagnosis is to be a condition other than eclampsia (e.g. cerebral venous thrombosis).

The first eclamptic fit is usually self-limiting.

Control of blood pressure is essential in the management of severe pre-eclampsia or eclampsia where high blood pressure may cause a cerebrovascular accident (stroke). Magnesium sulphate is essential for preventing eclampsia and, if eclampsia occurs, for preventing further fits.

TABLE 2.5.E.1 Differential diagnosis of hypertension and convulsions in pregnancy

| Symptoms | Signs | Results of investigations | Diagnosis | Treatment |
|--|--|---|---|--|
| None unless very severe | Blood pressure \geq 140/90 mmHg before 20 weeks' gestation | Urine for protein negative Renal function tests normal | Essential hypertension | Consider antihypertensive drugs |
| None unless very severe | Blood pressure \geq 140/90 mmHg before 20 weeks' gestation | Proteinuria \leq 2+ | Hypertension secondary to other disease such as renal impairment, or autoimmune disease | Treat hypertension with drugs if severe, and treat the underlying condition |
| None unless very severe | Blood pressure \geq 140/90 mmHg after 20 weeks' gestation | No proteinuria | Pregnancy-induced hypertension | Treat hypertension with drugs if severe |
| None unless very severe | Blood pressure \geq 140/90 mmHg before 20 weeks' gestation | Proteinuria \leq 2+ | Mild to moderate pre-eclampsia | Avoid work involving heavy labour |
| Headaches increasing in frequency and unrelieved by paracetamol Visual disturbance Upper abdominal pain Shortness of breath Passing small amounts of urine Oedema | Blood pressure \geq 140/90 mmHg after 20 weeks' gestation Hyper-reflexia Passing less than 400 mL of urine in 24 hours Pulmonary oedema Facial and rapidly developing oedema | Proteinuria \geq 2+ | Severe pre-eclampsia | Urgent admission to hospital Magnesium sulphate |
| May be history of the above Generalised convulsions Unconscious | Generalised fitting Coma Blood pressure \geq 140/90 mmHg after 20 weeks' gestation Facial and rapidly developing oedema | Proteinuria \geq 2+ | Eclampsia | ABC Magnesium sulphate |
| Difficulty opening mouth and swallowing | Spasms of the face, neck and trunk Arched back Board-like abdomen | | Tetanus | ABC, Penicillin, anti-tetanus immunoglobulin Muscle relaxants (magnesium and/or diazepam) Nasogastric feeding |
| Past history of convulsions | Convulsions Coma Normal blood pressure | EEG abnormal | Epilepsy | ABC, blood glucose Anticonvulsant drugs |
| Chills/rigors Headache Muscle/joint pain | Fever Convulsions Coma Severe anaemia Jaundice | Blood smear for malarial parasites | Severe malaria | ABC, blood glucose Antimalarial drugs |
| Headache Stiff neck Photophobia Vomiting | Fever Stiff neck Reduced conscious level or coma Convulsions | Full blood count Blood culture Lumbar puncture (unless there is evidence of raised intracranial pressure) | Meningitis or encephalitis | ABC Antibacterial or antiviral drugs |
| Headache Blurred vision Photophobia History of migraine | Normal blood pressure | No proteinuria | Migraine | Paracetamol Bed rest in dark room |
| | | | Cerebral venous thrombosis | |

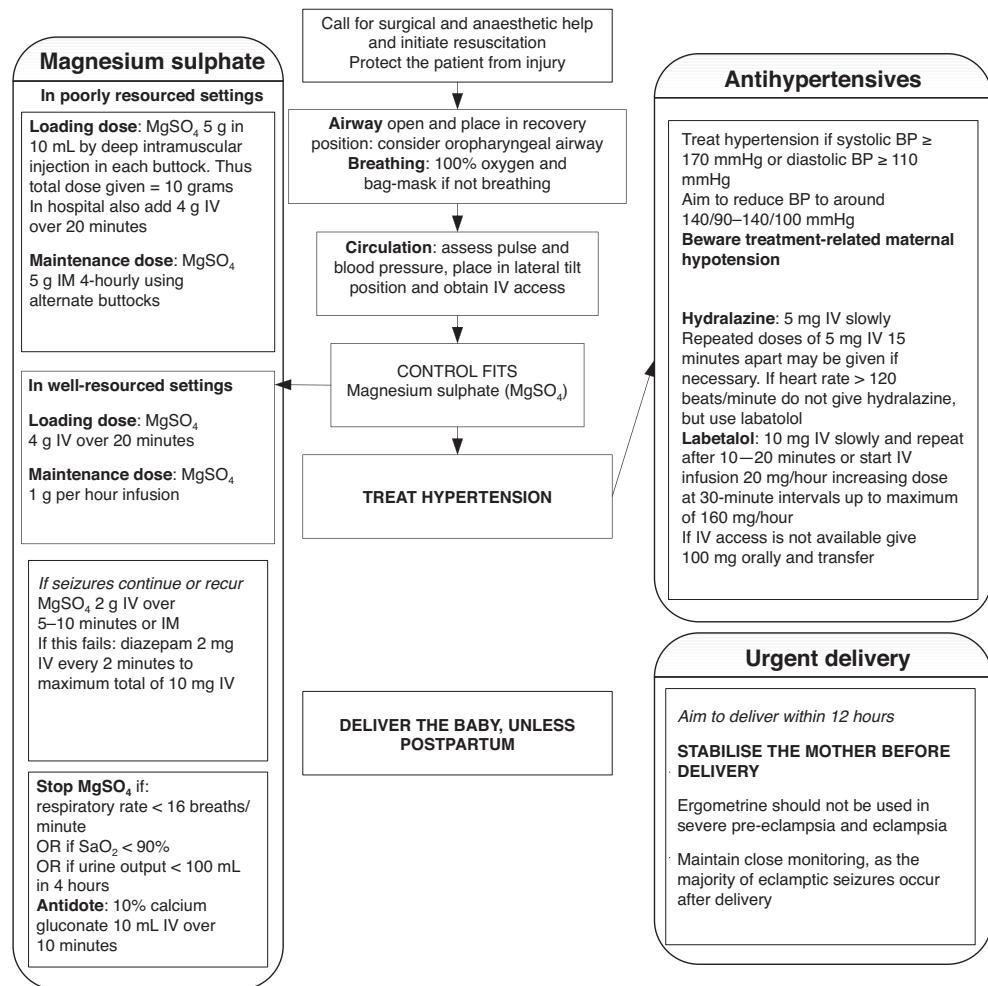


FIGURE 2.5.E.4 Pathway of care for eclampsia when the mother is having convulsions.

Maternal complications of severe pre-eclampsia

These include the following:

- eclampsia
- cerebrovascular accident (stroke)
- renal failure
- HELLP syndrome, possibly leading to rupture of the liver capsule
- pulmonary oedema
- placental abruption, possibly leading to DIC
- intrauterine growth restriction, fetal death.

- The oropharynx may need gentle suctioning under direct vision, being careful to avoid inducing laryngospasm.
- The recovery position should be adopted to minimise the risk of aspiration of vomit.

Breathing

- If there is spontaneous breathing, give a high concentration of oxygen via a face mask plus reservoir. Give 100% oxygen (mask with reservoir and a flow rate of at least 5 litres/minute) regardless of the mother's oxygen saturation (this increases fetal oxygen delivery as well as improving maternal tissue oxygenation).

Primary assessment, resuscitation and emergency treatment of convulsions in eclampsia

Call for help

- Never leave the patient alone.
- Prevent maternal injury during the convulsion.

Airway

- If the airway is not open, use an airway-opening manoeuvre and keep it open. Consider an airway adjunct such as an oropharyngeal airway or intubation. Do not attempt to insert an oropharyngeal airway while the patient is convulsing.



FIGURE 2.5.E.5 The recovery position.

- If there is apnoea or hypoventilation, provide ventilation with bag-valve-mask-reservoir ventilation and 100% oxygen.

Circulation

- Look for signs of life (breathing, movement, gagging/coughing) or for a pulse at the carotid. If these are absent or you are not sure, initiate CPR (see Sections 1.12 and 1.13).
- If the mother is over 20 weeks' gestation, put her in the left lateral tilt position and/or manually displace the uterus to reduce vena caval compression, or put her in the recovery position.
- Secure IV or intra-osseous access.
- Monitor the blood pressure.
- Attach a pulse oximeter.
- Insert a urinary catheter with strict fluid input/output chart.

Insert a 14G or 16G IV cannula and take 20mL of blood for full blood count, blood group, cross-matching (4 units = 2 litres) and clotting. Do a 20-minute whole blood clotting time (WBCT20) test if laboratory analyses are not available (see Section 7.5).

A central venous pressure (CVP) line may be a helpful monitor to avoid fluid overload, but the benefits must be weighed against the risks. If disseminated intravascular coagulation (DIC) is established, CVP insertion is more hazardous (you must avoid subclavian vein access).

Emergency drug treatment of eclampsia

Stopping the convulsion and preventing further convulsions

The majority of seizures are self-limiting.

Commence magnesium sulphate to prevent further fits.

Magnesium sulphate ($MgSO_4$) treatment

Magnesium sulphate is the anticonvulsant of choice.

If the mother is conscious, warn her that there will be a feeling of warmth passing through her body when magnesium sulphate is infused, and that this is not harmful. Failure to do so may result in the mother pulling out her IV cannula, and other potentially dangerous reactions.

Loading dose in well-resourced settings

Give 4 grams of $MgSO_4$ as 20mL of a 20% solution of magnesium sulphate IV added to 80mL of 5% dextrose solution given slowly over 20 minutes (total volume 100mL). (To make 20mL of a 20% solution, add 8mL of 50% $MgSO_4$ solution to 12mL of sterile water.)

If convulsions recur after completion of the loading regime, give 2 grams of $MgSO_4$ IV slowly over 10 minutes (10mL of 20% solution is added to 90mL of Ringer-lactate or Hartmann's solution).

Do not use the same IV line to inject other drugs if $MgSO_4$ is being given by IV infusion.

Loading dose in resource-limited settings

Give 5 grams of $MgSO_4$ (10mL of 50% solution) by deep intramuscular injection in **each** buttock. Thus the total dose given is 10 grams. (**Sometimes 0.5mL of 2% or 1mL of**

1% lignocaine is given in the same syringe for each injection of 5 grams, to reduce the pain of the injections.) An aseptic technique is essential.

Maintenance dosage

- Well-resourced countries:** Provided that there is close monitoring (ideally with a burette in giving set), give 1 gram of $MgSO_4$ /hour IV for 24 hours (i.e. 25mL/hour of the loading dose solution of 4 grams in 100mL described above).
- Resource-limited countries:** give 5 grams of $MgSO_4$ IM 4-hourly (plus 1mL of 1% lignocaine, or 0.5mL of 2%, in the same syringe) using alternate buttocks.

Alternative regime

This regime is recommended in Asia where pregnant women are smaller than those in Africa and there are more resources.

Loading dose: Give 4 grams of $MgSO_4$ as 20mL of a 20% solution added to 80mL of 5% dextrose solution slowly IV over 20 minutes (total 100mL). (To make 20mL of a 20% solution, add 8mL of 50% $MgSO_4$ solution to 12mL of sterile water).

Then immediately give 3 grams (6mL of 50% solution) by deep intramuscular injection in **each** buttock. (**Sometimes 1mL of 1% or 0.5mL of 2% lignocaine is given in the same syringe, to reduce the pain of the injections.**)

Maintenance dose

Give 2.5 grams of $MgSO_4$ IM every 4 hours using alternate buttocks.

Treatment if seizures continue or recur

Give 2 grams of $MgSO_4$ if body weight is less than 70kg, or 4 grams if body weight is over 70kg, as an extra loading dose IV over 5–10 minutes or IM in low-resource settings.

Alternative regime

This regime is undertaken in some West African countries, and was recommended by the World Health Organization in 2003.

Loading dose: 4 grams IV of $MgSO_4$ over 20 minutes: add 8mL 50% to 92mL Ringer-lactate or Hartmann's solution. This is followed by 10 grams 50% $MgSO_4$ solution IM (5 grams in each buttock: deep IM injections with lidocaine as above in the same syringe). **Ensure that the needle is not in a vein.**

Maintenance dose: This is 5 grams $MgSO_4$ 50% solution with lidocaine every 4 hours into alternate buttocks.

If eclampsia recurs, and only after 15 minutes, give 2 grams of $MgSO_4$ over 5 minutes IV: add 4mL of 50% to 16mL of Ringer-lactate or Hartmann's solution.

Continued treatment with magnesium sulphate

Continue $MgSO_4$ for 24 hours after delivery or the last convulsion, provided that:

- respiratory rate is > 12–16 breaths/minute
- urine output is > 30mL/hour (WHO figure is > 100mL over 4 hours)
- tendon reflexes are present.

Discontinue magnesium sulphate when:

- blood pressure is stable and consistently below 150/100mmHg
- diuresis has started
- there are no neurological symptoms.

Monitor the fetus by regular heart rate assessments.

A fluid balance chart must be kept (see below).

Remember to subtract the volume containing MgSO₄ infused from total maintenance infusion volume to avoid fluid overload.

When using magnesium sulphate, monitor hourly urine output, respiratory rate, SaO₂ and tendon reflexes every 15 minutes for the first 2 hours, and then every 30 minutes.

Progressive symptoms of magnesium toxicity

These include the following:

- double vision, confusion, slurred speech, nausea and weakness
- loss of tendon reflexes
- respiratory depression (< 12–15 breaths/minute) and/or SaO₂ < 94%
- respiratory arrest
- cardiac arrest.

If magnesium toxicity is suspected, stop the infusion and if severe signs such as very slow respiration, respiratory or cardiac arrest, administer antidote of 10mL 10% calcium gluconate IV slowly over at least 1–2 minutes.

Stop the infusion of magnesium sulphate if:

- patellar reflexes are absent
- there is respiratory depression (respiratory rate < 12–15 breaths/minute) or a fall in oxygen saturation to ≤ 92% on a pulse oximeter. Give oxygen to keep oxygen saturation at 94–98%
- urine output is less than 30mL/hour over the last 4 hours.

If respiratory depression develops, give 100% oxygen by face mask with reservoir, and give calcium gluconate 1 gram (= 10mL of 10% solution) IV slowly over 1–2 minutes. Too rapid administration can result in loss of consciousness, cardiac arrhythmias and cardiac arrest.

If respiratory arrest occurs:

- give chest inflations with bag-valve-mask ventilation with 100% oxygen
- inject calcium gluconate 1 gram (10mL of 10%) IV slowly over 5 minutes.

The magnesium sulphate infusion may be recommenced at a reduced dose, if this is considered necessary, once normal respiration and reflexes have returned.

Note for anaesthetists: there is an increased sensitivity to muscle relaxants (particularly non-depolarising agents) in patients on magnesium.

In patients with known renal disease or myasthenia gravis, magnesium sulphate is contraindicated and, if available, phenytoin should be used. The loading dose is 15mg/kg (maximum dose 2 grams) over 20 minutes by slow IV injection. Subsequently a dose of 100mg orally twice a day can be given. IV injection if given too rapidly can cause severe hypotension, cardiac arrhythmias or respiratory arrest.

Other anticonvulsant drugs

If repeated fits occur despite magnesium sulphate, give either rectal paraldehyde (10–20mL as an enema mixed with 10 parts of Ringer-lactate solution; do not give if it is a brownish colour or smells of acetic acid; note that it crosses the placenta) or rectal diazepam (500 micrograms/kg or 10–20mg; may cause neonatal hypothermia, hypotonia and respiratory depression).

Other causes of fitting should be considered if fits persist or recur despite magnesium sulphate. These include a cerebrovascular accident (stroke), malaria and meningitis.

If magnesium sulphate is not available, use diazepam (see below).

Diazepam

A bag-valve-mask must be immediately available in case the patient stops breathing.

Loading dose: diazepam 2mg increments IV every 2 minutes up to 10mg.

If convulsions recur, repeat the loading dose.

Maintenance dose: diazepam 40mg in 500mL of Ringer-lactate or Hartmann's solution, titrated to keep the mother sedated but able to be woken and without hypoventilation.

Maternal respiratory depression may occur when the dose exceeds 30mg in 1 hour. Assist ventilation (e.g. bag-valve-mask, anaesthesia apparatus, intubation) if necessary, and do not give more than 100mg in 24 hours.

Rectal administration: give diazepam rectally when IV access is not possible. The loading dose is 20mg in a 10-mL syringe. Remove the needle, lubricate the barrel and insert the syringe into the rectum to half its length. Discharge the contents and leave the syringe in place, holding the buttocks together for 10 minutes to prevent expulsion of the drug. Alternatively, the drug may be instilled in the rectum through a catheter.

If convulsions are not controlled within 10 minutes, administer an additional 10mg per hour or more, depending on the size of the woman and her clinical response.

Be prepared for neonatal resuscitation when diazepam has been administered, especially if it was used in large doses.

Severe pre-eclampsia

Stage 1: Prevention of fitting

If there are significantly increased tendon reflexes, often also with ankle clonus, before delivery or afterwards, and the patient shows other signs of impending eclampsia (e.g. confusion, jitteriness, severe headache), prophylactic 'anti-convulsant' therapy (magnesium sulphate where possible) should be commenced.

Other indications for magnesium sulphate treatment where eclampsia has not yet occurred include the following:

- persistent hypertension despite adequate antihypertensive drugs and good fluid management
- evidence of thrombocytopenia or liver dysfunction (if these can be measured).

The same regimen of magnesium sulphate (or diazepam if magnesium sulphate is not available) is used for prophylaxis as described above for the treatment of eclampsia. A loading dose alone may be sufficient.

Stage 2: Reduction of blood pressure and expansion of intravascular volume

Hypertension should be treated if the blood pressure is $\geq 170/110\text{ mmHg}$ as described above. Careful fetal monitoring during the commencement of treatment is vital, as a rapid fall in maternal blood pressure may cause fetal heart rate abnormalities, especially in a growth-restricted or compromised fetus.

If the gestation is less than 36 weeks, dexamethasone or betamethasone 12 mg IM in two doses 24 hours apart should be given to improve fetal lung maturity and decrease the risk of neonatal respiratory failure, if time allows.

Antihypertensive drugs

See pp. 202–3.

Volume expansion during antihypertensive treatment

Antihypertensive agents such as nifedipine and hydralazine act as vasodilators. In pre-eclampsia where intravascular volume is reduced, a small volume load should be given immediately prior to IV antihypertensive treatment (300 mL or Ringer-lactate or Hartmann's solution IV over 20 minutes). Colloid or starch, such as Haemaccel (500 mL), which remains for longer in the intravascular compartment, may be helpful. Clinical examination for signs of cardiac failure (see Section 2.7.A) should be sought before and after such treatment.

Stage 3: Anticipate and/or manage complications

Airway and breathing

- Keep the airway clear.
- The respiratory rate should be recorded regularly (ideally it should be 15–40 breaths/minute).
- **Beware of over-sedation, aspiration, pulmonary oedema and laryngeal oedema (which presents with stridor).**
- If the respiratory rate is less than 12–15 breaths/minute, particularly if the mother is receiving magnesium sulphate or opiates for pain control, action should be taken and other signs of toxicity sought (see above).
 - If an opiate is being used, naloxone may be required.
 - If magnesium sulphate is being given, stop this and give calcium gluconate (see above).
- Oxygen can be given using nasal cannulae (ideally with SaO_2 monitoring) if SaO_2 is less than 94%. Keep SaO_2 in the range 94–98%.
- Arrange for a chest X-ray if aspiration is suspected.
- An increased respiratory rate is an early sign of pulmonary oedema.

Circulation

Consider fluid balance/fluid overload (urinary catheterisation is important).

Usually there is net fluid overload in pre-eclampsia, but the fluid has leaked out of the intravascular compartment due to low oncotic pressure (partly due to hypoalbuminaemia) and increased capillary permeability.

Complications of excessive fluid in the wrong compartment include cerebral oedema, pulmonary oedema and laryngeal oedema (stridor).

Renal failure may develop secondary to the hypertension

or to intravascular hypovolaemia (or as a primary injury in severe pre-eclampsia).

Keep IV fluids at a rate of less than 100 mL/hour or less than 1 mL/kg per hour (the World Health Organization suggests a rate of less than 1 litre in 6–8 hours). Fluid restriction should be maintained until there is postpartum diuresis, which is easy to recognise as there is usually oliguria in severe pre-eclampsia. If there is APH or PPH, fluid restriction will probably not be appropriate.

- Insert an indwelling urinary catheter, and keep a strict intake–output chart with hourly running totals. The total maintenance fluid intake should not exceed 1.5–2 litres over 24 hours. If the average urine output is less than 30 mL/hour over a period of 4 hours this is usually due to the decreased intravascular volume, and will respond to a bolus of 200 mL of IV Ringer-lactate or Hartmann's solution, which can be repeated if necessary.
- In the presence of over-hydration, particularly with heart failure or renal impairment, furosemide 20–40 mg IV should be given. **Mannitol is not advisable because of the fluid load that results from its administration, and because of its rebound effects.**
- Beware of cardiac arrhythmias. Ideally monitor potassium levels regularly and ECG continuously.
- Magnesium sulphate is renally excreted, so careful observation for magnesium toxicity is required if there is oliguria.
- Fluid infusion equal to the same quantity as the urinary output in the preceding hour plus 30 mL is a useful guide to IV fluid administration.
- Central venous pressure (CVP) monitoring may be useful to guide management, especially if urine output is low. (Keep the CVP at up to + 6 cm H_2O in a spontaneously breathing patient.)

Additional organ involvement

Neurological complications

These include cerebrovascular accidents and cerebral oedema.

Undertake regular (2-hourly) neurological examination (including pupillary and tendon reflexes) and record the AVPU and/or Glasgow Coma Scale (GCS) scores. All patients should be able to open their eyes to stimulus, obey commands and respond to questions about their name and age. If not, they are over-sedated or may be developing cerebral complications.

The GCS Scale has three components, with a maximum possible score of 15:

| | | | |
|---|--------------------------|---------------------------------------|---|
| E | Eye-opening response (E) | Spontaneous | 4 |
| | | To speech | 3 |
| | | To pain | 2 |
| M | Best motor response (M) | None | 1 |
| | | Obeys command | 6 |
| | | Localises to pain stimulus | 5 |
| | | Withdraws | 4 |
| | | Abnormal flexion/decorticate posture | 3 |
| | | Extensor response/decerebrate posture | 2 |
| | | No movement | 1 |

| | | | |
|---|------------------------|-------------------------|--------|
| V | Verbal response (M) | Oriented Confused | 5 4 |
| | | Inappropriate words | 3 |
| | | Incomprehensible sounds | 2 |
| | | None | 1 |

A GCS score of ≤ 8 indicates coma and an airway that is not protected by pharyngeal and/or laryngeal reflexes.

Cerebral oedema is usually localised to the occipital and parietal cortical areas, and is a result of cerebral vasospasm. Magnesium sulphate can help to prevent this. Mannitol is not indicated. Recurrent convulsions despite magnesium sulphate with or without other anticonvulsants may require intubation and controlled ventilation (if available).

Haematological complications

These include disseminated intravascular coagulation (DIC).

- Group and save and cross-match fresh blood.
- Check the full blood count, including a platelet count if possible.
- Do a whole blood clotting test as well as APTT (if available) (see Section 7.5). Failure of a clot to form after 7 minutes, or formation of a soft clot that breaks down easily, suggests coagulopathy.
- If the platelet count is $> 100\,000 \times 10^9$, a major coagulation problem is unlikely. Spontaneous haemorrhage may occur with counts below $10\,000 \times 10^9$.
- In frank DIC, give whole fresh blood if there is bleeding.

Hepatic complications

These include jaundice, bleeding tendency, hepatic failure, hepatic sub-capsular oedema or hepatic rupture (the last two cause right upper quadrant or epigastric pain).

Delivery of the baby is urgent.

Fetal problems

These include intrauterine growth retardation, fetal distress in labour, preterm delivery as a result of obstetric intervention, fetal death due to placental abruption or fetal asphyxia in labour.

General nursing care

- Airway and breathing management should be undertaken as appropriate. This includes ensuring that SaO_2 remains normal at $\geq 94\%$.
- Maintain the patient in the lateral tilt or recovery position at all times before delivery.
- Indwelling aseptically placed urinary catheter and hourly urine output measurement.
- Care of eyes and oral hygiene.

The HELLP syndrome (Haemolysis, Elevated Liver enzymes, Low Platelet counts) syndrome is a dangerous form of severe pre-eclampsia.

- If the platelet count is $< 50\,000 \times 10^9$ there is a high risk of bleeding, and if bleeding occurs in the absence of platelet transfusions, fresh blood may be helpful.
- Liver dysfunction may cause upper abdominal pain, and lowering of the blood pressure may be helpful.
- Delivery is urgent.

Stage 4: Delivery of the baby

The need for *in-utero* transfer should be considered,

particularly if there are maternal complications that are likely to require a Caesarean section or high-dependency care. The need for delivery is dependent on the maternal and fetal conditions. Either Caesarean section or induction of labour may be appropriate, depending on the clinical findings. Although delivery will resolve the disease, it is inappropriate to deliver an unstable mother, even if there is fetal distress. Once eclamptic seizures have been controlled, severe hypertension has been treated and any hypoxaemia corrected, delivery can be expedited.

In severe pre-eclampsia, aim to deliver within 24 hours of the onset of symptoms. In eclampsia, aim to deliver within 12 hours of the onset of convulsions.

It is important to stabilise the mother's condition first. Then decide about the mode of delivery.

In selected patients, **labour may be induced** if the following conditions apply:

- the cervix is favourable
- the maternal condition is stable (i.e. eclampsia and blood pressure are controlled), there is no fetal distress and there is a cephalic presentation.

Assessment of the cervix

- If **the cervix is favourable** (i.e. soft, thin and partly dilated), rupture the membranes with an amniotic hook or a Kocher's forceps, and induce labour using an oxytocin infusion (see Section 2.3) or oral misoprostol (see Section 2.3 and below).
- If **vaginal delivery is not anticipated** within 12 hours (for eclampsia) or within 24 hours (for severe pre-eclampsia), deliver by Caesarean section.
- If there are **fetal heart rate abnormalities** (< 110 beats/minute or > 160 beats/minute), consider Caesarean section if this is safe for the mother.
- If **the cervix is unfavourable** (i.e. firm, thick and closed) and **the fetus is alive**, deliver by Caesarean section if the mother is adequately resuscitated.
- If **there are no facilities for Caesarean section** or **if the fetus is dead or too premature for survival**, deliver vaginally.

Aiming for vaginal delivery

If **the cervix is unfavourable** (i.e. firm, thick and closed) and the fetus is alive, Caesarean section should be performed. If the fetus is dead, consideration should be given to induction of labour using misoprostol (unless there has been a previous Caesarean section, in which case misoprostol is contraindicated).

There are many possible misoprostol regimens for induction of labour (vaginal misoprostol tablet, oral misoprostol solution or oral misoprostol tablet). Each has been widely used. The latest evidence is that oral misoprostol solution is the most appropriate treatment (Cochrane reviews).

Oral misoprostol solution: A single misoprostol tablet is dissolved in drinking water (a 200-microgram tablet in 200 mL of water or a 100-microgram tablet in 100 mL of water), and 20–25 mL of misoprostol solution (20–25 micrograms) are then given every 2 hours. The solution is stable for up to 24 hours at room temperature, but should then be discarded.

Oral misoprostol tablets: 100-microgram misoprostol tablets are cut to 25 micrograms size and administered orally every 2 hours up to a maximum of six doses. However,

this may not be very accurate, so there is a danger of giving an incorrect dosage. The solution described above is much safer.

Caesarean section

If Caesarean section is performed, ensure that coagulopathy has been treated. Ensure that fresh blood for transfusion is available.

Spinal anaesthesia is usually safer than general anaesthesia for Caesarean section, unless there is a contraindication (e.g. maternal refusal, coagulopathy, thrombocytopenia, decreased conscious level, ongoing seizures). There does not appear to be an exaggerated decrease in blood pressure after spinal anaesthesia, and vasopressors (e.g. ephedrine) should be used cautiously in order to avoid a hypertensive response. An IV bolus of 500mL of Ringer-lactate or Hartmann's solution may occasionally be required if the blood pressure does fall.

The use of general anaesthesia in severe pre-eclampsia or eclampsia is very hazardous. There may be laryngeal oedema, which makes airway management difficult, and increases in blood pressure during intubation and extubation, with an increased risk of intracranial haemorrhage. Drugs to weaken the vasopressor response to intubation should be used.

Local anaesthesia or ketamine in women with pre-eclampsia or eclampsia are contraindicated unless facilities and/or expertise dictate that these are the safest options in a given situation.

Stage 5: Management after delivery

- If the patient is post-eclampsia or at high risk of convulsions, continue to administer parenteral anticonvulsants (i.e. magnesium sulphate, or diazepam if magnesium sulphate is not available) for 24 hours after the birth. Continue for as long as the patient has increased tendon reflexes.
- **Do not give ergometrine to women with pre-eclampsia, eclampsia or high blood pressure, because it increases the risk of convulsions and cerebrovascular accidents.**
- Monitor the mother closely.
- Use antihypertensive agents if the diastolic blood pressure is > 105–110 mmHg or the systolic blood pressure is > 160 mmHg.
- Continue oxytocin infusion to keep the uterus contracted.
- **Syntometrine (which contains ergometrine, and can cause or worsen hypertension) is contraindicated.** Give oxytocin alone or with misoprostol, and avoid the possible hypertensive effects of ergometrine. If postpartum haemorrhage occurs, this should be managed as described in Section 2.5.D.iv.
- Keep the mother in the delivery unit or close observation area for at least 24 hours after the last fit.
- Review the need for further anticonvulsants and anti-hypertensive drugs.
- Regular monitoring is essential.
- It is not uncommon for the blood pressure to drop transiently following delivery only to rise again after 24 to 48 hours. Patients with severe pre-eclampsia and eclampsia should be monitored as in-patients for 72 hours after delivery so that dangerous post-partum rises in BP can be detected and treated.
- Plans for care should be communicated to the patient

BOX 2.5.E.2 Emergency box for eclampsia

| Equipment | Quantity |
|--------------------|--|
| Drugs | Magnesium sulphate 50%, 5 g in 10-mL ampoule × 10 ampoules Calcium gluconate 10%, 10-mL ampoule × 2 ampoules Hydralazine, 20 mg in 1-mL ampoule × 2 ampoules Labetalol, 200 mg in 20-mL ampoule × 1 ampoule 0.9% Sodium chloride, 10-mL ampoule × 10 ampoules Diazepam, 5 mg/mL ampoules × 20 |
| Intravenous fluids | 500-mL bag of Ringer-lactate or Hartmann's solution × 1 Giving set × 1 IV blood giving set × 1 |
| Venous access | 20-gauge cannula (pink) × 2 18-gauge cannula (green) × 2 16-gauge cannula (grey) × 2 Tourniquet × 1 Fixation tape × 1 roll |
| Airway equipment | Guedel airways: sizes 4, 3 and 2 Self-inflating bag-mask-valve Green oxygen tubing (2 metres) and high and medium concentration (MC) facemasks for oxygen delivery Yankauer sucker |
| Other equipment | 50-mL syringe × 2 20-mL syringe × 2 10-mL syringe × 2 Green needles × 2 Patella hammer × 1 Urinary catheter Charts for vital signs and fluid balance |

and her attendants. The attendants should be educated about the use of the left lateral tilt position prior to delivery, the use of the recovery position after convulsions, the risk of aspiration of food, and care of the IV site.

- Before the mother goes home, the family and attendants should be warned about the risk of postnatal depression, especially if the outcome has been poor. The woman or girl should be followed up closely in the community.
- In women with severe pre-eclampsia/eclampsia a plan should be made to monitor the BP in the post-partum period, even in women who are not discharged on antihypertensive medication. This is because the BP is commonly labile during this period. One or ideally two checks (or more if the BP is poorly controlled) should be advised over the first 2 weeks following delivery. This may be done at a clinic local to the patient's residence, but may require that the patient stay in or near the hospital if no facilities exist close to her home.
- Women and their families should also be warned about

the symptoms of severe pre-eclampsia and advised that although delivery does usually resolve the disease, it can still worsen suddenly in the first 2 weeks following delivery (rarely up to 6 weeks).

- Antenatal care provided by the hospital during a future pregnancy is important. There is an increased risk of pre-eclampsia and hypertension if these problems have been present before.
- All patients are at risk of deep vein thrombosis (DVT), so close observation and appropriate treatment if DVT is identified are important (see Section 2.5.H). Anti-embolism stockings and low-molecular-weight heparin (or unfractionated heparin if the former is not available) prophylaxis should be considered early on.

Hypertension may take from many days to up to 3 months to resolve. Resolution will occur if the diagnosis is pre-eclampsia, unless there is an underlying medical cause.

Monitoring and preparation for emergencies

- Measure pulse rate and volume, blood pressure, respiratory rate and oxygen saturation regularly. A minimum of hourly if receiving MgSO₄ and more often if unstable.
- Monitor fluid intake and urinary output hourly.
- Monitor AVPU and GCS scores, reflexes and pupil responses hourly.
- Monitor the mother for confusion and visual disturbance.
- Monitor the fetus regularly.
- Record all drugs used.

Each maternity unit should have an emergency box to ensure that appropriate equipment and drugs are readily available.

2.5.F Prolonged and obstructed labour, uterine rupture and shoulder dystocia

Prolonged and obstructed labour

It helps to reduce prolongation of labour if mothers in labour are allowed to sit upright, or in a lateral or semi-upright position, **never flat on their backs**. They should be encouraged to stand, and be mobile in the first stage of labour for as long as is comfortably possible. The benefits of this include the assistance of gravity in the descent of the baby, the avoidance of pressure on the inferior vena cava (IVC), with all of the effects of compression on the circulatory dynamics, and possibly a reduction in the pain of contractions.

Recognition of prolonged or obstructed labour and early referral

Remember the three P's: Power (too little), Passenger (too big) and Passage (too small).

Prevention of prolonged labour

- Good antenatal care is essential, so that the presentation of the fetus is known (and ideally confirmed by ultrasound examination) before the onset of labour. **If the presentation is abnormal, the mother must be transferred to hospital as soon as she goes into labour.**
- Use of the modified WHO partograph.
- Optimal nutritional state in the mother.
- Absence of anaemia in the mother.
- Adequate fluids and glucose during labour.
- Ensuring adequate bladder emptying.
- Emotional support.

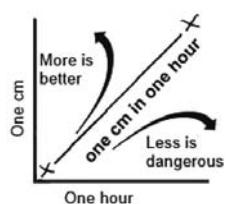


FIGURE 2.5.F.1 Cervical dilatation over time.

Risks associated with slow progress in labour

For the mother these include the following:

- infection
- uterine rupture
- fistulae
- death.

For the baby they include the following:

- infection
- insufficient oxygen supply to the brain and traumatic injury
- stillbirth
- neonatal death
- permanent brain damage.

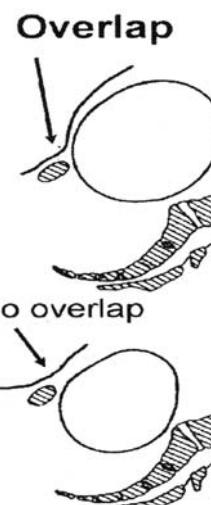


FIGURE 2.5.F.2 Obstruction of the fetal head's descent.

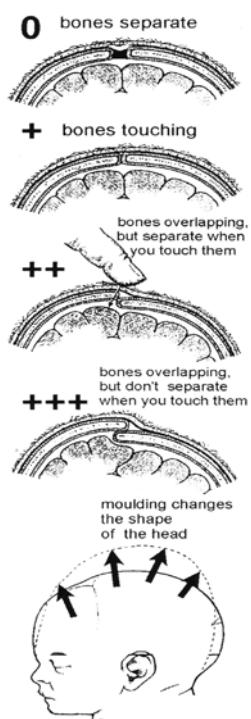


FIGURE 2.5.F.3 Development of increasing moulding of skull bones of fetus in labour. Increasing moulding is a sign of cephalo-pelvic disproportion.

Main causes of slow progress in labour

These include the following:

- 1 poor-quality uterine contractions
- 2 malpresentations and malpositions
- 3 disproportion between the size of the baby and the size of the pelvis; it is important to exclude causes (1) and (2) before diagnosing this.

All three of these causes require urgent transfer to hospital.

Bandl's ring

The presence of a Bandl's ring may be one sign that is seen in obstructed labour. It is often a late sign.

A Bandl's ring is a depression between the thickened upper segment and the thinned lower segment. A distended bladder sometimes forms a third swelling.

Moulding of the fetal head

Moulding refers to the overriding of the fetal skull bones that may occur during labour. Moulding should be assessed at the sagittal suture (not the lambdoid). During descent of the fetal head, the fetal skull bones move closer together. Moulding is described in three stages. The first stage (+) occurs when the bones touch, the second stage (2+) occurs when the bones overlap but are reducible, and the third stage (3+) is irreversible overlapping of the bones. Moulding, especially 3+, may suggest cephalo-pelvic disproportion, and should be looked at in conjunction with other clinical signs of obstructed labour.

Partogram in obstructed labour

Figure 2.5.F.4 shows the partogram for Mrs H, a mother who was admitted in active labour at 10 am.

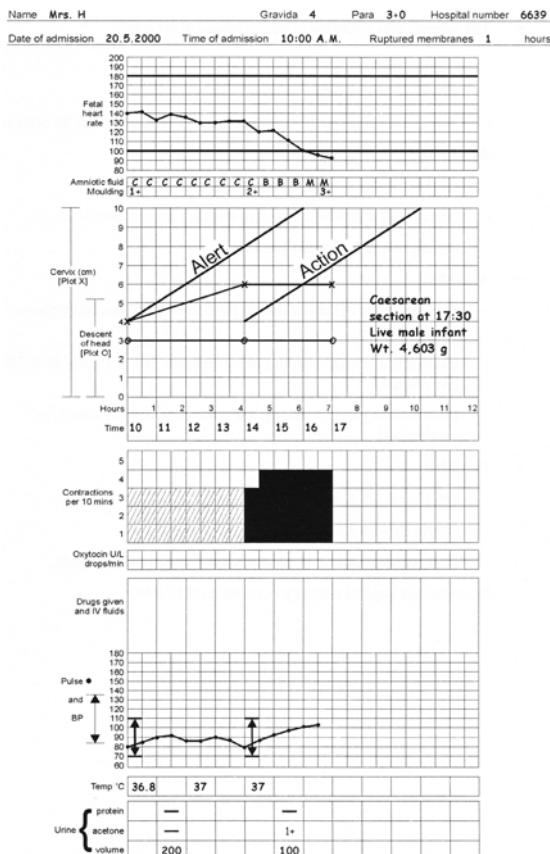


FIGURE 2.5.F.4 Partogram of obstructed labour.

- The fetal head is 3/5 palpable.
- The cervix is dilated to 4 cm.
- Three contractions occur in 10 minutes, each lasting for 20–40 seconds.
- Clear amniotic fluid is draining.
- There is fetal head moulding.

At 2 pm:

- The fetal head is still 3/5 palpable.
- The cervix is dilated to 6 cm and to the right of the alert line.
- There is a slight improvement in contractions (three in 10 minutes, each lasting for 40 seconds).
- There is second-degree moulding.

At 5 pm:

- The fetal head is still 3/5 palpable.
- The cervix is still dilated to 6 cm.
- There is third-degree moulding.
- The fetal heart rate 92 beats/minute.

Caesarean section was performed at 5.30 pm.

Note: The partogram for Mrs H is characteristic of obstructed labour. There is arrest of cervical dilatation in the active phase of labour, with no descent of the fetal head.

The presence of meconium and a falling fetal heart rate suggest fetal distress. All of these features, plus moulding of the fetal skull bones, point to cephalo-pelvic disproportion.

Oxytocin was rightly withheld, as Mrs H was multiparous, and this drug would therefore have increased the risk of uterine rupture in this patient.

Diagnostic issues in obstructed labour

The mother

- The patient may be dehydrated, tachycardic, ketotic (urine positive for ketone bodies, breath smells of ketones), febrile and exhausted, and there may be infected vaginal secretions.
- The bladder may be distended with retained urine, or it may be oedematous.
- Abdominal examination may reveal haemoperitoneum from a ruptured uterus. Blood may not appear vaginally, due to the impacted fetal head, which should be

dislodged upwards to allow full assessment. If a ruptured uterus is suspected, a laparotomy should be performed (see below).

- Abdominal examination may reveal distended bowel from sepsis and ileus.

The fetus

- The lie and relationship of the fetus to the pelvis must be assessed.
- Despite visible caput at the introitus, 60% of the fetal head may still be palpable abdominally.

TABLE 2.5.F.1 Diagnosis of unsatisfactory progress of labour

| | |
|---|--|
| Cervix not dilated | False labour |
| No palpable contractions/infrequent contractions | |
| Cervix not dilated beyond 4 cm after 8 hours of regular contractions | Prolonged latent phase |
| Cervical dilatation to the right of the alert line on the partogram | Prolonged active phase |
| Secondary arrest of cervical dilatation and descent of the presenting part in the presence of good contractions | Cephalo-pelvic disproportion |
| Secondary arrest of cervical dilatation and descent of the presenting part with large caput, third-degree moulding, cervix poorly applied to the presenting part, oedematous cervix, ballooning of the lower uterine segment, formation of a retraction band, and maternal and fetal distress | Obstruction |
| Less than 3–4 contractions in 10 minutes, each lasting from less than 40 seconds to 1 minute, with 1 minute of relaxation between contractions | Inadequate uterine activity |
| Presentation other than vertex with occipito-anterior | Malpresentation |
| Cervix fully dilated and the woman has the urge to push, but there is no descent | Prolonged expulsive (second stage) phase |

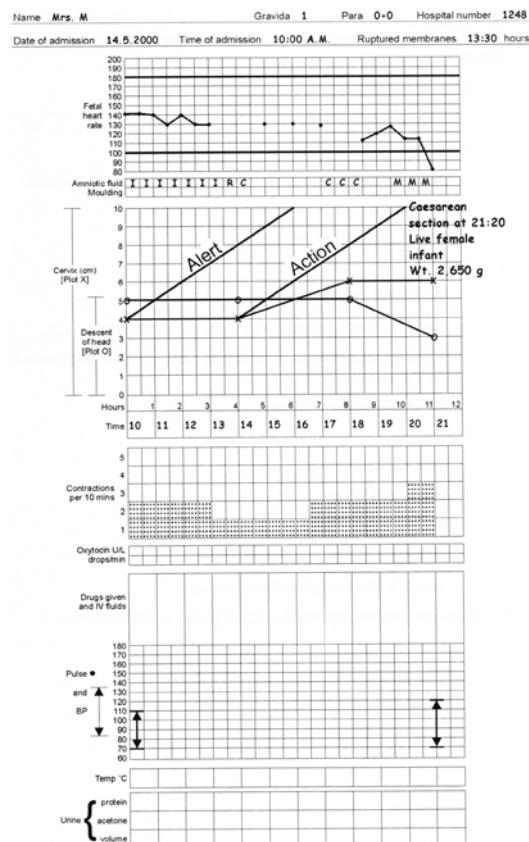


FIGURE 2.5.F.5 Partogram showing prolonged active phase of labour.

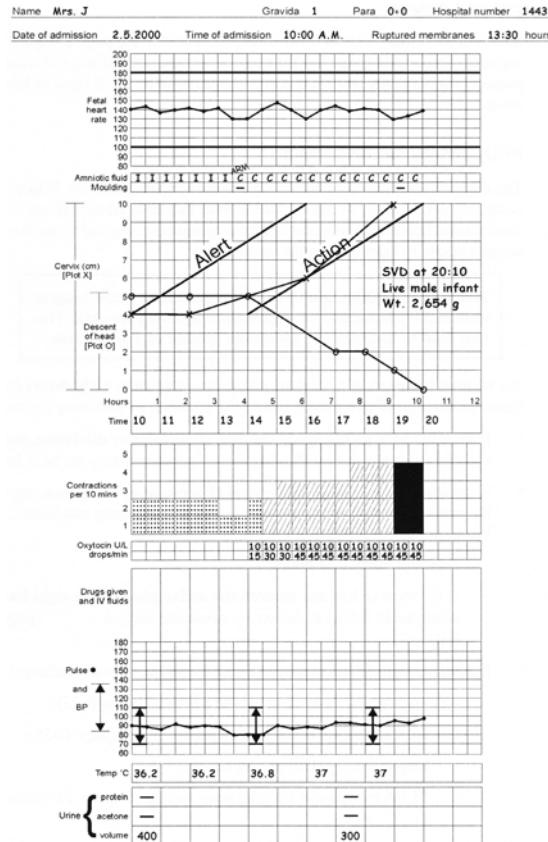
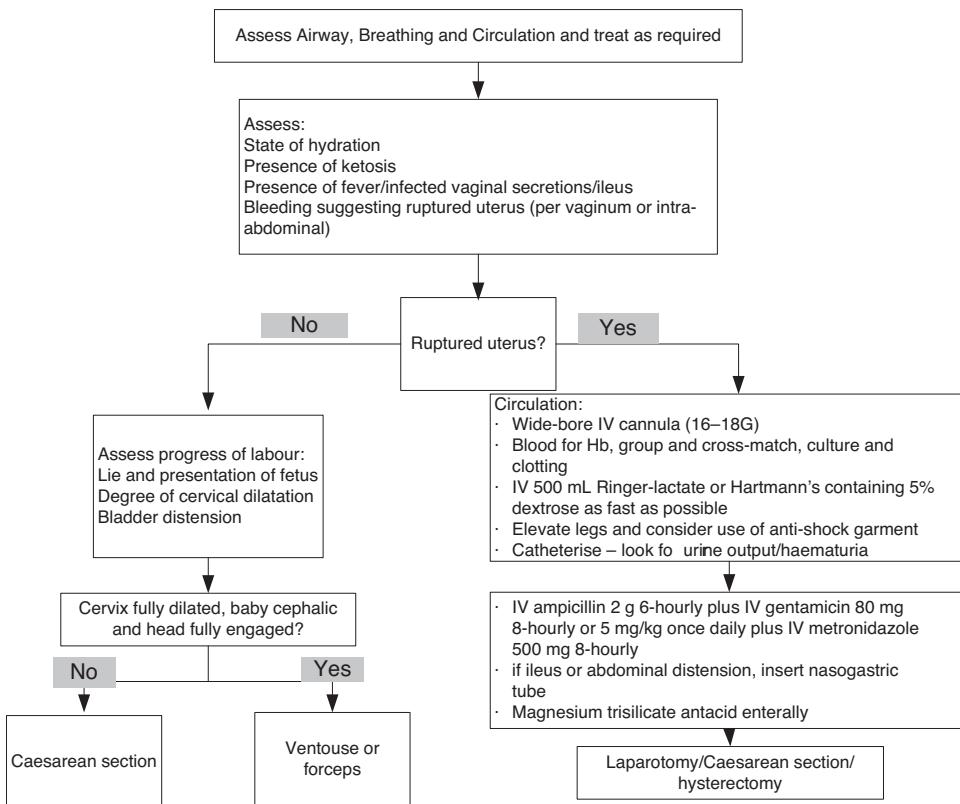


FIGURE 2.5.F.6 Partogram showing inadequate uterine contractions corrected with oxytocin.

**FIGURE 2.5.F.7** Pathway of care in obstructed labour.

The cervix in the primigravida whose partogram is shown in Figure 2.5.F.5 was 4 cm dilated on admission. Her contractions were ineffective at two in 10 minutes, decreasing to one contraction in 10 minutes. Her membranes ruptured 3.5 hours later, but her cervix dilated only a further 2 cm in 4 hours, with no further dilatation in the subsequent 3 hours. Fetal distress developed, with meconium and a falling fetal heart rate. Caesarean section was performed. It would have been advisable to start an oxytocin infusion at 13.30 hours, or at least by 15.30 hours.

The primigravida whose partogram is shown in Figure 2.5.F.6 started an oxytocin infusion at the time of membrane rupture, which increased the efficacy of contractions. She progressed to a spontaneous vaginal delivery. The fetal heart rate was satisfactory throughout.

Emergency treatment for obstructed labour

Assess ABC and resuscitate if required.

- Place a wide-bore IV cannula (14- to 16G).
- Place the mother in the left lateral tilt or recovery position.
- Send blood for haemoglobin, grouping and cross-matching, and electrolytes if possible.
- Give 1 litre IV of Ringer-lactate or Hartmann's solution containing 5% or 10% glucose over 1 hour as an infusion, or as rapidly as possible if the patient is shocked. Then reassess.
- Catheterise the patient to decompress the bladder, measure urine output and look for haematuria.
 - The presence of haematuria may suggest uterine rupture.
 - If there is concern about the viability of the vaginal

and bladder wall, the catheter may be kept *in situ* for up to 6 weeks to prevent or minimise the formation of a vesico-vaginal fistula.

- Give IV ampicillin (2 grams 6-hourly), gentamicin (80 mg IV/IM 8-hourly or 5 mg/kg body weight IV/IM once every 24 hours) and metronidazole (500 mg 8-hourly). Cefuroxime (1.5 grams 8-hourly, if available) can be given instead of ampicillin plus gentamicin.
- Measure the pulse rate, capillary refill time (CRT), blood pressure, temperature and urine output frequently.
- If uterine rupture has been excluded, shock may be due to hypovolaemia, sepsis or both.

If there has been recent food intake, or abdominal distension is present, the stomach should be emptied using a nasogastric tube, and then 10 mL of magnesium trisilicate oral suspension should be given to reduce the acidity of the gastric contents.

Overcoming slow progress in labour

- If the cervix is fully dilated and there is cephalic presentation and no signs of obstruction, instrumental delivery (ventouse or forceps) can avoid the need for Caesarean section. However, if the cervix is fully dilated and there is obstruction, instrumental delivery can make Caesarean section very difficult by causing further impaction of the fetal head.
- If the cervix is not fully dilated, in the primigravida with cephalic presentation, give an oxytocin infusion.
- If the cervix is not fully dilated, with abnormal presentation, perform a Caesarean section.
- If there is a ruptured uterus, a laparotomy and Caesarean hysterectomy must be performed.

Urgent referral is required if the above measures are not possible. Stabilise the mother's ABC before transfer if necessary.

Reasons for fetal death in obstructed labour

- Strong contractions with inadequate relaxation between contractions (sometimes made worse by inappropriate use of oxytocin) interfere with placental exchange.
- Excessive moulding of the head, in cephalic presentation, leads to intracranial haemorrhage. In breech presentation, the head may be trapped by an incompletely dilated cervix, or may not enter the pelvis because of disproportion.
- Ascending infection, amnionitis and severe intrauterine infection caused by prolonged ruptured membranes and labour, and/or unsterile vaginal examinations.
- Ruptured uterus.

Risks of Caesarean section in obstructed labour

These include the following:

- intra-operative haemorrhage
- post-operative shock
- generalised peritonitis
- the hazards of general or regional anaesthesia
- rupture of the uterine scar in subsequent pregnancies

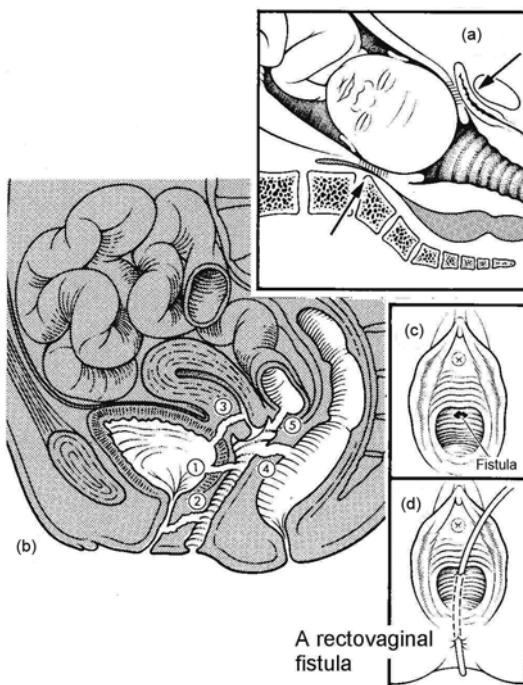


FIGURE 2.5.F.8 Mechanism and anatomy of vaginal fistulae. The arrows show where this mother's cervix, rectum and bladder are being pinched between the baby's head and the mother's spine and pubis. (a) The baby's head can press the mother's vagina and bladder against the symphysis pubis or the sacrum. This can make the tissues necrose (die) and cause a fistula. (b) The fistula can be in various places: 1, between the bladder and the vagina; 2, between the urethra and the vagina; 3, between the bladder and the cervix; 4, between the rectum and the vagina (rectovaginal fistula); 5, between the vagina and the small gut. (c) A vesico-vaginal fistula. (d) A catheter has been placed in a rectovaginal fistula.

- wound complications
- pelvic abscess
- visceral damage, especially to the bladder; it may be difficult to pass a catheter with a very impacted fetal head, and the bladder is often oedematous.

The management of uterine rupture in this setting depends on its site and extent. With a straightforward anterior rupture without extension, uterine repair (plus bilateral tubal ligation) may be most appropriate and safe.

If infection is present before a Caesarean section is performed, dangerous complications can follow. In one series of 107 Caesarean sections, performed in 156 patients with intrapartum infection, the following complications occurred:

- post-operative shock: 18 patients (17%)
- generalised peritonitis: 70 patients (65%)
- mortality: 13 patients (12%).

Rupture of the uterus

Complete rupture of the uterus is life-threatening to both mother and baby.

Causes

A previous Caesarean section scar may rupture during labour. However, obstructed labour, even without a uterine scar, particularly in a woman of high parity, may cause uterine rupture. It may be caused by inappropriate use of oxytocic drugs, especially in multiparous women, or in the presence of cephalo-pelvic disproportion. No woman who is receiving an oxytocin infusion should be left alone.

Ideally, always use a burette giving set to administer IV oxytocin to avoid dangerous over-dosage. **In the absence of a burette, refer to the progressive oxytocin dosage, and use as described in Section 2.3, making sure to slow or stop once labour is well established.**

Uterine rupture may be caused by violence or trauma during pregnancy, sometimes as a result of domestic violence (see Section 2.11).

Risk factors for uterine rupture

These include the following:

- malpresentation and malposition
- previous Caesarean section, especially if oxytocic agents

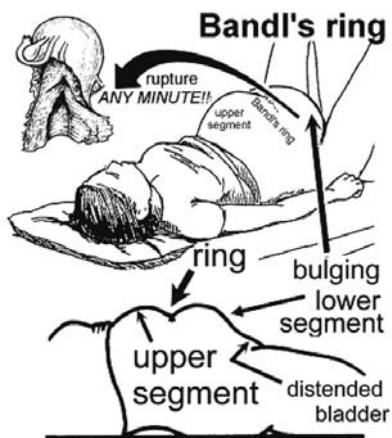


FIGURE 2.5.F.9 Bandl's ring in obstructed labour. Uterine rupture may be imminent.

- are used, or if a classical Caesarean section scar is present
- previous uterine surgery (e.g. myomectomy), or uterine perforation at the time of dilatation and curettage (D&C) or manual removal of the placenta; this is often unrecognised
- the multiparous woman who has delivered normally before and has a significantly larger baby or a malposition in the current pregnancy, and is allowed a prolonged second stage.

Symptoms and signs

Uterine rupture usually presents with hypovolaemic shock, but vaginal bleeding can be concealed. The baby is usually dead.

Around 50% of ruptures occur at or near full dilatation.

- There is a change in the nature of the pain, from severe intermittent pain to a constant dull ache.
- Vaginal bleeding may or may not be present.
- There is maternal shock due to blood loss with or without vagal stimulation, as well as dehydration, exhaustion, and ketoacidosis in cases of prolonged obstructed labour.
- Abdominal distension occurs that is tender to palpation, the fetal parts may be very easily palpated, and there is absence of a fetal heart rate.
- On vaginal examination, the presenting part may be high or impacted.
- Uterine rupture may be preceded by the appearance of Bandl's ring (see Figure 2.5.F.9).

Suspect rupture in a patient with any of these risk factors.

Primary assessment and resuscitation

Call for help, especially for a surgeon and an anaesthetist, as urgent laparotomy will be required.

Airway

- If the airway is not open, use an airway-opening manoeuvre and keep it open. Consider an airway adjunct such as an oropharyngeal airway or intubation.
- The oropharynx may need gentle suctioning under direct vision, but be careful to avoid inducing laryngospasm.
- The recovery position should be adopted to minimise the risk of aspiration of vomit (see Figure 2.5.F.10).



FIGURE 2.5.F.10 The semi-prone or recovery position.

Breathing

- If there is spontaneous breathing, give a high concentration of oxygen via a face mask with reservoir. Give

100% oxygen (mask with reservoir and flow rate of at least 6 litres/minute) regardless of the mother's oxygen saturation. This increases fetal oxygen delivery as well as improving maternal tissue oxygenation.

- If the patient is apnoeic or hypoventilating, provide chest inflations with bag-valve-mask-reservoir ventilation and high-flow oxygen.

Circulation

Evaluate the pulse rate and volume, peripheral circulation (capillary refill time) and blood pressure.

- If signs of life are absent, initiate CPR.
- Perform the left lateral tilt or manual displacement of the uterus.
- If the patient shows signs of shock, support the circulation as described below.
 - Insert a 14- to 16G IV cannula and take 20mL of blood for a full blood count, cross-matching (4 units = 2 litres) and clotting. Do a whole blood clotting time (WBCT) test if laboratory analyses are not available.
- Give 500mL to 1 litre of Ringer-lactate or Hartmann's solution by rapid IV bolus.
- Reassess, and if shock is still present, give blood (if available) (500mL as rapidly as possible after warming) or another 500mL to 1 litre of Ringer-lactate or Hartmann's solution.
- If the patient is ketotic from prolonged obstructed labour, add 50mL of 50% glucose to the second litre of Ringer-lactate or Hartmann's solution.
- Central venous access may be needed for volume replacement if peripheral access is not possible.

Emergency treatment

- Obtain consent for laparotomy and hysterectomy.
- Try to place a second IV cannula.
- Perform urgent laparotomy under general anaesthesia.
- The type of operation will depend upon the size and site of rupture, and the degree of haemorrhage.
- Give IV prophylactic antibiotics (ampicillin 2 grams or cefuroxime 1.5 grams plus metronidazole 500mg).

The rupture may extend anteriorly towards the back of the bladder, laterally towards the uterine arteries, or into the broad ligament plexus of veins, leading to massive haemorrhage.

Posterior rupture may occur, and is usually associated with intrauterine malformations, but has occurred in patients who have had a previous Caesarean section or uterine trauma, or after rotational forceps. Fundal rupture has been documented, and a detailed history usually elicits previous dilatation and curettage (D&C) or manual removal of the placenta.

Continuing haemorrhage is an indication for performing a total or subtotal hysterectomy. Subtotal hysterectomy is a simpler procedure than total hysterectomy, and has a reduced risk of ureteric or bladder damage.

The choice of uterine repair depends on the site of the injury. In one series of 23 cases of ruptured uterus, hysterectomy was undertaken in 15 cases (65%) and repair in the other 8 cases. Five successful further pregnancies were reported without repeat rupture (all delivered by Caesarean section). In another Middle Eastern series of 11 cases of uterine rupture, 8 cases had uterine repair, and all became pregnant again and were delivered by Caesarean section.

Shoulder dystocia (see video for download on www.mca.org.uk)

Shoulder dystocia is caused by impaction of the shoulders against the bony pelvis. Special manoeuvres are required to deliver the shoulders. The reported incidence is between 0.15% and 2% of all vaginal deliveries. Shoulder dystocia carries a significant risk to the baby due to hypoxia, fractures of the clavicle and humerus, and injuries to the brachial plexus.

The problem lies at the **pelvic brim** where the anterior shoulder gets caught, while the posterior shoulder has usually entered the pelvis. Treatment therefore aims to encourage the anterior shoulder into the pelvis, or if this fails, either rotating the posterior shoulder round into the anterior position or delivering the posterior arm first. Traction on the head when the anterior shoulder is caught above the pelvic brim will not work and is dangerous.

Delivery should occur within 5 minutes of the delivery of the head. The longer the delay, the greater the risk of hypoxic injury to the baby.

Postpartum haemorrhage is common after shoulder dystocia, and there is a risk of serious vaginal and perineal lacerations.

Risk factors for shoulder dystocia

Antepartum risk factors include the following:

- fetal macrosomia
- maternal obesity
- diabetes
- prolonged pregnancy
- advanced maternal age
- male gender
- excessive weight gain
- previous shoulder dystocia
- previous big baby.

Intrapartum risk factors include the following:

- prolonged first stage
- prolonged second stage
- oxytocin augmentation of labour
- assisted delivery.

These risk factors often do not help in the prediction of individual cases of shoulder dystocia. Therefore the practice of emergency drills is essential for good management of the unexpected case.

Slow progress in labour, particularly in the multiparous patient or in the woman with a past history of a big baby or difficulty delivering the shoulders, should alert one to the possibility of shoulder dystocia.

During delivery, signs include the following:

- difficulty delivering the face and chin
- head retractions between contractions
- head bobbing
- the delivered head becomes tightly pulled back against the perineum (turtle sign).

As soon as the situation is suspected, a plan of action should be initiated.

Management of shoulder dystocia

If risk factors are present, try if possible to have an experienced obstetrician present in the second stage of labour. However, 50% of cases are unexpected.

Be prepared for the problem, including postpartum haemorrhage, which may follow.

Try each manoeuvre for 30–60 seconds only: if it does not work, move on. Try to recognise it early on and before applying any traction to the head, which can delay helpful procedures and cause Erb's paralysis.

The following acronym suggested by Advanced Life Support in Obstetrics (ALSO) is helpful (see www.also.org.uk):

HELPERR: H = Help

- E = Evaluate/Episiotomy
- L = Legs (McRoberts)
- P = Pressure (suprapubic)
- E = Enter (posterior arm and Wood's screw)
- R = Rotate (on to all fours)
- R = Repeat

1 **Call for help. This condition needs the most experienced team and extra helpers.**

2 **McRoberts manoeuvre (legs)** (see Figures 2.5.F.11 and 2.5.F.12). Both thighs are sharply flexed, abducted and rotated outwards, ideally by two assistants. Each assistant holds the leg in the region of the thigh and flexes the leg until the thigh lies parallel to the anterior abdominal wall. This will reduce the angle between the sacrum and the lumbar vertebrae to help to free the impacted shoulder. If two assistants are not available, the mother may be placed in the all fours position (see below).



FIGURE 2.5.F.11 McRoberts manoeuvre, showing how important it is to fully flex both legs on to the mother's abdomen so that the thighs lie parallel to the anterior abdominal wall.



FIGURE 2.5.F.12 In McRoberts manoeuvre, with only one assistant the left leg is held flexed against the abdomen by a nurse, and the mother holds her right leg in this position.

- 3 Suprapubic pressure with moderate traction (not fundal pressure).** Suprapubic pressure is applied to reduce the diameter between the shoulders and push the anterior shoulder underneath the symphysis pubis. It is important to know where the fetal back lies, so that pressure is applied in the right direction (i.e. from the fetal back forwards towards the fetal chest). If you are unsure of the position of the back, confirm it by vaginal examination. Pressure should be applied to the back of the shoulder with the heel of the hand, and sometimes a rocking movement may be helpful. Strong traction and fundal pressure should be avoided.



FIGURE 2.5.F.13 Suprapubic pressure.

- 4 Apply moderate traction (harder pulling can make impaction worse and cause Erb's paralysis).** Once both McRoberts manoeuvre and suprapubic pressure are in place, moderate traction can be applied while discouraging maternal efforts (which can increase the impaction of the shoulders).
- 5 Consider an episiotomy.** A medio-lateral episiotomy is recommended to allow more room for manoeuvres such as delivering the posterior shoulder, allowing the operator to use the sacral hollow, and reducing vaginal trauma.
- 6 Deliver the posterior arm and shoulder.** Insert a hand up to the fetal axilla and hook the posterior shoulder down. Traction on the posterior axilla then brings the posterior arm within reach. Run your index finger or middle finger, or both, along the back of the fetal humerus, then flex the elbow at the antecubital fossa, which will disengage the arm, which can then be brought down (hold the hand and sweep it across the chest). Sometimes it comes out directly lying alongside the head, and sometimes it comes out with an element of rotation anteriorly.
- 7 Internal rotational manoeuvres (Rubin's and Wood's screw manoeuvres).** These measures are rarely required.

Rubin's manoeuvre. The operator inserts the fingers of one hand vaginally, positioning the fingertips behind the anterior shoulder. The shoulder is then pushed towards the fetal chest.

Wood's screw manoeuvre. If Rubin's manoeuvre is unsuccessful, the fingers of the opposite hand may be inserted vaginally to approach the posterior shoulder from the front of the fetus. The combination of these two movements may allow rotation of the shoulders and aid delivery. If delivery of the posterior shoulder or arm is not successful, try to rotate the posterior shoulder 180-degrees in a corkscrew fashion (clockwise or anticlockwise) to bring it to an anterior position, from which the delivery can continue as normal (this rotation

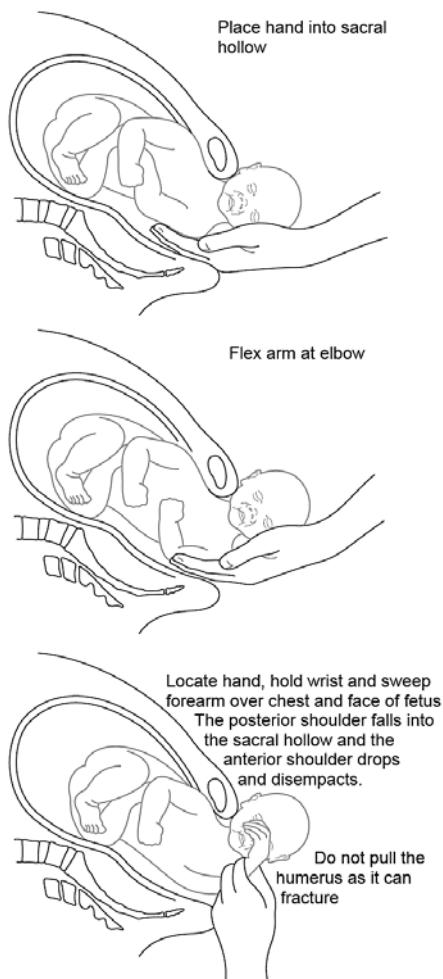


FIGURE 2.5.F.14 Delivery of the posterior arm. Reproduced with permission from Macdonald S, Magill-Cuerden J (ed.) *Mayes' Midwifery: a textbook for midwives*. Elsevier Health Sciences; 2010. © Elsevier

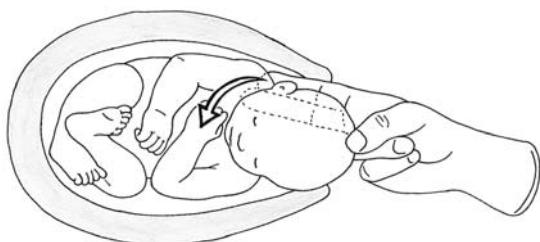


FIGURE 2.5.F.15 Rubin's manoeuvre.

- releases the impacted anterior shoulder that ends up in the posterior pelvis). It is important not to twist the fetal head or neck during this manoeuvre.
- 8 All fours position.** This is another procedure that can be useful if no help is available. The mother quickly positions herself evenly on hands and knees (Gaskin's manoeuvre). In many cases this alone relieves the dystocia. In addition, it can assist with the delivery of the posterior arm. The other manoeuvres described above can also be performed with the mother in this position. Early on try to deliver the posterior shoulder from this position. Sometimes pushing one leg forward into the

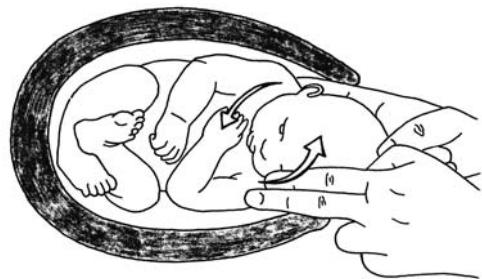


FIGURE 2.5.F.16 Wood's screw manoeuvre.

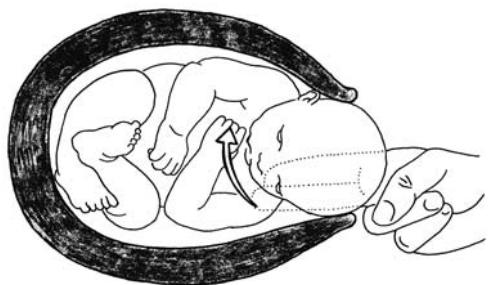


FIGURE 2.5.F.17 Reverse Wood's screw manoeuvre.

FIGURE 2.5.F.18 The all-fours position for shoulder dystocia (the method to use if you have no one to assist you). Guide the head downwards so that the posterior shoulder which has now become upwards with the adoption of the all-fours position is delivered.

'starting of a race' position can open up the pelvis from this position.

- 9 **Syphymiotomy.** If the baby is still undelivered, symphysiotomy should be considered.
- 10 Check the vagina and perineum for trauma, and repair accordingly.
- 11 Prepare for postpartum haemorrhage.

2.5.G Severe infection in the puerperal period

Diagnosis of infection after childbirth

TABLE 2.5.G.1 Symptoms and signs of infection, with diagnosis and treatment

| Symptoms | Signs | Investigations | Diagnosis | Treatment |
|--|--|---|-----------------------|---|
| Rigors/chills Lower abdominal and/or pelvic pain Foul-smelling liquor Persistent light vaginal bleeding History of incomplete placenta delivered History of prolonged rupture of membranes, frequent unsterile vaginal examinations in labour | Fever (usually > 38°C) Tender uterus Shock Delayed rate of involution of uterus | Full blood count, including white blood cell count Blood culture Lochia for microscopy, culture and sensitivity | Endometritis | Treat shock urgently if present IV antibiotics Ampicillin 2 grams IV/IM every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours |
| Breast pain Rigors | Tender over breast Red wedge-shaped area of induration of one breast Fever > 38°C | | Mastitis | If bacterial infection is suspected, give anti-staphylococcal antibiotics: flucloxacillin or cephalexin orally for 7 days |
| Breast pain Rigors, chills and/or malaise | Swinging fever Fluctuant swelling in the breast, possibly with pointing and draining of pus | | Breast abscess | Surgical drainage If the patient is systemically very unwell, give anti-staphylococcal antibiotics IV: flucloxacillin or cefotaxime or ceftriaxone |

(continued)

| Symptoms | Signs | Investigations | Diagnosis | Treatment |
|--|---|---|--|---|
| History of Caesarean section Rigors, chills and/or malaise Severe abdominal pain Vomiting | High, swinging fever Swelling and redness around incision High fever Abdominal distension Rigid abdomen Absent bowel sounds Shock (see above for signs) | | Wound abscess Peritonitis | Surgical drainage Treat shock Give IV antibiotics Nasogastric tube Immediate laparotomy in operating theatre |
| Lower abdominal pain Diarrhoea History of Caesarean section | Swinging fever Swelling in adnexae or pouch of Douglas Tender uterus Ultrasound | Full blood count, including white blood cell count Blood culture Pus for microscopy, culture and sensitivity | Pelvic abscess | Give IV antibiotics: Ampicillin 2 grams IV/IM every 6 hours <i>plus</i> gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours <i>plus</i> metronidazole 500 mg IV every 8 hours Surgical drainage |
| Pain in the lower abdomen or loin Nausea and/or vomiting Increased frequency of passing urine | High fever Tenderness of one of the loins over the kidney Normal bowel sounds | Microscopic examination of urine Stick tests for infection (if available) Urine culture and sensitivity if possible | Pyelonephritis | IV antibiotics (see Section 2.8.F) If the patient is in shock, initiate immediate treatment |
| Difficulty in breathing Cough, sometimes with expectoration Pleuritic chest pain | Fever Respiratory distress Signs of consolidation or effusion | Chest X-ray Ultrasound if there is effusion | Pneumonia | IV antibiotics (see Section 2.8.A) |
| Rigors Headache Muscle and/or joint pains | Fever Enlarged spleen Shock Reduced consciousness Jaundice Anaemia Fitting | Full blood count Thick film for parasites Blood glucose | Malaria | Antimalarial drugs (see Section 2.8.D) |

Endometritis

This is the most serious and common cause of puerperal sepsis. It accounts for up to 15% of maternal deaths in resource-limited countries.

Infection of retained products of conception is the most common cause (suspect this if there is excessive vaginal bleeding or poor involution of the uterus). This can lead to long-term health problems, including infertility, chronic pelvic inflammatory disease and ectopic pregnancies.

Endometritis is defined as infection of the genital tract at any time between the onset of rupture of the membranes or labour and the 42nd day following delivery or abortion, in which two or more of the following are present:

- abdominal and/or pelvic pain
- fever of $\geq 37.5^{\circ}\text{C}$ (can be masked by paracetamol or other antipyretic drugs)
- abnormal quantity of vaginal discharge
- foul-smelling discharge
- delay in the rate of involution of the uterus.

Puerperal sepsis can present with few symptoms (the

woman feels unwell and usually has a fever). It can also progress rapidly to become life-threatening within hours.

Pathogens that cause sepsis

The pathogens most commonly responsible are group A beta-haemolytic streptococcus (often of community origin) and endotoxin-producing enterobacteria (e.g. *E. coli*). Less commonly involved are *Clostridium*, *Bacteroides*, *Chlamydia* and *Mycoplasma*. Bacterial infections are often mixed.

Risk factors

These include the following:

- prolonged rupture of membranes (> 48 hours before delivery)
- contact with others, especially children, with a bacterial throat infection (*Streptococcus*)
- frequent (particularly unsterile) vaginal examinations
- prolonged and obstructed labour
- instrumentation (e.g. forceps delivery)
- Caesarean section (especially in an emergency)

- retained products of conception
- lack of sanitary towels and hygienic materials to manage lochia during the postnatal period
- sickle-cell disease.

Pathogenesis

- Endotoxins are released from the cell wall of Gram-negative bacteria.
- Endotoxins can cause shock.
- Extensive tissue necrosis, even gangrene, may occur, especially in the uterus.

Prevention

- Antibiotic prophylaxis for prolonged rupture of membranes, manual removal of the placenta and Caesarean section.
- Antiseptic cream for vaginal examinations (e.g. Hibitane obstetric cream).
- Provision of sanitary towels and other hygienic items to all women and girls who have given birth, and where family poverty means that these items are not available.

Complications

These include the following:

- wound infection and wound dehiscence (burst abdomen)
- peritonitis
- ileus
- septicaemia, possibly accompanied by shock
- abscess formation in cul-de-sac and sub-diaphragmatic space
- adnexal infections
- ovarian abscess
- pelvic abscess
- breast infection or abscess
- deep vein thrombosis
- pulmonary embolus.

Investigations

These include the following:

- high vaginal swab if bacteriology facilities are available
- midstream samples of urine (MSSU) and microscopy of urine.

Treatment

Treat as an emergency, including IV fluid boluses if shock is present (see Section 2.5A), if there is persistent tachycardia (> 100 beats/minute), hypotension (systolic blood pressure < 90 mmHg), increased respiratory rate (> 25 breaths/minute), confusion or disorientation, oliguria (< 30 mL/hour), rash or bradycardia (< 50 beats/minute).

Give antibiotics until the patient has been fever-free for 48 hours or 7–10 days:

- ampicillin 2 grams IV every 6 hours
 - plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours
 - plus metronidazole 500 mg IV every 8 hours.

If fever is still present 72 hours after initiating antibiotics, re-evaluate the patient and consider revising the diagnosis.

Often a 1 to 2 week antibiotic course is completed orally once the patient has been fever free for 48 hours.

If retained placental fragments are suspected, perform a digital exploration of the uterus to remove clots and large

pieces. Use ovum forceps or a large curette if necessary, but be very careful not to penetrate the uterine wall, which is very soft at this stage. Where general anaesthesia is not available, agents such as ketamine may be considered for this procedure.

If there is no improvement with conservative measures, and there are symptoms and signs of general peritonitis (abdominal pain, fever, and abdominal tenderness with rebound tenderness), perform a laparotomy to drain the pus, and if the uterus is the source do not leave it too late to perform a hysterectomy.

Wound infections

Wound infections may be superficial or deep. Superficial infections involve the skin and subcutaneous tissues, but not the rectus sheath (fascia). They may present with cellulitis or abscess formation. Cellulitis should be treated with antibiotics; this may prevent the development of a wound abscess.

Clear or purulent fluid exuding from the wound should raise concern that the infection is deep to the sheath. Where there is abscess formation, the wound should be opened by removing sutures to the skin and subcutaneous tissues, to allow drainage of pus. Antibiotics are not always required if an abscess is drained and the surrounding tissues appear healthy.

The wound may require debridement if tissue necrosis is suspected. If the sheath looks healthy and intact, the fascial sutures should be left *in situ*. The wound should be packed with a damp dressing, which must be changed every 24 hours.

If the sheath appears necrotic or infected, it should be opened and the peritoneal cavity inspected for collections of pus. If pus is present, it should be evacuated, and a broad corrugated drain left *in situ* in the peritoneal cavity to facilitate drainage post-operatively.

Necrotising fasciitis is a relatively uncommon but potentially life-threatening variant of wound infection, which presents with rapidly spreading cellulitis, with severe pain and tenderness. Urgent wide debridement of necrotic tissue is required, with antibiotics as for deep wound infection (see below). Secondary closure should be undertaken 2–4 weeks later, provided that the infection has resolved.

Antibiotic regimes for wound infections

Where possible, swabs should be taken for culture and sensitivity before starting antibiotics.

Superficial infections

Give ampicillin 500 mg by mouth, four times a day for 5 days, plus metronidazole 500 mg by mouth, three times a day for 5 days.

Deep infections

Give benzyl penicillin, 2 million units (1200 mg) IV every 6 hours, plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours, plus metronidazole 500 mg IV every 8 hours.

IV antibiotics should be continued until at least 48 hours after the pyrexia has settled.

The patient may then be switched to oral antibiotics, as described above.

Peritonitis

Treat shock, if present. Then:

- provide nasogastric suction
- infuse IV fluids for maintenance and replacement
- give antibiotics IV until the patient has been fever-free for 48 hours:
 - ampicillin/amoxicillin 2 grams IV/IM every 6 hours
 - plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours
 - plus metronidazole 500 mg IV every 8 hours.
- if necessary, perform a laparotomy to repair diseased or injured bowel.

Pelvic abscess

Give antibiotics before draining the abscess, and continue until the patient has been fever-free for 48 hours:

- ampicillin/amoxicillin 2 grams IV every 6 hours
- plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours
- plus metronidazole 500 mg IV every 8 hours.

If the abscess is fluctuant in the cul-de-sac, drain the pus through the cul-de-sac (culdocentesis) (see below). If the spiking fever continues, perform a laparotomy.

Bowel may be secondarily involved in the inflammatory process, and care must be taken to avoid bowel perforation.

Peritonitis may develop in association with a pelvic abscess. Prompt nasogastric suction and administration of intravenous fluids are important, as well as IV antibiotic therapy as described above.

Colpotomy for a pelvic abscess

If pus is obtained on culdocentesis, keep the needle in place and make a stab incision at the site of the puncture.

Remove the needle and insert blunt forceps or a finger through the incision to break the loculi in the abscess cavity (see Figure 2.5.G.2).

- Allow the pus to drain.
- Insert a disinfected soft rubber corrugated drain through the incision. (If a surgical drain is not available, a make-shift drain can be prepared by cutting off the fingertips of a disinfected rubber glove.)
- If required, use a stitch through the drain to anchor it in the vagina.
- Remove the drain when there is no more drainage of pus.
- If no pus is obtained, the abscess may be higher than the pouch of Douglas. A laparotomy will be required for peritoneal lavage (wash-out).

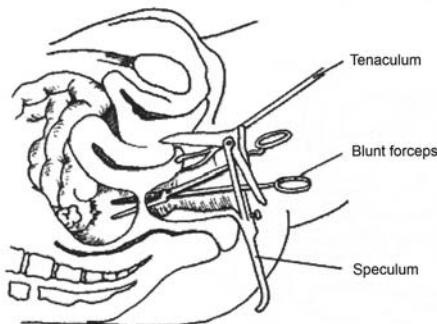


FIGURE 2.5.G.2 Colpotomy for pelvic abscess.

Culdocentesis and colpotomy

Culdocentesis for the detection of pus

- Apply antiseptic solution to the vagina, especially the posterior fornix.
- Infiltrate with 1% lignocaine.
- Gently grasp the posterior lip of the cervix with a tenaculum and gently pull to elevate the cervix and expose the posterior vagina.
- Place a long needle (e.g. spinal needle) on a syringe and insert it through the posterior vagina, just below the posterior lip of the cervix (see Figure 2.5.G.1).
- Pull back on the syringe to aspirate the cul-de-sac (the space behind the uterus).
- If pus is obtained, keep the needle in place and proceed to colpotomy (see below).

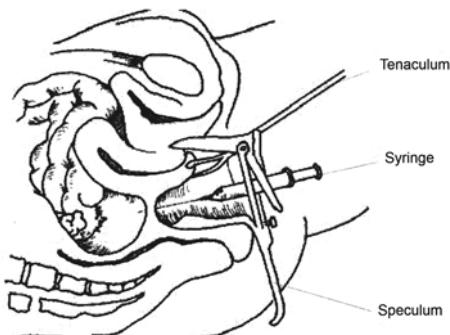


FIGURE 2.5.G.1 Culdocentesis: diagnostic needle aspiration of the cul-de-sac.

Mastitis

Mastitis may be infective or non-infective, ranging in severity from mild local erythema and tenderness through to abscess and septicaemia.

- Non-infective mastitis may be due to a blocked lactiferous duct, or to difficulties with breastfeeding technique. It may lead to infective mastitis.
- Infective mastitis is common in lactating women. It is usually caused by the bacterium *Staphylococcus*, which generally responds to a 7- to 10-day oral course of flucloxacillin or a cephalosporin, both of which are safe to take while breastfeeding.

Mastitis usually presents with a hot red swollen section of one breast. It may be associated with flu-like symptoms, namely pyrexia of 38°C or above, chills and myalgia.

Treatment

Continue breastfeeding. Although the symptoms of mastitis may discourage breastfeeding, it is important to try to continue. Regular breastfeeding will help to:

- remove any blocked breast milk from the breast
- resolve the symptoms of mastitis more quickly
- prevent mastitis from becoming more serious.

The milk from the affected breast may be a little saltier than normal, but is safe for the baby to drink. Any bacteria that are present in the milk will be harmlessly absorbed by the baby's digestive system and cause no problems.

Breastfeed frequently on the affected side, in order to empty the breast of retained milk. The baby can empty

the breast more efficiently than a breast pump. However, if the baby is not feeding well, a **breast pump or hand expression** will be needed to get the milk out. It may be less painful if the affected breast is given to the baby second, after the let-down reflex has occurred.

Mastitis can usually be successfully treated by resting, drinking plenty of fluids and varying the baby's position at the breast. It is important to ensure that the baby is properly attached to the nipple, and that the breast is empty after the feed. It may be necessary to feed more frequently, and to express the remaining milk after a feed. Paracetamol is useful for pain control. Massaging the areas of tenderness may be beneficial.

Prevention of mastitis

The following advice should be given to any mother who has experienced mastitis:

- Relieve engorgement promptly. Milk that does not flow gets thicker and clogs the ducts.
- Breastfeed frequently. Do not restrict the length of feedings.
- If the mother feels her breasts getting full, she should encourage the baby to feed without waiting for the baby to initiate this.

Repeated mastitis

This is usually the result of irregular breastfeeding patterns, such as missing feeds and giving bottles in place of breastfeeding. Recurrent mastitis may also result from tiredness and stress.

With regard to antibiotic treatment, the bacterium involved in mastitis is usually *Staphylococcus*, and the two most effective antibiotics are cloxacillins and cephalosporins, which are safe to take while breastfeeding. A 10-day oral course is recommended.

2.5.H Pulmonary embolism

BOX 2.5.H.1 Minimum standards

- Oxygen.
- IV unfractionated heparin.
- Low molecular weight heparin.
- Subcutaneous heparin.
- Blood clotting measurements.
- Anti-embolism stockings.

Introduction

If left untreated, as many as 24% of patients with deep vein thrombosis (DVT) will have a pulmonary embolism. However, when DVT is treated with anticoagulants (if that is possible), pulmonary embolism occurs in only 4.5% of cases, and the mortality rate is less than 1%.

Deaths are equally common antenatally and postnatally. Pregnancy is a thrombogenic state associated with a five- or sixfold increase in the risk of pulmonary embolism. The majority of DVTs in pregnancy are ilio-femoral, and these are more likely to embolise.

Anti-embolism stockings and early mobility after Caesarean section and after childbirth are the main ways of preventing this.

Additional risk factors

- **Operative delivery:** Caesarean section increases the risk of pulmonary embolism by two- to eightfold; the risk is greater after an emergency procedure than after an elective one.
- **Age:** The mortality from pulmonary embolism is 100 times higher in pregnant women over 40 years of age than in those aged 20–25 years.
- **Obesity.**
- **Congenital and acquired thrombophilia:** Patients with antithrombin III deficiency, protein C and S deficiency, activated protein C resistance, and lupus anticoagulant and antiphospholipid antibody are at increased risk of pulmonary embolism.

- **Surgical procedures during pregnancy or the puerperium (especially Caesarean section).**
- **Other risk factors:** Restricted activity, pre-eclampsia, dehydration, excessive blood loss and homocystinuria.

Clinical presentation

- Dyspnoea, tachypnoea, pleuritic chest pain, cough, haemoptysis and leg pain.
- Massive pulmonary embolism may be associated with cyanosis, circulatory collapse with hypotension, syncope or convulsions and central chest pain.
- Occasionally, patients present with unexplained tachycardia.

TABLE 2.5.H.1 Signs and symptoms of pulmonary embolism

| Findings | Patients with proven pulmonary embolism (%) |
|--------------------|---|
| Tachypnoea | 89 |
| Dyspnoea | 81 |
| Pleuritic pain | 72 |
| Apprehension | 59 |
| Cough | 54 |
| Tachycardia | 43 |
| Haemoptysis | 34 |
| Temperature > 37°C | 34 |

Tachycardia and a few localised crepitations may be the only findings on physical examination.

Massive pulmonary embolism may produce right-sided heart failure with jugular venous distension, an enlarged liver, a left parasternal heave, and fixed splitting of the second heart sound.

Clinical evidence of DVT may not be found in patients with pulmonary embolism. Symptoms and physical findings must be interpreted with caution during pregnancy, because

dyspnoea, tachypnoea and leg discomfort are common findings as pregnancy progresses.

Investigations

Request a full blood count, urine and electrolytes, oxygen saturation, and (when available) clotting studies and arterial blood gases.

Request an ECG and chest X-ray (if available). These investigations do not confirm or refute the diagnosis of pulmonary embolism.

- **ECG** is non-specific for the diagnosis of pulmonary embolism. The changes in electrical axis that occur in normal pregnancy make the ECG findings in pulmonary embolism even less specific. Sinus tachycardia is the most common abnormality. Right axis deviation and right ventricular strain pattern may be present with a large pulmonary embolism. The S1Q3T3 pattern is very rare.
- **Chest X-ray** helps to exclude pneumothorax and pneumonia. The non-specific radiological changes in pulmonary embolism include segmental collapse, a raised hemidiaphragm, consolidation and unilateral pleural effusion. A wedge-shaped infarction is a rare finding.

Primary assessment and resuscitation for possible pulmonary embolism (ABC approach)

Call for help.

Airway

- Use an opening manoeuvre if the airway is not open or is partially obstructed. If there is an improvement, use airway adjuncts to maintain the airway.
 - An oropharyngeal airway is usually appropriate only if the patient is unconscious.
- Suction if necessary.
- The airway may need to be maintained and protected by intubation using experienced senior help (if available).

Breathing

- Provide a high concentration of **oxygen** through a face mask with reservoir bag, if there is adequate spontaneous respiration.
- For patients with inadequate ventilation or depressed conscious level, respiration should be supported with oxygen via a bag-valve-mask and experienced senior help summoned (if available).

Give 100% oxygen (mask with reservoir and flow rate of at least 6 litres/minute) regardless of SaO_2 , as it increases fetal oxygen delivery as well as improving maternal tissue oxygenation.

Circulation

- Place a wide-bore IV cannula (16- to 18G).
- Place the woman in a lateral tilt or recovery position if undelivered and more than 20 weeks' gestation.
- If possible, locally treat clinically suspected pulmonary embolism while awaiting confirmation from objective tests (if available) to prevent further thromboembolic complications and extension of the existing thrombus.
 - IV unfractionated heparin is the mainstay of treatment.
 - Initiate treatment with an IV bolus of 5000 IU of heparin given over 5 minutes.

- **Note:** there are serious potential risks of anticoagulation, in particular the risk of life-threatening haemorrhage in the 24 hours after delivery, especially after Caesarean section.
- Empirical anticoagulation should be undertaken only when the diagnosis is clear clinically.
- **Additional treatment options for shocked patients** (if available) include thrombolytic therapy using streptokinase, pulmonary embolectomy and transvenous catheter fragmentation of the clot (available only in well-resourced units). Expert advice should be sought (if available).

Secondary assessment and emergency treatment

Involve the senior obstetrician, the anaesthetist and the medical team (if available).

Transfer the patient to the **high-dependency area** (if available) and commence close monitoring of heart rate, blood pressure, central oxygenation (SaO_2 if possible), ECG (if available) and urine output.

Anticoagulation

Heparin is the anticoagulant of choice in pregnancy, as it does not cross the placenta. Rapid and prolonged anticoagulation prevents extension of the thrombus and its recurrence.

When available, acute therapy is with an IV bolus of unfractionated heparin, 5000IU over 5 minutes, followed by an IV infusion of 1000–2000IU/hour for 5–10 days. The dose is adjusted to maintain the activated partial thromboplastin time (APTT) at 1.5–2.5 times the control. Repeat the APTT every 6 hours during the first 24 hours of therapy, and thereafter monitor it daily.

Treatment may then be continued with subcutaneous heparin at a dose of 10000IU twice daily. Maintaining the APTT in the therapeutic range (1.5–2.5 times the control) following subcutaneous heparin may be problematic, and can lead to under- or over-anticoagulation. Low-molecular-weight heparin (LMWH) is ideal if available.

Before giving heparin, measure the platelet count (if available).

Rare complications of heparin treatment are allergy and thrombocytopenia. The platelet count should be monitored at the onset of treatment and monthly thereafter.

Warfarin crosses the placenta and is associated with characteristic damage to the fetus in the first trimester. Major fetal CNS abnormalities such as microcephaly and optic atrophy are also seen with warfarin use in the second and third trimesters. In addition, there is a higher risk of intracerebral bleeds from the trauma of delivery, and a higher risk of bleeding complications during labour and delivery.

For all these reasons, warfarin is not recommended in the antenatal period. However, warfarin can be initiated in the postpartum period and overlapped with heparin until the INR is maintained at 2.0–3.0.

Can a patient be anticoagulated with heparin if APTT is not available?

This is difficult. You will need to weigh the risks of not treating against the risks of treating. The only good thing about this situation is that the half-life of heparin is short (a few hours).

- If the diagnosis is uncertain and/or the risk to the patient is low, do not give heparin.

- If the diagnosis is likely and the patient is unwell, give 5000 units IV as a bolus and then subcutaneous heparin in small doses of 5000 units 12-hourly. Increase to 10000 units twice daily over a few days.
- If the diagnosis is certain and the patient is severely ill, give 5000 units IV as a bolus and start an infusion at 500 units/hour. Use your clinical judgement and increase slowly over 6 hours to 1000–2000 units/hour. Switch to subcutaneous heparin as soon as possible and be aware of bleeding complications.

LMWH as described above is a good alternative.

Anticoagulant treatment of deep vein thrombosis and/or pulmonary embolism

Following IV unfractionated heparin given as resuscitation (as described above), provide a heparin infusion of 1000–2000 IU/hour, and adjust the dose to maintain the APTT at 1.5–2.5 times the patient's control. Repeat the APTT every 6 hours during the first 24 hours of therapy. Thereafter monitor the APTT daily unless it falls outside the therapeutic range.

Another option is to treat with an LMWH such as enoxaparin given subcutaneously. The drug is available in syringes of 40, 60, 80 and 100 mg. The dose should be based on the patient's pre-pregnancy weight and should be given 12-hourly. The dose will vary depending on the drug used, but for enoxaparin is 1 mg/kg 12 hourly (note this is a greater total dose than the non-pregnancy dose of 1.5 mg/kg/24 hours). If coagulation tests are available, the aim is to achieve an APTT of 1.5–2.5 times the pre-treatment level. If these tests are not available, careful monitoring for signs of overdose, which can cause haemorrhage, should be

undertaken and the mother should be warned of the symptoms to be alert for.

The mother can then be discharged home when she has been taught how to administer the injections and dispose safely of the needles.

Anticoagulation following pulmonary embolism or DVT should be continued throughout pregnancy and for at least 3 months postpartum.

LMWH should be continued for the duration of the pregnancy, and for at least 3 months after delivery. An expert should be consulted about the use of prophylactic heparin during any further pregnancy.

On entering labour, the mother should not be given any further doses of LMWH. If an elective Caesarean section is planned, the mother should have the usual dose of LMWH on the night before surgery, but the morning dose should be omitted. After delivery, as long as there are no concerns about bleeding, enoxaparin should be restarted 4 hours after a vaginal delivery and 8 hours after a Caesarean section. A once daily regimen may be used, especially after 3 days when concerns about haemorrhage are much reduced.

Shocked patients with a pulmonary embolus should ideally be managed on an intensive-care or high-dependency unit (if available). These patients will ideally have arterial blood pressure and central venous pressure (CVP) monitoring. They will also receive haemodynamic support with adequate fluid management and inotropes, in order to ensure maximal right heart filling.

All women at high risk of DVT or pulmonary embolism (e.g. those who have suffered these conditions before, in this or a previous pregnancy) should use anti-embolism stockings and receive subcutaneous heparin until they are fully mobile.

2.5.1 Amniotic fluid embolism

Introduction

Amniotic fluid embolism occurs when a bolus of amniotic fluid is released into the maternal circulation during uterine contractions. It becomes trapped in the maternal pulmonary circulation and causes cardiorespiratory collapse and clotting problems with disseminated intravascular coagulation (DIC). It is very rare, and extremely difficult if not impossible to treat without high-level resources.

- acute hypoxaemia (dyspnoea, cyanosis or respiratory arrest)
- coagulopathy (laboratory evidence of DIC or fibrinolysis or severe clinical haemorrhage) if the patient survives long enough for DIC to become established (more than 30 minutes)
- the absence of other causes or symptoms.

Diagnosis

- This is based on the clinical presentation.
- Chest X-ray may show pulmonary oedema, adult respiratory distress syndrome (ARDS), or right atrial enlargement and prominent pulmonary arteries.
- The ECG may show a tachycardia and right ventricular strain pattern.
- Clotting studies may show thrombocytopenia and elevated fibrin degradation products or D-dimers. The clotting and bleeding times are very prolonged.

Differential diagnosis

- **Pulmonary embolus:** infrequent during labour, often

Clinical presentation

Amniotic fluid embolism usually presents late in the first stage of labour. It has also been reported during first-trimester surgical termination of pregnancy, second-trimester termination, after abdominal trauma and after amniocentesis.

The diagnosis is essentially clinical and by exclusion and treatment of other possible causes. Amniotic fluid embolism may occur during labour (70%), during Caesarean section (19%) or immediately postpartum (11%).

The major signs include the following:

- acute hypotension or cardiac arrest

- accompanied by chest pain, without development of coagulopathy.
- **Air embolism:** may follow ruptured uterus, pressurised IV infusion or Caesarean section. The distinguishing feature in air embolism is pre-cordial water-wheel murmur. There is no coagulopathy.
 - **Septic shock:** unlikely in the absence of evidence of preceding infection and pyrexia.
 - **Anaphylactic shock:** there is no coagulopathy.
 - **Eclampsia:** usually preceded or accompanied by hypertension and proteinuria.
 - **Toxic reaction to anaesthetic or local anaesthetic agents:** there is no coagulopathy.
 - **Acute left heart failure:** usually more insidious onset. There is no coagulopathy.
 - **Cerebral haemorrhage:** no cyanosis or hypotension. There is no coagulopathy.
 - **Massive obstetric haemorrhage:** the history may help. Beware concealed abruption. Uterine atony may be a feature of both. Hypoxaemia in massive obstetric haemorrhage is less pronounced than in amniotic fluid embolism.
 - **Aspiration of gastric contents:** usually occurs in an unconscious patient, or during induction of or emergence from general anaesthesia. There is no coagulopathy.

Management

Management is supportive, and aims to correct hypoxaemia, shock and coagulopathy and its consequences.

- Give 100% inspired oxygen by face mask and reservoir.
- If the patient is unconscious (P or U on the AVPU scale), intubation and assisted ventilation (if available) are needed.
- High positive end-expiratory pressure (PEEP) should be avoided.
- Two large-bore cannulae (16G) IV should be sited.
- Urgently cross-match blood, ideally at least 6 units of group-specific blood with retrospective cross-matching (if available) should be ordered. Check clotting factors (or clotting time) and platelets. Blood needs to be sent for a full blood count, clotting, fibrinogen and fibrinogen degradation product (FDP) levels (if available) immediately, and frequent repeated estimations of haematological parameters are required (if available).

- Cardiac arrest is managed according to protocols (see Section 1.13).
- If the woman is in labour, immediate delivery is required, by Caesarean section (under general anaesthetic) if vaginal delivery is not imminent. In cardiac arrest, if a cardiac output cannot be restored immediately, cardiac massage and ventilation should continue and Caesarean section should be performed.
- Circulatory support depends on the causes of decreased cardiac output. The available haemodynamic data indicate that high left heart filling pressures, reflecting a failing left ventricle, are a feature of the condition. In patients who survive the initial haemodynamic collapse, there is a high risk of secondary pulmonary oedema (70%). Inotropic support, ideally guided by monitoring of the central venous pressure (CVP), may be life-saving.
- If massive obstetric haemorrhage occurs, large volumes of fresh blood and blood products may be required.
- Monitoring of cardiac filling pressures may help to prevent fluid overload and pulmonary oedema.
- Place an arterial line if possible.
- Correct coagulopathy with fresh blood, platelets, fresh-frozen plasma and cryoprecipitate (rich in fibrinogen) if available.
- Massive haemorrhage may be due not only to coagulopathy, but also to coexisting uterine atony. Oxytocic drugs will be needed. Uterine tamponade may reduce blood loss while the coagulopathy is corrected.
- Patients who survive are at high risk for heart failure, ARDS and DIC. If the patient is sustaining a cardiac arrest, there is a high risk of neurological injury. As in other cardiac arrests associated with pregnancy, delivery may improve the success of resuscitation.

Outcome

The outcome is poor, even when optimum treatment and monitoring is available, so it is important to exclude other possible and treatable causes of collapse, including anaphylaxis, pulmonary embolism, haemorrhage, sepsis, myocardial infarction, eclampsia, intracranial haemorrhage, hypoglycaemia and drug toxicity (e.g. magnesium, local anaesthetics).

The outcome depends on the facilities for cardiorespiratory support and the ability to manage the DIC with blood and blood products.

2.6

Complications that require hospital care

2.6.A Ovarian cysts in pregnancy

Ovarian cysts in pregnancy may cause abdominal pain due to torsion or rupture. Laparotomy is required if torsion of an ovarian cyst is suspected. If the findings at laparotomy

are suggestive of malignancy (i.e. solid areas in the tumour, growth extending outside the cyst wall), the specimen should be sent for immediate histological examination if

available and the woman should be referred to a tertiary care centre for evaluation and management.

Corpus luteum cysts are common and normal in the first trimester. They should **not** be removed surgically, as the corpus luteum will disappear as pregnancy progresses.

Asymptomatic ovarian cysts

If, on ultrasound, the cyst is found to be more than 10cm in diameter, observe by regular ultrasound examinations for growth or complications. If there is torsion this will produce pain and the cyst will need to be surgically removed.

Surgery will pose a significant risk of miscarriage and premature delivery. In the case of a twisted cyst, the resulting

necrosis and infection will themselves place the women and fetus at risk of acute complications and therefore prompt intervention is unavoidable.

Malignancy is difficult to diagnose even where access to advanced imaging such as MRI is available, and therefore a decision to operate on the basis of suspected malignancy is not advised in low resource settings, unless the index of suspicion is very high. If this is considered then it should take into account the gestation of the pregnancy, the risk of pregnancy loss/prematurity, and the treatment available to the mother following delivery.

If the cyst is less than 10cm in diameter and remains so on ultrasound examination, it will usually regress on its own and does not require treatment.

2.6.B Reduced fetal movements, intrauterine death and stillbirth

BOX 2.6.B.1 Minimum standards

- Pinard's stethoscope.
- Doppler device for fetal heart rate monitoring.
- Ultrasound scan.
- Misoprostol and oxytocin or ergometrine.
- Fresh blood for transfusion.

General management

Check for fetal heart sounds, and if they are present, measure the fetal heart rate.

If the fetal heart cannot be detected with a Pinard's stethoscope, Doppler device or ultrasound scan, refer to Table 2.6.B.1 below.

Diagnosis

TABLE 2.6.B.1 Diagnosis of reduced fetal movements

| Symptoms | Signs | Investigation | Diagnosis | Treatment |
|---|---|---|--|--|
| Decreased or absent fetal movements Bleeding (but may not be external) Collapse Severe constant abdominal pain | Shock in the mother Tense and/or tender uterus Fetal distress or absent fetal heart sounds | Pinard's stethoscope, Doppler device or ultrasound scan | Placental abruption | Deliver the baby as soon as possible (see below) by Caesarean section if there are signs of fetal life |
| Decreased or absent fetal movements Bleeding (but may not be external) Collapse Severe constant abdominal pain | Shock in the mother Diffuse uterine tenderness with easily felt fetal parts Fetal distress or absent fetal heart sounds | Pinard's stethoscope, Doppler device or ultrasound scan | Ruptured uterus Major risk factors are prolonged labour, previous Caesarean section and use of oxytocin | Treat shock When the mother is stable perform laparotomy |
| Decreased or absent fetal movements If membranes are ruptured, meconium staining of liquor | Abnormal fetal heart rate (< 100 beats/minute or > 180 beats/minute) Partogram should show alerts | Pinard's stethoscope, Doppler device or ultrasound scan | Fetal asphyxia | Deliver the baby as soon as possible (see below) by Caesarean section if there are signs of fetal life |
| Absent fetal movements | Symphysis-fundal height decreases Absent fetal heart rate If membranes are ruptured, meconium staining may be present | Pinard's stethoscope, Doppler device or ultrasound scan Full blood count in mother Clotting screen, including measurement of platelet count in mother | Fetal death | Deliver baby as soon as possible (see below) |

Fetal death in the absence of an abruption

Fetal death *in utero* (IUFD) may be the result of fetal asphyxia from placental failure, fetal infection, cord accident or congenital anomalies. Where syphilis is prevalent, a large proportion of fetal deaths are due to this disease.

Fetal death can be confirmed by abdominal ultrasound with confidence if there is a lack of fetal heart activity.

If fetal death *in utero* is diagnosed, inform the woman or girl and her family and discuss the options for management with them.

Common causes are infection (especially malaria and chorioamniomitis), abruption, and placental insufficiency. In the case of intrapartum IUFD, fetal hypoxæmia, often, but not always, associated with a prolonged obstructed labour or malposition, may be to blame. In the laboring patient uterine rupture must also be considered.

The following investigations should be performed as a minimum: blood group and cross match, Hb, malaria RDT +/- malaria smear and urine analysis to assess for urinary infection and pre-eclampsia. Syphilis is also common in some settings and may cause IUFD and premature labour.

If a clotting test shows failure of a clot to form after 7 minutes, or a soft clot that breaks down easily, suspect coagulopathy. Obtain fresh blood for transfusion and give broad-spectrum IV antibiotics, including metronidazole.

Expectant management

Explain to the mother that in 90% of cases the fetus is spontaneously expelled within 1 month of diagnosis. However, most mothers and their families will request delivery as soon as possible.

In addition, expectant management carries with it the risk of infection and DIC both of which complicate management and risk the mother's life. If this approach is used, it should be possible to monitor the patient for complications and there should be access to prompt and comprehensive treatment if they occur.

If IUFD is diagnosed in a laboring women, then once she has been assessed and treated for potential causes as above the labour can be allowed to continue with the usual monitoring. It is important to actively assess for life-threatening causes such as abruption and rupture.

Active management

If there is no evidence of active labour and no indication for urgent delivery by Caesarean section, induction of labour with misoprostol is an effective way of inducing labour. As is the case for mid-trimester miscarriage, mifepristone, where available, can be helpful in shortening the length of time it takes for misoprostol to work. This is especially the case where there is no evidence of labour, the cervix is unfavourable and the patient is primiparous.

The following drug regime is recommended for women with an IUFD of 26 weeks' gestation or more (see below for women with a previous Caesarean section and Section 2.5.D.ii for management of miscarriage before 26 weeks' gestation):

- Mifepristone 200 mg orally stat (omit if not available). Wait for 36 to 48 hours after giving this drug – shorten if any clinical concerns arise during this interval
- misoprostol 50 micrograms orally or vaginally every 4 hours to a total of 5 doses
- if delivery has not occurred by the fifth dose of

misoprostol, the patient should be reviewed by a doctor. Subsequent options for management include continued use of misoprostol (usually after a period of 'rest' for 12 to 24 hours), or use of oxytocin.

For women with an IUFD at term (37 weeks and over) an alternative is to use the same induction of labour protocol as described previously (Section 2.3 'Managing labour and delivery'), for women with a live fetus, i.e. 25 micrograms of misoprostol every 2 hours.

Note: The evidence base for the optimum dose of misoprostol to be used in this scenario is poor, and it is recognised that higher doses of 100 micrograms or more every 4 to 6 hours, have historically been used. Recent evidence suggests that lower doses may be as efficacious, and it is with this in mind, as well as concerns about optimising safety, that the above dose has been recommended. Further research is needed into the optimal regimen, especially in resource poor settings.

Women who have undergone a previous caesarean section

In women with a previous Caesarean section, previous uterine surgery, or in grandmultiparae, there is a risk of dehiscence/rupture in labour that is likely to be increased with the use of misoprostol, and therefore its use should be avoided. Vaginal delivery is still the preferred mode of delivery if the fetus is dead, but care must be taken to minimise the risk as much as possible.

If the cervix is favourable (Bishop score 6 or more) and ARM possible, then especially in women who have delivered previously, ARM alone will often result in delivery over the following 24 hours. If labour does not become established following ARM, then oxytocin can be titrated, using the usual protocol to augment/induce the labour.

If the cervix is unfavourable, then the oxytocin infusion may be started with intact membranes, and continued until the cervix becomes favourable for ARM (usually < 8 hours). Oxytocin use is associated with a lower risk of dehiscence/rupture than induction with misoprostol, but still increases the risk as compared with spontaneous labour. Close monitoring of the infusion, to prevent hyperstimulation, and of the patient for signs of any complication, is therefore essential.

Alternatively, the cervix can be 'ripened' with a Foley balloon catheter as previously described. ARM may then be performed, and oxytocin used as above if necessary.

Whichever method is used, all women with risk factors for rupture/dehiscence must be identified and monitored carefully with this complication in mind. Early recognition is the key to preventing maternal morbidity and mortality.

The membranes should be kept intact for as long as possible to prevent infection. However, they may be ruptured if it is necessary to achieve delivery. Vaginal assessments should be performed in a sterile manner and as infrequently as possible. If the membranes have been ruptured for more than 18 hours, treat the patient with prophylactic antibiotics (ampicillin 2 grams IV stat followed by 1 gram every 6 hours). If there are **signs of infection** (fever and/or foul-smelling vaginal discharge), give antibiotics as described for endometritis (see Section 2.5.G).

Oxytocin

Although misoprostol is recommended as the first-line induction agent in the case of IUFD where there are no risk factors

for dehiscence/rupture, Oxytocin may be used if misoprostol is not available or proves ineffective. It may also be used where the risk of rupture is high (as discussed above), and a titratable and short-acting agent is therefore preferred.

In practice oxytocin is more effective following rupture of the membranes, although of course it is preferable to keep these intact as long as possible to avoid infection. As a minimum, rupturing the membranes before the cervix becomes favourable (Bishop score > 6), should be avoided.

Try not to use oxytocin within 8 hours of using misoprostol.

Avoid Caesarean section if possible, except for unavoidable obstetric reasons such as transverse lie, suspected uterine rupture or major abruption.

Fetal death in the presence of an abruption

Adopt the active management approach described above.

Stillbirth

Introduction

Between 2.08 and 3.79 million stillbirths occur each year worldwide. Of these, 98% occur in low- and middle-income countries and 55% occur in rural families in sub-Saharan Africa or South Asia where facilities for giving birth are much poorer than in urban areas (less skilled birth attendants and comprehensive emergency obstetric care). Around 45% of stillbirths occur during birth (intra-partum). The global average rate is 19 in 1000 births, the rate in low-resource settings is ≥ 25 in 1000 births, and the rate in well-resourced settings is < 5 in 1000 births.

Most stillbirths are not registered and the body is disposed of without any recognition or rituals such as naming, funeral services, or even the mother holding or dressing her baby. In some cultural settings there is a belief that sining by the mother or evil spirits are responsible for the stillbirth, and the dead baby may be seen as a taboo object. Families affected may be subjected to stigma and marginalisation. Some healthcare workers believe that few stillbirths are preventable, and that these babies were just 'not meant to live'. There is considerable suffering involved for the family, and mothers frequently become depressed or anxious after a stillbirth, with similar emotions to those experienced after the death of a child.

Definitions of stillbirth

An early stillbirth is defined by the International Classification of Diseases as a birth weight of ≥ 500 grams or, if this measurement is missing, ≥ 22 completed weeks of gestation or, if this is missing, a body length of ≥ 25 cm.

The World Health Organization defines stillbirth as a birth weight of ≥ 1000 grams or, if this measurement is missing, ≥ 28 completed weeks of gestation or, if this is missing, a body length of ≥ 35 cm.

Causes of stillbirth

The major causes, which are the same as the causes of maternal and neonatal mortality, are as follows:

- complications of childbirth
- maternal infections in pregnancy (e.g. syphilis)
- medical disorders of pregnancy (especially pre-eclampsia or hypertension)
- maternal under-nutrition and fetal intrauterine growth retardation
- congenital abnormalities.

Prevention

The most important issues in low-resource situations are to increase the number of skilled birth attendants who can manage antenatal and intra-partum care, to increase the number of healthcare facility-based births, and to prevent or treat syphilis and malaria during pregnancy.

Specifically, the following ten interventions have been subjected to systematic review and reported to reduce stillbirth rates:

- 1 taking folic acid before and soon after conception
- 2 insecticide-treated bed nets or intermittent drug treatment to prevent malaria
- 3 detection and treatment of syphilis
- 4 detection and management of hypertensive disorders in pregnancy
- 5 detection and management of diabetes
- 6 detection and management of fetal growth restriction
- 7 routine induction to prevent post-term pregnancy
- 8 skilled care at birth
- 9 basic emergency obstetric care
- 10 comprehensive emergency obstetric care.

The main aim is to strengthen the healthcare systems involved in antepartum and intra-partum care, which include in addition to the ten items listed above:

- prevention of malaria (see Section 2.8.D) and syphilis (see Section 2.8.H) in endemic areas
- the availability of emergency obstetric surgery, in particular Caesarean section, without delay and with attention to 'task shifting' to improve access, especially in rural areas
- improved antenatal care
- advocacy to address poverty and its consequences (stillbirth rates are inversely correlated with wealth and development)
- systems to manage and prevent domestic violence
- efforts to achieve sexual equality, improve reproductive health and improve the secondary education of boys and girls.

Ideally, bereaved families should form groups that advocate for change at all of the levels identified above.

Further reading

The Lancet Stillbirths series, launched in London, New York, Hobart, Geneva, New Delhi, Florence, and Cape Town on 14 April 2011. www.thelancet.com/series/stillbirth

2.6.C Fetal distress during labour

BOX 2.6.C.1 Minimum standards

Pinard's stethoscope
Hand-held battery-operated ultrasonic fetal heart rate monitor

Introduction

In all clinical circumstances, the well-being of the pregnant woman takes precedence over that of the unborn baby, and there are often situations where resuscitation of the mother will automatically bring about benefits for the fetus.

Careful thought has to be given to the assessment and management of the fetal condition in labour. This is especially so in resource-limited countries, where severe shortages of both equipment and suitably trained personnel often mean that women do not receive the life-saving care which they require in labour.

In such situations, strict prioritisation of needs is required, and fetal well-being has to take second place to maternal survival.

When considering taking steps to monitor fetal well-being, the following factors must be taken into account:

- 1 the cost of monitoring equipment, including maintenance, and replacement of disposable items
- 2 the cost of training staff in the use of such equipment
- 3 the proportion of caregivers' time required to be allocated to assessment of fetal well-being
- 4 the availability of suitable interventions, should fetal distress be diagnosed
- 5 the potential risks to the mother of an intervention for the sake of fetal well-being
- 6 the availability of neonatal care facilities and expertise, following on from an intervention to deliver a distressed and possibly premature baby.

Methods of monitoring fetal well-being in labour range from the low-cost low-technology Pinard's stethoscope to the relatively expensive high-technology cardiotocograph.

Pinard's stethoscope

The Pinard's stethoscope is cheap, portable and resilient, and requires no electricity or battery. It is used to listen to the fetal heart through the maternal abdomen for 60 seconds immediately following a contraction. It should be recorded every 60 minutes in the latent phase of labour, every 15–30 minutes in the active phase of the first stage of labour, every 5 minutes in the second stage, and after every contraction when the woman is pushing in the second stage.

A healthy fetus will withstand the relative hypoxia brought about by the compression of the blood vessels in the placenta during a uterine contraction.

A simple ultrasound Doppler monitor (e.g. a Sonicaid) can be used instead of a Pinard's stethoscope, but it does require batteries.

Fetal heart rate monitoring by Pinard's/Sonicaid: normal ranges and abnormalities

It should be noted that evidence and guidance is lacking

on the use of intermittent fetal monitoring in settings without access to continuous electronic fetal monitoring (CEFM).

Where CEFM is available any abnormality detected by intermittent monitoring results in the mother being transferred on to CEFM. Where this is not possible, it is even more difficult to determine whether fetal distress is present.

In addition, without the ability to perform fetal blood sampling (below), it is not possible to confirm whether the fetus is distressed before delivery, or to determine the degree of distress likely. It should be noted that approximately 50% of babies with pathological electronic fetal heart rate tracings are not in fact distressed.

The impact of intermittent fetal monitoring on Caesarean section rates and neonatal morbidity and mortality, in this context, is therefore unknown. Decisions on whether to pursue Caesarean section with its inherent risks for the current and future pregnancies, is extremely difficult in this context, where information on the fetal condition is so incomplete.

The normal fetal heart rate

Baseline: The baseline is the rate that is returned to after any episodes of variation such as an acceleration or a deceleration. In simple terms it is the most common heart rate for that baby.

When listening with a Pinard's this may be the rate over the first minute of listening. However, if part of the minute includes a period of more rapid heartbeat (an acceleration), or slower heart beat (deceleration) then it may be higher or lower than the baseline.

Therefore, if when listening, the fetal heart can be heard to be very slow or very fast for part or all of the period, auscultating this may not be the baseline and it will be necessary to continue listening over a longer period to gain more information.

The normal range for the baseline is between 120 and 160 bpm. A rate of 110 to 120 bpm is often also a normal finding, especially in babies at term or post term. A rate of 160 to 170 can also be a normal finding in a premature baby. A rate below 110 and above 170 is always considered to be abnormal.

Variability: It is normal for the fetal heart rate to vary with every beat. This variation occurs continually above and below the baseline and is usually by approximately 5 to 15 bpm from the lowest to the highest reading (although normal variation is up to 25 bpm). Variation is not easily detected by the Pinard's stethoscope as monitoring involves counting for 1 minute and it is therefore the average heart rate over that time that is obtained. With a Sonicaid, however, the fetal heart rate is often displayed and it can be seen to vary around a certain level (the baseline).

Variability is a positive sign, and generally suggests that the fetus is coping well with labour.

Accelerations: These are episodes where the fetal heart rate increases by 15 beats or more above the baseline and for more than 15 seconds. They can be heard on a Pinard's with practice, although they are easier to hear the higher and longer they are. They are easier to see on a Sonicaid,

where the number displayed can be seen to increase over a period before falling back to its more usual level.

Accelerations are a positive sign as they represent fetal movement. If the fetus is distressed it will not move and the accelerations will stop. Although it is reassuring when they are present, accelerations are often not present during labour.

Abnormalities of the fetal heart rate

Tachycardia: This is a fetal heart rate above 160–170 bpm.

A tachycardia is often caused by a maternal pyrexia or tachycardia and in these instances it will often resolve once the maternal observations have normalised.

Decelerations: A deceleration is a reduction in the fetal heart rate 15 bpm or more below the base line for 15 seconds or more.

An early deceleration occurs at the onset of the contraction and recovers by the end of the contraction. It is a common feature during labour (especially the second stage) and is not usually associated with fetal distress, and therefore it is not routine to listen to the fetal heart rate during a contraction.

A late deceleration starts during or at the end of a contraction and persists beyond the end of the contraction. This is more commonly associated with fetal distress and if it occurs the fetal heart should be monitored following the next 2 contractions to see if it recurs. If it does, there is a significant chance that the fetus is distressed.

Bradycardia: A bradycardia is a deceleration that continues for over 3 minutes. It may occur during pregnancy or labour and may be associated with inferior veno-caval compression if the patient is lying supine, sudden drops in blood pressure from any cause or cord compression.

It may also represent the end stage of a prolonged period of fetal distress. If the cause of the bradycardia is self-limiting, then the fetal heart should recover, whereas if it has occurred due to period of prolonged distress or the insult is ongoing, it will not recover and will end in fetal death. Even if it resolves, a bradycardia of over 10 minutes may cause brain damage to the fetus and have implications for the neonate.

Cardiotocograph

The cardiotocograph is a relatively expensive, sophisticated but non-invasive item of equipment that requires expertise in its use and in its interpretation, as well as regular maintenance, and ongoing provision of disposables, such as print-out paper. It also requires a power supply (either mains electricity or batteries).

It has a high sensitivity for detecting possible evidence of fetal distress, but a relatively low specificity, such that an additional method of assessment of fetal well-being, usually scalp pH assessment, is required in order to avoid excessive intervention.

If a cardiotocograph is used in the absence of fetal blood sampling, there are certain fetal heart rate patterns which are very likely to be associated with serious fetal distress and that warrant urgent actions to protect the fetus, usually immediate delivery.

Fetal scalp pH assessment

This is achieved by fetal scalp blood sampling, which is

carried out with the woman in the lithotomy position with a wedge to prevent aorto-caval compression or in the left lateral position.

A speculum is inserted in the vagina, the fetal scalp is visualised with the aid of a light source, and a blood sample is obtained using a lancet and a capillary tube.

A blood gas analyser (an extremely expensive item of equipment) is required for assessment of the sample.

Fetal blood gas analysis

This is used to detect fetal acidosis, which is a consequence of hypoxia.

A capillary sample is assessed for pH and base excess. Generally, a pH of ≥ 7.25 is considered to be normal, but it has to be borne in mind that acidosis may develop rapidly, and the sample therefore needs to be repeated if the CTG abnormality persists. A full guide to the interpretation and use of fetal blood gas analysis is not included here as it is not a technique available in the majority of resource poor settings.

Fetal blood sampling is contraindicated if the mother is infected with HIV or in high prevalence areas in the untested patient.

Clinical assessment of fetal well-being

A large amount of information may be gained by clinical assessment as follows.

History

- Gestational age is important, as an immature fetus withstands the stresses of labour less well than if it had reached term. Similarly, those with intrauterine growth retardation are at risk.
- A reduction in fetal movements should always give rise to concern, as it may reflect fetal distress (see Section 2.6.B).
- Pre-eclampsia, antepartum haemorrhage (APH), preterm pre-labour rupture of membranes (PPROM) or other obstetric or medical problems, prolonged pregnancy, multiple pregnancy, diabetes and previous Caesarean section all increase the risk of fetal distress.
- The use of oxytocin, a maternal fever, meconium- or bloodstained liquor, and prolonged first and second stage of labour also increase the risk.
- The duration of labour at the time of admission is crucial, as obstructed labour is a potent cause of severe maternal and fetal morbidity and mortality.

Examination of the maternal abdomen

- **Fetal size:** small or large for dates.
- **Amniotic fluid volume:** oligohydramnios (too little) or polyhydramnios (too much).
 - Oligohydramnios is often associated with poor fetal growth. Growth-restricted fetuses are more likely to become distressed in labour than are well-grown fetuses.
 - Polyhydramnios may be associated with fetal abnormalities or fetal infection *in utero*.
- **Abdominal tenderness with or without hardness feeling like wood:** consider placental abruption.
- **Colour of amniotic fluid after rupture of membranes:**
 - bloodstained: consider placental abruption

- meconium-stained: consider the possibility of a hypoxic episode causing fetal distress.
 - (a) Passage of meconium is often a physiological (normal) phenomenon in a mature fetus.
 - (b) In the presence of plentiful amniotic fluid, the meconium will be dilute. Where there is little fluid, it will be thick.
 - (c) Meconium may signal fetal distress. It may also trigger neonatal respiratory problems through meconium aspiration, which occurs when a distressed fetus gasps *in utero* or during delivery.
 - (d) During the final stages of a breech delivery, meconium may be passed because of the compression of the fetal abdomen. In this case, passage of meconium is not necessarily a sign of fetal distress.
- **Frank blood loss vaginally:** consider placental abruption, uterine rupture, placenta praevia and vasa praevia.
- **Haematuria in labour:** this may signal uterine rupture, usually in association with severe abdominal pain and tenderness, commonly in a woman with a previous Caesarean section scar or in a woman of high parity, particularly where labour is induced or augmented.
- The woman should be turned (tilted) on her left side or placed in the recovery position, to prevent aorto-caval compression.
- Facial oxygen should be administered at a high flow rate.
- Oxytocin should be discontinued if ongoing, and if still detected *in situ*, misoprostol tablets may be removed from the vagina.
- Antibiotic therapy will be indicated if infection (including chorio-amnionitis) is suspected.
- Vaginal examination should be performed to assess the feasibility of vaginal delivery, either spontaneously or by using forceps or ventouse.
- If suspected fetal distress continues despite the above measures and vaginal delivery is not rapidly achievable then a decision about whether to proceed to Caesarean section needs to be made. This is a difficult decision, which ideally takes into consideration a number of factors including: the obstetric history and wishes of the patient, the availability of neonatal care, the degree of fetal compromise suspected and the speed with which Caesarean section can be performed, the availability of hospital care and Caesarean section in subsequent deliveries, and the presence/absence of other relative indications for Caesarean section.
- If a decision is made to deliver by Caesarean section and a delay is anticipated (> 30 minutes), then a tocolytic such as terbutaline 250 microgram s/c may be beneficial if the contractions are felt to be contributing to the fetal distress.

Management of fetal distress

- If fetal distress is suspected, attention should first be paid to detecting and treating maternal factors, including hypovolaemia, sepsis, obstructed labour and uterine rupture.

2.6.D Multiple births

Introduction

Twins occur in around 1 in 80 pregnancies. Non-identical twin rates vary depending on age, parity and racial background; in Africa, rates are higher than the world average. The incidence of monozygous (identical) twins is relatively constant worldwide, at 3.5 in 1000 births.

Multiple pregnancies are associated with higher risks for both the mother and the fetus. Ultrasound scanning should be undertaken if the uterine size is larger than expected, or if abdominal examination of fetal parts leads to suspicion of multiple fetuses.

If ultrasound scanning facilities are not available, abdominal examination after delivery of any first baby should be performed to **exclude a second twin before oxytocin or Syntometrine is given to aid delivery of the placenta**.

Maternal risks associated with multiple pregnancy

These include the following:

- miscarriage
- anaemia
- preterm labour
- hypertension
- polyhydramnios
- operative delivery
- postpartum haemorrhage.

Fetal risks associated with multiple pregnancy

These include the following:

- stillbirth or neonatal death
- preterm delivery
- intrauterine growth restriction
- congenital abnormalities
- cord accident
- specific complications of twin pregnancies (e.g. twin-to-twin transfusion syndrome)
- difficulties with delivery.



FIGURE 2.6.D.1 Twin pregnancy.

If a twin pregnancy is diagnosed, additional care should be provided. Iron and folate treatment must be ensured, due to the increased risk of anaemia. Preterm labour and delivery present the greatest risk of fetal illness and death. If the mother develops premature labour, a course of antenatal steroid injections should be given, betamethasone 12 mg IM, two doses 24 hours apart, or dexamethasone 6 mg IM four doses 12 hours apart.

Presentation of twins

- In 40% of cases both twins are cephalic.
- In 21% the second twin is a breech.
- In 14% the first twin is a breech.
- In 10% of cases both twins are breeches.
- In all remaining cases, one twin or the other, or occasionally both, are transverse.

In Figure 2.6.D.2, the first twin is the lower one.

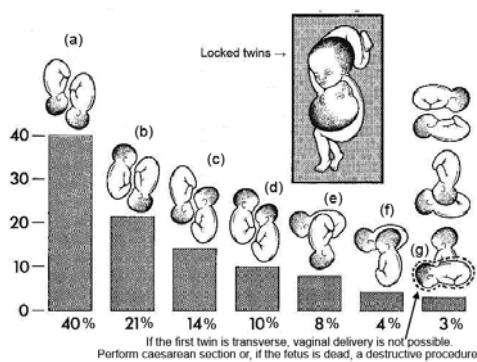


FIGURE 2.6.D.2 The range of different twin positions *in utero* at birth.

Antenatal monitoring in multiple pregnancy

- A 2-weekly check-up (urine for protein if blood pressure is elevated, ultrasound if possible) is recommended from 28 to 36 weeks; warn the woman about the risk of preterm delivery.
- Iron and folate treatment must be ensured as increased risk of anaemia is present.
- A weekly check-up is recommended from 37 weeks.
- Be alert for signs of pre-eclampsia and premature labour.

Twin delivery

Vaginal delivery is usually safe, but must be undertaken in a healthcare facility where comprehensive emergency obstetric care is available. If labour has not started by 39–40 weeks' gestation based on an accurate LMP or first trimester ultrasound, consider induction.

Summary of management during labour

Delivery of first twin

- 1 Insert an IV cannula. Maternal blood should be obtained for a full blood count and blood grouping. A blood sample should be kept for cross-matching.
- 2 Ensure that the lie of the first baby is longitudinal.
- 3 Augment contractions only when indicated.
- 4 Prepare two delivery packs with extra clamps. Remember that there are almost always two membranes to rupture with twins, so have an amniohook ready.

- 5 Make sure that the cervix is fully dilated.
- 6 Empty the mother's bladder.
- 7 Deliver the first baby as normal.
- 8 **Always clamp the maternal end of the cord of the first twin to prevent the second twin bleeding from it.**
- 9 As the first baby is delivered, stabilise the lie of the second twin to a longitudinal position by asking an assistant to place their palms firmly on either side of the uterus in a longitudinal direction. The baby's position should be stabilised in this way until the head or buttocks are fixed in the maternal pelvis. If the second twin is not longitudinal on assessment, undertake version (see below).
- 10 Tie a marker (e.g. gauze) to the clamp on the cord of the first baby to identify it.

Delivery of second twin

- 1 The second baby should preferably be born within 30 minutes.
- 2 Check the fetal heart rate of the second baby.
- 3 Stabilise the lie of the second twin, by external version if necessary (see above).
- 4 Provided the lie is longitudinal and contractions do not restart 5–10 minutes after delivery of the first baby, start an oxytocin infusion, increasing carefully to achieve adequate contractions. Note that contractions may not be felt by the mother, so it is important to keep your hand on the uterus to identify them.
- 5 When the presenting part is well into the pelvis, rupture of the membranes can be performed during a uterine contraction.
- 6 Delivery of the second baby should not be rushed, but assisted delivery should be considered if the second baby has not been delivered by 30 minutes after delivery of the first.
- 7 If the lie of the second twin is transverse, attempt external version.
- 8 If external version is successful, or the second twin is longitudinal, wait for the presenting part to enter the pelvis, then perform artificial rupture of membranes (ARM) and allow normal cephalic or breech delivery if there is no fetal distress.
- 9 If external cephalic version is unsuccessful, either carry out internal version with breech extraction or perform a Caesarean section.

Internal podalic version: It is essential that as the baby descends, rotation of the fetus is encouraged to obtain a back-up (back anterior) position (as in breech delivery). Grasp a fetal foot. Make sure that it is a foot, not a hand. Pull gently down into the birth canal so that the fetal back is encouraged to turn anteriorly. An attempt is made to pull the fetal foot as gently as possible in an attempt to pull it as low as the vulva before the membranes rupture. It may be that maternal effort will be sufficient once the baby's leg has been brought down into the vagina and the remainder of the delivery can then be managed as for an assisted breech delivery. Continued traction (avoiding soft tissues as for all breech deliveries) is permissible in this scenario, to facilitate descent of the buttocks, arm and head (breech extraction, see Figure 2.6.D.3).

- 10 If there is fetal distress or delay, perform an assisted vaginal delivery if cephalic. Note that cephalo-pelvic

disproportion is very uncommon in the case of the second twin.

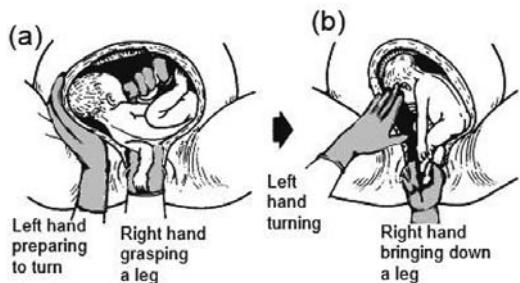


FIGURE 2.6.D.3 Internal version for transverse lie in a second twin.

Postpartum management of a twin birth

- 1 After the birth of the second baby, give 10 IU oxytocin IM after ensuring that there is no third baby in the uterus. Then give oxytocin 40 units IV in 500 mL of Ringer-lactate or Hartmann's solution over 4 hours, to reduce the risks of postpartum haemorrhage due to atonic uterus.
- 2 Deliver the placenta by controlled cord traction after giving oxytocin IM.
- 3 After the placenta and membranes have been delivered, examine and record on the chart the number of placentas, amnions, chorions and cord vessels. Check the placenta and membranes for completeness.
- 4 Check and repair any vaginal and perineal damage.
- 5 Monitor the mother carefully for postpartum bleeding over the next few hours.
- 6 Provide extra support to assist with the care of the babies.
- 7 At least a 24-hour stay in hospital is required.
- 8 Observe vaginal bleeding closely, because of the risk of postpartum haemorrhage.

Hooking or locking of heads

This is a rare complication during vaginal delivery.

Women may present with locked twins with the first trunk partially delivered. The head of the second twin will have entered the maternal pelvis, and needs to be pushed upwards to allow descent of the head of the first twin. If the first baby is already dead, it can be delivered by decapitation. After delivery of the body, the head is dis-impacted and the second twin is delivered. Finally, the first head is delivered with a vulsellum.

If the first baby is still alive (e.g. if the delivery is taking place in hospital), or if despite decapitation of the first baby the second one cannot be delivered, proceed immediately to Caesarean section if this is safe for the mother.

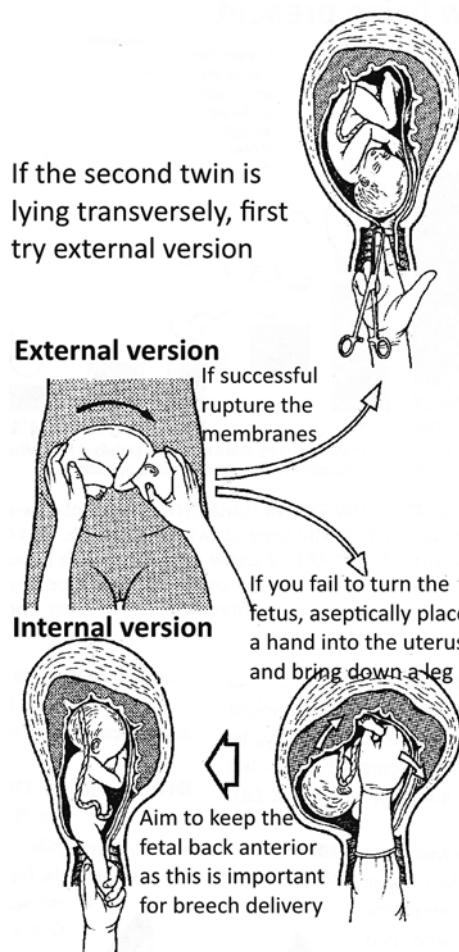


FIGURE 2.6.D.4 Transverse lie in a second twin, ensuring the correct foot is pulled so that the fetal back becomes anterior in the birth canal.



FIGURE 2.6.D.5 Locked twins.

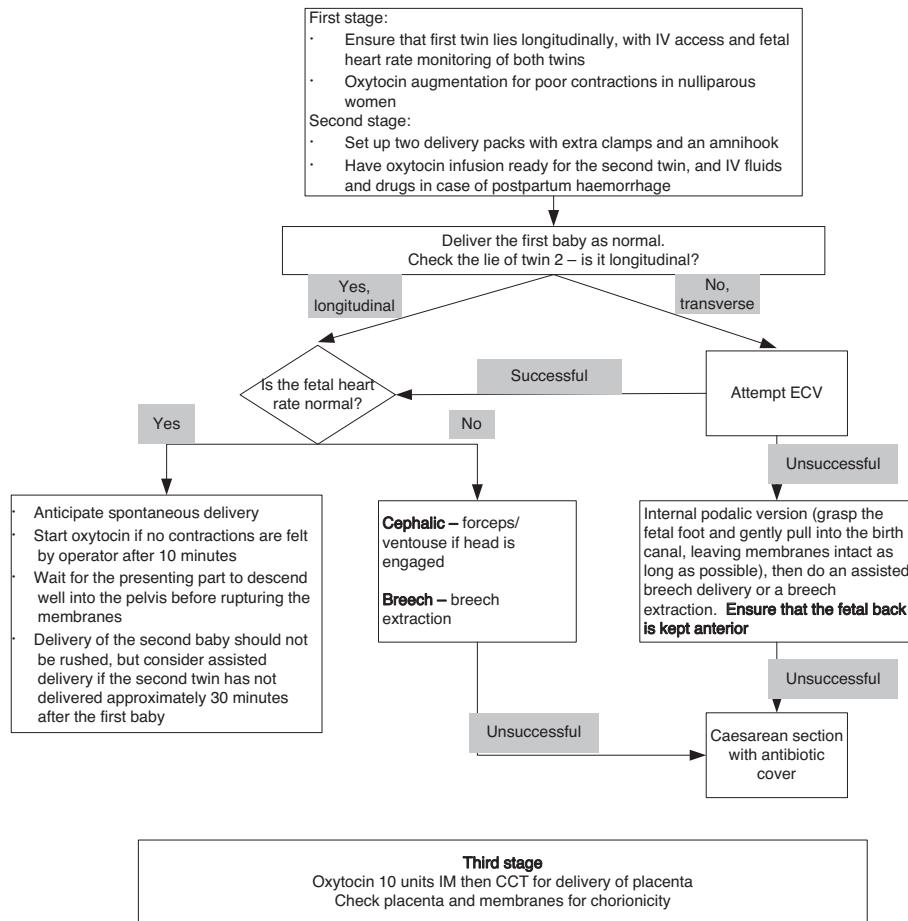


FIGURE 2.6.D.6 Pathway of care for delivery of twins. ECV, external cephalic version; CCT, controlled cord traction.

2.6.E Malpresentations and malpositions including breech delivery

Introduction

Malpresentations and malpositions can be due to maternal pathology (e.g. contracted pelvis, uterine fibroids) or fetal pathology (e.g. hydrocephalus), which ideally should be diagnosed antenatally. Most often there is no apparent cause.

Malpresentations are all presentations of the fetus other than a vertex presentation (e.g. face presentation, breech presentation).

Malpositions are abnormal positions of the vertex of the fetal head (with the occiput as the reference point) relative to the maternal pelvis.

A fetus in an abnormal position or presentation may result in prolonged or obstructed labour.

Management

Review the progress of labour using a partograph (see Section 2.2).

Note: Observe the mother closely. Malpresentations increase the risk of uterine rupture because of the potential for obstructed labour.

Assessment of the fetal position

Determining the presenting part

The most common presentation is the vertex of the fetal head.

If the vertex is the presenting part, use landmarks of the fetal skull to determine the position of the fetal head (see Figure 2.6.E.1). However, although the anterior fontanelle is larger than the posterior one and has four sutures leading from it, one of these is small and may be difficult to feel.

Determining the position of the fetal head

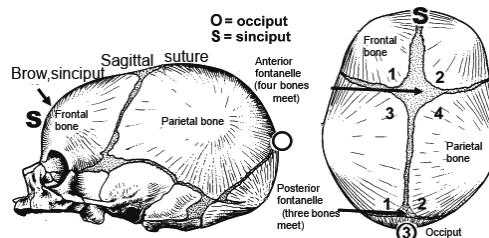


FIGURE 2.6.E.1 The fetal skull.

The fetal head normally engages in the maternal pelvis in an occiput transverse position.

With descent, the fetal head rotates so that the fetal occiput is anterior in the maternal pelvis (see Table 2.6.E.1). Failure of an occiput to rotate to an occiput anterior position results in a persistent transverse presentation. Rotation may also occur to an occiput posterior position.

An additional feature of a normal presentation is a well-flexed vertex (see Figure 2.6.E.2), with the fetal occiput lower in the vagina than the sinciput.

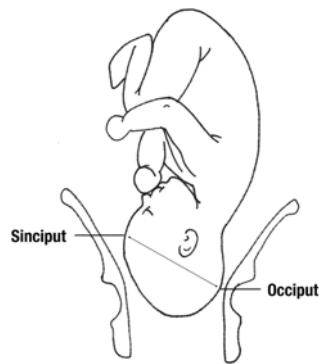
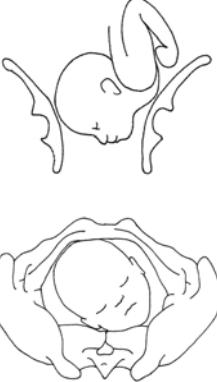
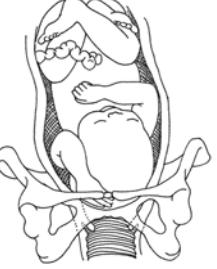
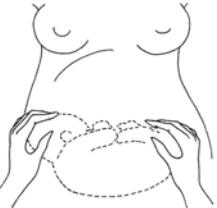
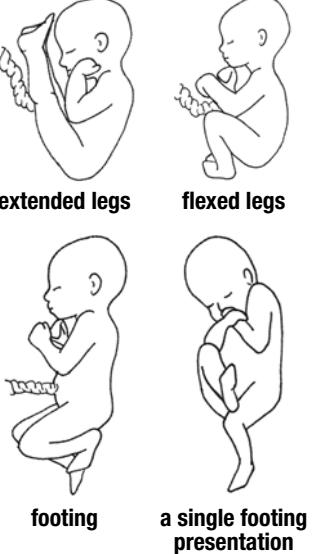


FIGURE 2.6.E.2 Well-flexed vertex presentation.

TABLE 2.6.E.1 Diagnostic features of malpositions and malpresentations

| Position | Observations | Picture from introitus |
|---|---|-----------------------------------|
| <i>Malpositions</i> | | |
| Occiput anterior | On vaginal examination provided that the head is flexed only the posterior fontanelle with three sutures entering it is felt | Occiput anterior |
| | | Left occiput anterior |
| | | Right occiput anterior |
| Occiput posterior | On vaginal examination , the posterior fontanelle is towards the sacrum and the anterior fontanelle may be easily felt if the head is deflexed On abdominal examination the lower part of the abdomen is flattened, and the fetal limbs are palpable anteriorly | Occiput posterior |
| | | Left occiput posterior |
| <i>Malpresentations</i> | | |
| Brow presentation is caused by partial extension of the fetal head so that the occiput is higher than the sinciput | On abdominal examination , more than half of the fetal head is above the symphysis pubis, and the occiput is palpable at a higher level than the sinciput On vaginal examination , the anterior fontanelle and the orbits are felt | |

| Position | Observations | Picture from introitus |
|--|--|---|
| Face presentation is caused by hyper-extension of the fetal head so that neither the occiput nor the sinciput are palpable on vaginal examination | On abdominal examination , a large amount of head is palpable on the same side as the back, without a cephalic prominence on the same side as the limbs On vaginal examination , the face is palpated, the examiner's finger enters the mouth easily and the bony jaws are felt |  |
| Compound presentation occurs when an arm prolapses alongside the presenting part | Both the prolapsed arm and the fetal head present in the pelvis simultaneously |  |
| Transverse lie and shoulder presentation | The fetus lies in the transverse position with usually the shoulder presenting On abdominal examination , neither the head nor the buttocks can be felt at the symphysis, and the head is usually in the flank On vaginal examination , a shoulder may sometimes be felt. An arm may prolapse and the elbow, arm or hand may be felt in the vagina |  |
| Breech presentation occurs when the buttocks and/or the feet are the presenting parts | On abdominal examination , the head is felt in the upper abdomen and the breech in the pelvic brim. Auscultation locates the fetal heart higher than expected with a vertex presentation On vaginal examination during labour , the buttocks and/or feet are felt; thick, dark meconium is normal |  |

Malpositions of the fetal head

As the baby's head extends (deflexes), the diameter that has to pass through the mother's birth canal gets larger, until the baby becomes a brow presentation (14 cm). Then it gets smaller as the baby becomes a face presentation (see Figure 2.6.E.3).

Labour gets more difficult as the head extends, with brow and mento-posterior face presentations being

impossible to deliver vaginally unless the baby is particularly small in relation to the mother's pelvis.

A face presentation is easier to deliver than a brow presentation. This is because the head has now become fully deflexed.

The vertex presentations in Figure 2.6.E.3 show the diameters of the skull. When the head is well flexed (a), the shortest diameter of the skull is entering the mother's pelvis.

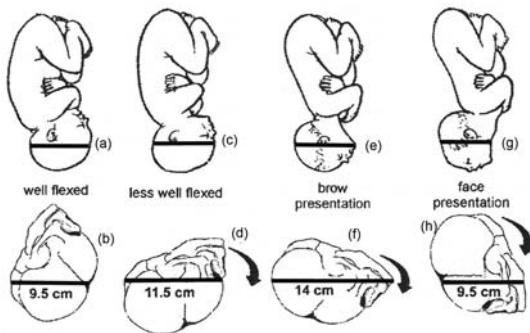


FIGURE 2.6.E.3 (a), (c), (e) and (g) are all vertex presentations. The only normal one is the well-flexed head (a). As (a) turns through to become (g), the baby's head becomes more and more extended (deflexed).

In a brow presentation (e), which is the most difficult type, the longest diameter is trying to enter it.

Management of malpositions

Occiput-posterior positions

Around 15–20% of term cephalic fetuses are in an occiput-posterior (OP) position before labour, and approximately 5% are OP at delivery. Most fetuses (around 90%) rotate to the occiput-anterior (OA) position, some maintain a persistent OP position, and others rotate from an OA to an OP position during labour and delivery.

Arrested labour may occur when the head does not rotate and/or descend. Delivery may be complicated by perineal tears or extension of an episiotomy because an instrumental delivery is performed or because a persistent OP presentation requires passage of a greater diameter. The newborn infant is more likely to need resuscitation.

Diagnosis of an OP position in the second stage is generally made by digital examination, but if there is uncertainty, ultrasound examination is both useful and accurate in the right hands.

Management

There is no effective method of facilitating rotation from OP to OA before labour begins.

First stage of labour

Manual rotation (see below) must not be attempted in the first stage of labour, as it can lead to a prolapsed cord or complex presentations (e.g. hand). It is also technically more difficult and may introduce infection.

- 1 If there are signs of obstruction or the fetal heart rate or pattern is abnormal (< 110 beats/minute or > 160 beats/minute, or abnormal dips) at any stage, deliver by Caesarean section if this can be safely undertaken.
- 2 If the membranes are intact, rupture them.
- 3 If there are no signs of obstruction, augment labour with oxytocin.

Second stage of labour

If the cervix is fully dilated:

- If the fetal head is more than 3/5 palpable above the symphysis pubis, or the leading bony edge of the head is above –2 station and there is fetal distress and/failure to descend, perform a Caesarean section.

- If the fetal head is less than 3/5 above the symphysis pubis, or the leading bony edge of the head is between 0 station and –2 station, try manual rotation (see below) if there is no clear progress in the second stage with an OP position after 30 minutes of pushing.

However, expectant management of the OP position is appropriate in the presence of a reassuring fetal heart rate, adequate space on clinical examination of the pelvis, and continued progress in the second stage. More than 50% of multiparous women and more than 25% of nulliparous women with persistently OP fetuses achieve spontaneous vaginal delivery.

Therefore it is not appropriate to routinely perform prophylactic rotation at the beginning of the second stage of labour.

Delivery from an OP position rather than rotation (see below) is more appropriate in women who, on clinical examination, are found to have ample room between the fetal occiput and the maternal sacrum/coccyx, and when the pelvis is too narrow to permit anterior rotation (women with an anthropoid pelvis with a narrow transverse diameter, and women with an android pelvis with a narrow arch).

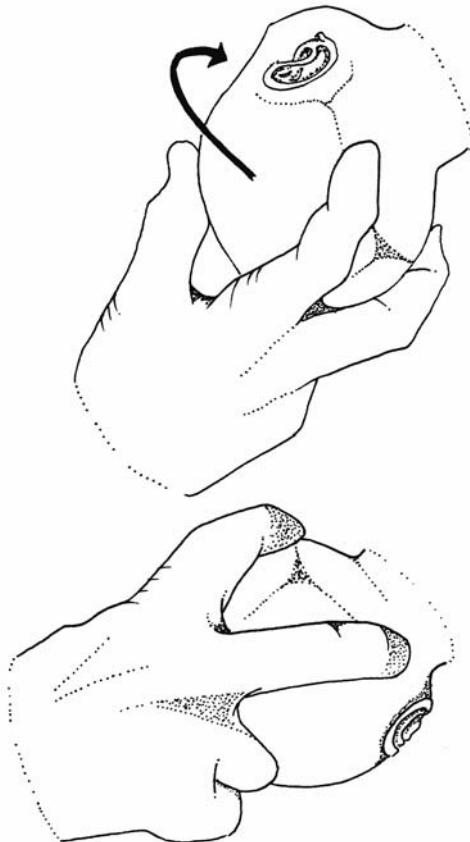


FIGURE 2.6.E.4 Finger rotation of occiput posterior to occiput anterior position. Reproduced with permission from Argani CH, Satin A. Management of the fetus in occiput posterior position. In: UpToDate, Post TW (ed.), UpToDate, Waltham, MA (accessed 5/8/14). © 2014 UpToDate, Inc. For more information visit www.uptodate.com.

Manual rotation

Successful rotation after the onset of the second stage of labour is more likely to be successful if it is performed before arrest occurs. Manual rotation can convert 90% of OP or transverse arrest situations to OA.

Manual rotation is more successful in multiparous women and young women.

Rotation is important if there is a need for a fast delivery and/or if there is minimal or slow descent after a trial of pushing.

First empty the bladder.

There are two methods for rotating the fetus.

1 A hand is inserted into the vagina with the palm upward.

Digital rotation is performed by placing the tips of the index and middle fingers in the anterior segment of the lambdoid suture near the posterior fontanelle (see Figure 2.6.E.4).

The fingers are used to flex and slightly dislodge the vertex, rotating the fetal head to the OA position by rotation of the operator's hand and forearm. The thumb may also be used with gentle downward pressure more anteriorly on the parietal bone to aid this rotation. The fetal head should be held in place for a few contractions to prevent rotation back towards the posterior position.

2 The operator's four fingers are placed behind the posterior parietal bone with the palm up and the thumb over the anterior parietal bone. The right hand is used for the left OP position, and the left hand is used for the right

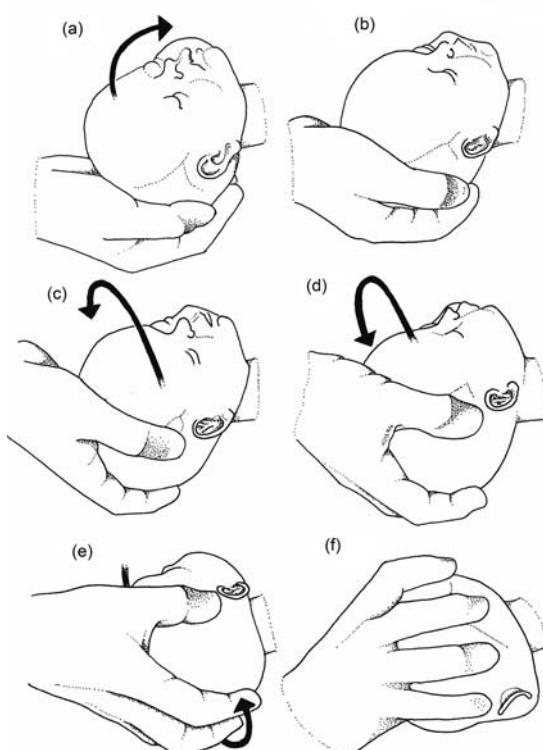


FIGURE 2.6.E.5 Manual rotation of occiput posterior to occiput anterior position. **Manual rotation of occiput posterior to occiput anterior position.** Reproduced with permission from Argani CH, Satin A. Management of the fetus in occiput posterior position. In: UpToDate, Post TW (ed.), UpToDate, Waltham, MA (accessed 5/8/14). © 2014 UpToDate, Inc. For more information visit www.uptodate.com.

OP position. The head is grasped with the tips of the fingers and thumb. During a contraction, the patient is encouraged to push and the operator attempts to flex and rotate the fetal head anteriorly. Occasional mild upward pressure may help to slightly displace the head and facilitate rotation (see Figure 2.6.E.5).

If rapid delivery is indicated, failed manual rotation may be followed by vacuum delivery from the OP position. Manual rotation performed prior to instrumental birth is associated with little or no increase in risk to the pregnant woman or to the fetus.

Ventouse or forceps delivery should never be attempted above 0 station or if the head is more than 1/5 above the symphysis pubis.

Delivery of a brow presentation (see Table 2.6.E.1)

In brow presentation, engagement is usually impossible, and arrested labour is common. Spontaneous conversion to either vertex presentation or face presentation can rarely occur, particularly when the fetus is small or when there is fetal death with maceration. It is unusual for spontaneous conversion to occur with an average-sized live fetus once the membranes have ruptured.

If the fetus is alive, deliver by Caesarean section if this can safely be undertaken.

If the fetus is dead and:

- the cervix is not fully dilated, deliver by Caesarean section
- the cervix is fully dilated, deliver after craniotomy.

If the operator is not proficient in craniotomy, deliver by Caesarean section.

Only if the fetus is small or very low in the vagina, a brow presentation might be delivered by vacuum extraction, forceps delivery or symphysiotomy.

Delivery of a face presentation (see Table 2.6.E.1)

Background

This presentation occurs in 1 in 500–1000 pregnancies. It is due to extension of the fetal neck, caused by either a fetal abnormality or progression from a deflexed occipito-posterior position in labour. Diagnosis is important, as a face presentation may be mistaken for breech presentation.

Diagnosis

Face presentation may be detected on ultrasound scan before labour, but the majority of cases are unpredictable because they arise in labour.

On abdominal examination, a large amount of head is palpable on the same side as the back, without a cephalic prominence on the same side as the limbs.

On vaginal examination, in early labour the presenting part is high. Landmarks are the mouth, jaws, nose, and malar and orbital ridges. The presence of bony gums (alveolar margins) distinguishes the mouth from the anus. The mouth and the zygoma ridges of the maxillae (upper jawbone) form the corners of a triangle, whereas the anus is on a straight line between the ischial tuberosities.

Avoid damaging the eyes with trauma or use of antiseptics.

Ventouse must not be used.

In early labour, particularly with the occipito-posterior position and a multiparous patient, deflexion is common. In such cases, uterine contractions often cause increased flexion, and delivery will proceed as normal. However, if extension occurs, a brow presentation and finally the fully extended face will result. Most face presentations therefore only become obvious late in labour.

Descent is usually followed by internal rotation with the chin passing anteriorly. If the chin is towards the pubis (mento-anterior), the baby can often be delivered normally, although an episiotomy is usually necessary. If the chin lies towards the back, delivery will not occur and a Caesarean section will be required.

The widest biparietal diameter is 7 cm behind the advancing face, so even when the face is distending the vulva, the biparietal diameter has only just entered the pelvis. Descent is less advanced than vaginal examination suggests, even allowing for gross oedema. The head is always higher than you think.

Abdominal examination is vital.

The head is born by flexion, causing considerable perineal distension in the process and risking considerable perineal trauma, so **consider an episiotomy**. Anterior rotation having occurred, the neck comes to lie behind the symphysis pubis and the head is born by flexion. The shoulders and body are born in the usual way.

With satisfactory uterine action and the mento-anterior (MA) position, spontaneous delivery or easy 'lift-out' (forceps-only) assisted delivery will ensue in 60–90% of cases (see Figure 2.6.E.6).

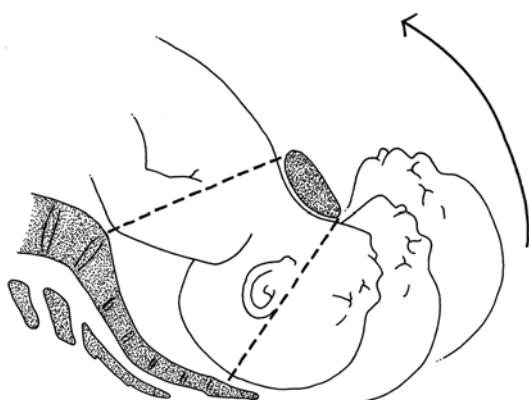


FIGURE 2.6.E.6 Mento-anterior position.

If spontaneous delivery of an MA face does not occur, a 'lift-out' forceps delivery can be performed (see Section 2.13 on forceps delivery).

In mento-posterior (MP) positions (see Figure 2.6.E.7), the neck is too short to span the 12 cm of the anterior aspect of the sacrum. In addition, the neck would have to be extended to pass under the symphysis, but it is already maximally extended. Delivery is impossible unless a very small fetus or one that is macerated allows the shoulders to enter the pelvis at the same time as the head.

Even with MP positions, anterior rotation will occur in the second stage in 45–65% of cases, so a persistent MP



FIGURE 2.6.E.7 Mento-posterior position. Reproduced with permission from Macdonald S, Magill-Cuerden J (ed.) *Mayes' Midwifery: a textbook for midwives*. Elsevier Health Sciences; 2010. © Elsevier

position or mento-transverse arrest is encountered in only 10% of face presentations.

Persistent MP positions are usually delivered by Caesarean section (if this is possible and safe), in order to reduce fetal and maternal morbidity.

After birth, the oedema and bruising of the child's face may persist for some days, and may make feeding difficult.

Vaginal manipulation of persistent MP position has been successfully achieved with ultrasound guidance.

Management

- Make a diagnosis.
- Check for cord presentation or prolapse.
- Continuously monitor the fetal heart rate.
- Examine regularly to check that progress is adequate.
- Give oxytocin if progress is not satisfactory. (Caesarean section may be preferred to augmentation if facilities are available.)
- **Do not use scalp electrodes or perform fetal blood sampling.**
- If the position is MA, vaginal delivery should be possible.
- Perform an episiotomy.
- If the fetus is persistently presenting in an MP position, deliver by Caesarean section (if appropriate resources are available and it is safe to do so).

Delivery of compound presentations (see Table 2.6.E.1)

Here more than one part of the fetus is facing the cervix (e.g. an arm prolapsing alongside the presenting part). It is more common in prematurity.

Compound presentations, especially minor degrees involving just a hand can be managed expectantly in the early stages of labour, especially in the multiparous patient, and can sometimes be digitally encouraged back into the uterus. If they progress or persist and cause delay in the first or second stages of labour, then Caesarean section should be undertaken.

Transverse and oblique lies (see Table 2.6.E.1)

Background

These are associated with prematurity, uterine fibroids and placenta praevia, and consequently are associated with high maternal and fetal morbidity. Always try to identify the underlying pathology, if any.

If the membranes are intact in early labour, it is worth attempting external cephalic version (see below under breech).

The presentation of shoulder, limb or cord in the presence of ruptured membranes means that Caesarean section is the only option for delivering a viable infant. If the fetus is dead, unless it is very small and macerated, it is safer to perform a destructive procedure if an operator experienced in the procedure is available, and it is acceptable to the patient.

Practical points to remember

- Using ultrasound, try to identify the cause of the abnormal lie, if any.
- **Positively exclude placenta praevia with ultrasound before performing digital vaginal examinations. If there has been no vaginal bleeding, placenta praevia is still possible.**
- Caesarean section can be extremely difficult:
 - The lower segment will be poorly formed.
 - Fibroids, when present, can distort the anatomy and inhibit access.
 - Placenta praevia is associated with severe haemorrhage.
- A vertical uterine incision may sometimes be most appropriate for the above reasons.
- Keep the membranes intact while making and extending the uterine incision, as this aids manipulation of the fetus into a longitudinal plane for delivery.
- Delivery is usually best achieved by finding, grasping and bringing down a foot (recognisable by the heel) into the incision. If the foot is difficult to find, the back and buttocks should be identified and the legs followed until a foot is found.
- If delivery is still impossible, the uterine incision can be extended upwards in the midline, making an 'inverted T'. **If an extended uterine incision has been used, it is essential to undertake an elective Caesarean section in subsequent pregnancies, because of the risk of uterine rupture during labour.**

Breech delivery (see Table 2.6.E.1)

Background

At 28 weeks, 20% of babies are breech, but most fetuses will turn spontaneously so that only 3–4% will remain breech at term. There is a higher rate with prematurity. Vaginal delivery (although safer for the mother than Caesarean section) carries a higher risk of perinatal and neonatal mortality and morbidity due to birth asphyxia and trauma.

Hazards of vaginal breech delivery

Compared with the cephalic presentation at term, there is a greater risk of perinatal and neonatal mortality and morbidity, due principally to fetal congenital anomalies and birth trauma and asphyxia. In terms of maternal outcomes, vaginal birth is generally better for the mother than Caesarean

section, as the operative complications associated with major abdominal surgery and the resulting uterine scar are avoided. All of these factors are especially relevant in resource-limited countries.

Minimising problems

Options

- If there are no associated complications of pregnancy (e.g. previous Caesarean section, pre-eclampsia), explain the three options to the woman and her family:
 - external cephalic version (ECV)
 - trial of vaginal breech
 - elective Caesarean section (only if this is safe).
- On the basis of current evidence, all women with uncomplicated breech presentation at term should be offered ECV.
- If it is decided that an elective Caesarean section is the best option, wait until at least 39 weeks (babies may still turn spontaneously until then).
- A trial of vaginal breech delivery is appropriate if **both mother and baby** are of normal proportions.
 - The presentation should be either frank (hips flexed, knees extended) or complete (hips flexed, knees flexed, but feet not below the fetal buttocks).
 - There should be no evidence of feto-pelvic disproportion – that is, adequate pelvis (using clinical judgement) and estimated fetal weight < 4000 grams (clinical measurement).
 - In some smaller women it may be appropriate to exclude a vaginal breech option where the estimated fetal weight is < 4000 grams, provided that Caesarean section is safe.
 - There should be no evidence (on ultrasound) of hyperextension of the fetal head.

Fetal complications of breech presentation

These include the following:

- cord prolapse
- birth trauma as a result of extended arm or head, incomplete dilatation of the cervix, or cephalo-pelvic disproportion
- asphyxia due to cord prolapse, cord compression, placental detachment or arrested head
- damage to abdominal organs
- broken neck.

External cephalic version (ECV)

Background

Current recommendations in well-resourced countries are that ECV should be performed with the mother wide awake, but 'starved', having made her informed choice and having given consent for Caesarean section if necessary, close to theatre, after fetal monitoring has been carried out, and using ultrasound guidance, and tocolysis where necessary. These safety guidelines minimise the risks of maternal injury and fetal distress, allowing early detection and treatment if necessary. However, in resource-limited settings, the avoidance of breech delivery by ECV is highly beneficial, and the method described below is a reasonable compromise.

ECV may be performed between 37 and 42 weeks' gestation if there is a single uncomplicated breech pregnancy. There should be no previous uterine scars, previous antepartum bleeding, fibroids or a placenta praevia. On admission, the fetal heart should be listened to regularly. If

available, ultrasound should be performed to demonstrate the fetal presentation, an adequate amount of liquor, a flexed fetal head and the position of the fetal legs. The mother should be awake and have given consent to the procedure.

The membranes must be intact, with adequate amniotic fluid and no complications of pregnancy.

Procedure

If possible, use ultrasound to demonstrate the fetal position, an adequate amount of liquor, a flexed fetal head, a free loop of cord, and the position of the fetal legs (extended or flexed).

- The mother lies on her side (usually her right), which will allow a forward somersault (from 'left sacro-anterior' position, which is the commonest breech position).
- The bed is tilted head down to allow gravity to assist in disengaging the breech.
- If the uterus is relaxed, an attempt is made to turn the baby, by disengaging the breech with one hand and flexing the head further with the other.
 - This should not hurt the mother, but it will be uncomfortable; the movement on her abdomen is made easier by using lubricant (e.g. sweet almond oil, talc, ultrasound gel).
 - The manoeuvres are illustrated in Figure 2.6.E.8.
- Ensure that the fetal heart rate is normal (110–160 beats/minute).
- In well-resourced settings only, and with relatively only slightly more success, and if the uterus is not relaxed, tocolysis may be helpful. Consider giving a dose of 250 micrograms terbutaline subcutaneously.
- The fetal heart rate should be listened to regularly during the procedure.
- Whether the ECV is successful or not, after the procedure listen carefully to the fetal heart every 5 minutes for 30–60 minutes. If this is normal, the mother is allowed home.
- If the first attempt is unsuccessful, consider bringing the mother back the next day for a repeat trial.
- If the fetal heart rate becomes abnormal, turn the woman on to her left side, and reassess every 5 minutes. If the

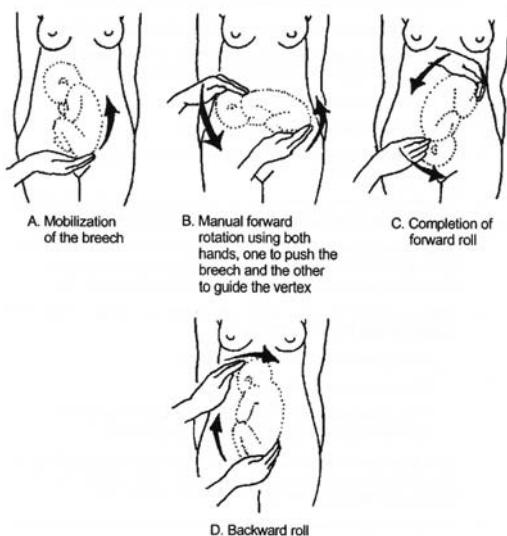


FIGURE 2.6.E.8 External cephalic version.

fetal heart rate does not become normal within 30 minutes, deliver by Caesarean section (if the facilities are available and it is safe to do so).

- In well-resourced settings where blood group including rhesus factor is universally collected, and where the mother is rhesus negative, 500 IU of anti-D immunoglobulin should be given after ECV. Unfortunately, anti-D immunoglobulin is expensive.

Figure 2.6.E.8 shows the steps involved in ECV. It illustrates how a right-handed person would turn a baby. If you are left-handed, turn the baby the other way.

(a) Place one hand below the breech, and your other hand above the head. Lift the breech out of the pelvis. Bring the head and breech closer together so as to flex the baby.

(b) and (c) Turn the baby by guiding the head forwards as you lift the buttocks up. In this way you make the baby do a forward somersault (i.e. turn head over heels).

(d) If you fail to turn the baby, try turning them with a backward somersault.

All mothers should be warned about the possible subsequent risks of reduced fetal movements, vaginal bleeding, rupture of the membranes and onset of labour. If ECV is successful, the pregnancy can be managed as a cephalic presentation. If it is unsuccessful, future management should be discussed and a decision made regarding whether to opt for elective Caesarean section or trial of vaginal breech delivery.

Trial of vaginal breech delivery

This is a difficult issue where there is limited availability of safe surgery, or surgery without delay. A trial may not be appropriate if:

- the mother is very small and/or the baby is large
- there is evidence of fetal–pelvic disproportion – that is, an inadequate pelvis (using clinical judgement) and an estimated fetal weight exceeding 4000 grams
- evidence (on ultrasound) of hyper-extension of the fetal head.

If there has been a previous Caesarean section or other scar in the uterus, a repeat Caesarean section may be preferable, although this will depend on the availability of safe surgery. Moving the woman to a waiting home next to a unit that provides comprehensive emergency obstetric care from 37 weeks' gestation (if available) may be a good option.

Procedure

- The mother should confirm her informed choice of vaginal delivery.
- If the mother is in hospital, an obstetrician, anaesthetist and operating theatre should be ready.
- Careful fetal monitoring and documentation of the partograph should be undertaken.
- The bladder must be emptied either naturally or with an in-out catheter.
- If spontaneous rupture of the membranes occurs, do a vaginal examination to check for cord prolapse. Meconium is common and not a sign of fetal distress.
- Amniotomy may be used to accelerate labour, where indicated, and careful use of oxytocin may be used to correct poor uterine activity if the mother is having her first baby. However, oxytocin should only be used in a well-resourced hospital. It should not be used for poor

progress due to poor uterine contractions in a mother who has previously given birth. Where available and safe, it is reasonable to perform a Caesarean section, rather than commencing oxytocin, even in primiparous women who are making inadequate spontaneous progress in labour.

- Caesarean section should be considered if there is poor progress or fetal distress.
- Ensure that a healthcare worker with adequate experience in delivering breech babies vaginally is present during the second stage.

The basic principle of delivering a breech is to avoid interfering.

- Active pushing should not be encouraged until the breech has descended to the pelvic floor and the cervix is fully dilated as confirmed by vaginal examination.
- Sitting the patient up at this stage may help to encourage descent of the breech. An **episiotomy** may well be required, but should not be performed until the anus is visible or until the baby's buttocks are distending the perineum.
- The breech will usually rotate spontaneously to lie with the sacrum anteriorly. **Rarely it will try to turn posteriorly, and this must be prevented by holding the baby by the bony pelvis and rotating the baby to the back-anterior position as it descends with maternal effort.**
- Extended legs are delivered by flexing the knee joint of the baby and then extending at the hips.
- The baby is **supported** only when the arms are delivered and the nape of the neck becomes visible. Avoid holding the baby's abdomen, as internal organs may be traumatised; the pelvis should be held gently to support the weight of the baby and prevent hyperextension of the fetal neck.
- As the mother pushes, the anterior shoulder tip will become visible. A finger is run over the shoulder and down to the elbow to deliver the arm, if this does not occur spontaneously. The other shoulder will rotate anteriorly spontaneously to allow similar delivery of the other arm. If the arms are not delivering spontaneously despite the shoulders being visible, the Løvset manoeuvre should be used (see Figure 2.6.E.9). Traction on

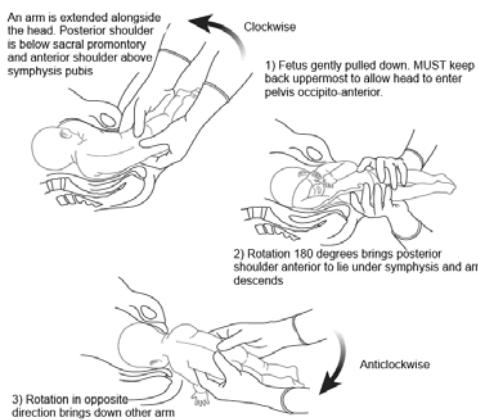


FIGURE 2.6.E.9 Breech delivery using Løvset method. Reproduced with permission from Macdonald S, Magill-Cuerden J (ed.) *Mayes' Midwifery: a textbook for midwives*. Elsevier Health Sciences; 2010. © Elsevier

the baby combined with rotations as shown (multiple if necessary) will usually result in each arm dropping out of the cervix. Minimal assistance by the healthcare worker running a finger along the arm to disengage it may sometimes help.

- The baby lies supported as the head engages and the neck comes into view (see Figure 2.6.E.10).



FIGURE 2.6.E.10 Breech delivery: the baby should hang until the hair line at the back of the neck is seen.

- Delivery of the head may then be performed by the Mauriceau-Smellie-Veit manoeuvre (see Figure 2.6.E.11). The right hand is placed in the vagina, the fetus is supported on the right forearm, the middle finger of the hand is passed into the baby's mouth, and the first and third fingers are placed **just below** the bony ridges of the lower part of the orbits (the maxilla). The eyes must not be compressed. Pressure is applied to flex and deliver the head. The left hand is used to press upwards and posteriorly on the back of the fetal head to encourage flexion.
- Alternatively, forceps may be used to achieve the controlled delivery of the head. An assistant should hold the baby's feet to elevate the body above the horizontal to

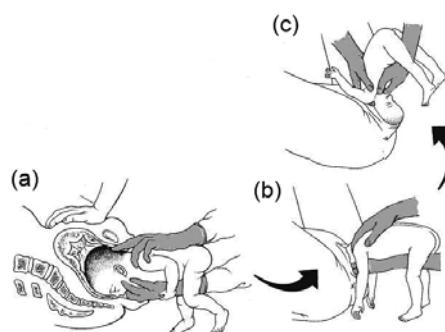


FIGURE 2.6.E.11 Breech delivery: delivering the head by the Mauriceau-Smellie-Veit manoeuvre. To help to deliver the head safely, lay the body on your forearm. Put the index and middle fingers of your left hand on the bony ridges below the eyes. Place your right index finger on the occiput, flex the head, and deliver the head slowly and in a controlled way.

allow the operator access to apply forceps. The nape of the neck must be in view before the baby's body is lifted upwards, or damage to the fetal neck may be caused. It is also essential that the baby is not lifted too high, as this will damage the neck.

If the head fails to descend into the pelvis (i.e. the nape of the neck does not appear), first check that the cervix is fully dilated. If it is not, it will need to be incised. If the cervix is fully dilated, if possible forceps (ideally Piper's) may be applied to the fetal head to facilitate delivery. Firm suprapubic pressure may be applied in the midline to encourage the unengaged head to flex and facilitate delivery. If this is unsuccessful, a symphysiotomy should be considered. All of these manoeuvres are potentially dangerous for the mother. If the fetus dies, a destructive procedure should be undertaken.

Elective Caesarean section for breech

This is advisable for the following:

- failed external cephalic version
- if vaginal birth is contraindicated, or the mother wishes
- double footling breech
- a very large fetus
- a small or malformed maternal pelvis
- a hyperextended or deflexed fetal head.

Before and at operation:

- Explain to the woman that she will have a scarred uterus, which may create problems in future pregnancies.
- Ensure that the presentation remains breech before anaesthetising the patient.
- Note that if the uterine incision is too small, there can be difficulty delivering the after-coming head.
- Remember to keep the fetal back upwards during delivery.

2.6.F Preterm pre-labour rupture of membranes (PPROM) and/or preterm labour

Introduction

PPROM is defined as spontaneous rupture of the membranes before the onset of labour and prior to 37 weeks' gestation. It occurs in 2–4% of single pregnancies and 7–20% of multiple pregnancies, and accompanies 60% or more of preterm births.

PPROM is associated with maternal mortality and morbidity with neonatal complications, which include cord prolapse, neonatal sepsis and respiratory failure, pulmonary hypoplasia and malpresentations.

Preterm labour is defined as labour that begins before 37 weeks' gestation. It has increasingly serious implications for the neonate the earlier it occurs.

Preterm labour may occur without PPROM. However, ruptured membranes are a common early consequence of premature labour. Likewise PPROM can occur before labour, but the risk of progression to labour following PPROM is high (see below).

There are multiple risk factors for preterm labour and PPROM. They include intrauterine infection, twin pregnancy, polyhydramnios, abruption, malaria, urinary tract infection/pyelonephritis and uterine anomalies (including large fibroids).

Clinical findings in the woman with PPROM and/or preterm labour

In PPROM the fluid may come out quickly as a sudden large flow, or it may trickle out over 1–2 hours, after which recognition is more difficult. Around 50% of women go into labour within 24–48 hours, and 70–90% within 1 week. The gap is longer the earlier in pregnancy the rupture occurs.

There may be no history or signs to suggest that PPROM has occurred, and therefore the woman may present with preterm labour. Preterm labour may also occur without PPROM.

It is important if possible to distinguish PPROM from

urinary incontinence, bacterial/fungal vaginal infection or a 'show' of cervical mucus.

Premature labour is considered to be present if there are regular contractions (usually at least every 10 minutes) associated with cervical effacement and/or dilatation.

In its early stages it is very difficult to diagnose accurately, as the patient may present before cervical change has occurred, and it is then only with time that the cervical change becomes apparent.

Important differential diagnosis for premature labour, where cervical change has not yet occurred, include: Braxton Hicks contractions, urinary tract infection, musculoskeletal pain, constipation and diarrhoea.

Infection can itself result in premature labour and therefore patients presenting with threatened preterm labour should be assessed and treated for an underlying cause. Common examples of infections that precipitate preterm labour include malaria and urinary tract infection/pyelonephritis.

Management of PPROM and/or preterm labour

Avoid doing a digital vaginal examination unless active labour is under way and/or birth is imminent, as it increases the risk of infection.

A sterile speculum examination should be undertaken to look for amniotic fluid passing through the cervix or in the posterior fornix. A swab should be taken of the fluid and sent to the laboratory for microscopy and culture (if bacteriological facilities are available), looking especially for group B streptococcus.

Monitor vital signs (temperature, heart rate and blood pressure), vaginal discharge (check sanitary towels regularly; do not use tampons), uterine activity and possible tenderness, and fetal heart rate, and where possible perform an ultrasound examination to assess the amniotic fluid index, presentation, gestation and placental site.

Also check a full blood count, maternal blood group, malaria RDT +/- smear and a midstream specimen of urine (MSSU). If available a CRP along with the white blood cell count may help to indicate an underlying infection.

Although there is no evidence that bed rest is appropriate, if it is undertaken apply anti-embolism stockings (if available) and encourage leg exercises to prevent deep vein thrombosis.

Inform the paediatrician (if available).

Sexual intercourse should not occur after PPROM.

When to consider antibiotics

- 1 Symptomatic ascending infection *in utero* in the mother (fever, maternal and/or fetal tachycardia, foul-smelling vaginal discharge, uterine tenderness and signs of systemic illness) needs **urgent treatment with IV antibiotics (ampicillin plus gentamicin plus metronidazole)**. If this is overlooked, the lives of both the mother and the baby will be in danger:
 - ampicillin 2 grams IV/IM, then 1 gram IV 6-hourly
 - *plus* gentamicin 80 mg IV/IM 8-hourly or 5 mg/kg body weight IV/IM once every 24 hours
 - *plus* metronidazole (vial containing 500 mg in 100 mL) 500 mg or 100 mL IV infusion every 8 hours. Do not give metronidazole IM.

Usually there will be uterine contractions, but whether or not they are present the baby must be delivered as soon as possible.

- 2 Asymptomatic infection (no fever and no systemic signs of illness) is a more common problem which may progress to a life-threatening infection at any time. It is therefore essential that all women who have/or may have undergone rupture of membranes, are monitored regularly for the symptoms and signs of infection. These include: labour, generalised uterine pain, flushing and chills, body aches, fever ($> 37.5^{\circ}\text{C}$), tachycardia, tachypnoea and fetal tachycardia.
- 3 If premature rupture of membranes is confirmed, the patient is stable, and a decision has been made to manage the patient expectantly (see below) then give prophylactic antibiotics as follows to help more safely to prolong the pregnancy:
 - a. Erythromycin 250 mg TDS plus amoxicillin 500 mg TDS both orally and for 7 days.
- 4 **All patients with confirmed premature labour should receive prophylactic antibiotics when in active labour as follows:**
 - a. IV ampicillin 2 grams IV/IM, then 1 gram IV 6-hourly. Discontinue antibiotics immediately after delivery if there are no signs of infection in the mother.
- 5 Maternal fever ($> 38^{\circ}\text{C}$) or other indication of infection in labour (e.g. offensive liquor) requires that the mother be treated with IV penicillin/ampicillin, metronidazole and gentamicin as in 1. above. If this is the case, **the newborn infant should also be treated with IV antibiotics from birth without waiting for any signs of infection to appear (see Section 3.1)**.

Minimising the risk of surfactant deficiency in the newborn with antenatal steroids

High-dose corticosteroids can improve surfactant production in the newborn, but steroids must not be given if there is evidence of tuberculosis or HIV infection. A transient

increase in blood glucose levels can occur with the use of steroids in diabetes. Even one dose of steroids can be effective in improving lung maturity in the newborn.

Give betamethasone, 12 mg IM, two doses 24 hours apart or dexamethasone, 6 mg IM, four doses 12 hours apart. Maximum benefit is achieved 24 hours following the second dose and for 1 week thereafter. Although it is not evidence based, where delivery is urgent, it is common practice to accelerate the course of steroids by giving the two 12 mg doses of either betamethasone or dexamethasone 12 hours apart.

A second course of dexamethasone or betamethasone can be given if more than 2 weeks have elapsed since the first course of treatment was given, and delivery has not occurred but premature labour has restarted. No more than two courses should be given.

Stopping premature labour

There is evidence to demonstrate that labour can sometimes be delayed by treating the mother with tocolytic drugs. There is no evidence, however, that tocolysis alone is beneficial to the baby or mother. In fact their use is potentially dangerous, as delaying delivery may result in progression of the process which caused the premature labour in the first place, e.g. infection or abruption.

However, tocolysis may be useful to allow administration of antenatal corticosteroids (as above), thereby protecting the baby from lung surfactant deficiency. They may also allow transfer of the mother to a hospital where safer therapy can be provided for a preterm baby.

Tocolysis should not be given for more than 48 hours as this is the time taken for antenatal steroids to achieve their maximum therapeutic effects.

Premature labour is considered to be present if there are regular contractions at least every 10 minutes associated with cervical effacement and/or dilatation.

It is unsafe to try to stop labour if the membranes are ruptured.

Although tocolysis is not recommended after 34 weeks' gestation in well-resourced settings, it may possibly be helpful between 34 and 36 weeks' gestation in low-resource settings, as well as between 28 and 34 weeks.

If labour is well advanced and the cervix is more than 5 cm dilated, tocolysis will probably not be helpful.

Drugs used for tocolysis

There is always the option of not trying to stop uterine contractions, as the evidence of benefit is very limited. If antenatal corticosteroids are not going to be given and there is no need to transfer the patient, then tocolytics are not indicated.

Terbutaline

This is given in a dose of 250 micrograms subcutaneously every 6 hours.

Nifedipine

Nifedipine given orally is the most appropriate drug.

The side effects of nifedipine include facial flushing, headache, nausea, tachycardia, dizziness, a fall in blood pressure, heart failure and (rarely) increased liver enzymes.

Contraindications are situations where delivery is desired, such as antepartum haemorrhage, severe pre-eclampsia, infection, fetal distress and all cases of PPROM

in low-resource settings. Nifedipine should not be given if the mother has heart disease.

Before starting nifedipine, measure urea and electrolytes and liver function tests (where available).

Regular and frequent measurements of the mother's vital signs, as well as the fetal heart rate, should be undertaken. Closely observe for signs of heart failure. If the blood pressure falls, give a bolus of 250–500 mL of Ringer-lactate or Hartmann's solution.

Doses of nifedipine:

- Initial dose: 20 mg of oral nifedipine.
- Up to three further doses can be given at 30-minute intervals if uterine contractions persist.
- If this stops labour, and the blood pressure is stable, give a maintenance dose of 20 mg three times a day for up to a total of 48 hours. The maximum daily dose is 120 mg of nifedipine.

How long to wait before inducing labour when there is PPROM

The decision on timing of delivery is difficult, and it depends on the stage of pregnancy, the availability of comprehensive emergency obstetric care, the quality of neonatal care available and the obstetric history and wishes of the patient.

If expectant management is undertaken women with PPROM should be resident in a healthcare facility where comprehensive emergency obstetric care is available. Induction of labour should be undertaken by 36 weeks as prolonging the pregnancy beyond this stage is of reduced benefit to the fetus.

In a resource poor setting it is reasonable to induce the pregnancy at a much earlier gestation, even if this will result in a neonatal death, in order to reduce maternal risk.

Patients should be monitored closely for any symptoms or signs of infection, and if any develop delivery should be achieved urgently (via induction or Caesarean section, whichever is indicated) regardless of gestation.

Suggested monitoring would include:

- Regular review for symptoms of infection, e.g. uterine pain, body aches, flushing, chills. The patient should be advised to report such symptoms as they occur.
- 2 to 4 times daily vital sign assessment – tachycardia ($> 100 \text{ bpm}$), tachypnoea (> 20), and pyrexia ($> 37.5^\circ \text{C}$) should raise suspicion of infection.
- At least twice weekly inflammatory marker assessment such as CRP (where available). Note: corticosteroid administration causes a transient increase in the maternal white blood cell count but does not affect CRP.

Clinical problems in the neonate associated with preterm birth

These include the following:

- Surfactant deficiency leads to increasing levels of respiratory difficulty with decreasing gestational age.
- There is an increased risk of infection and hypothermia.
- Nutritional problems: maturity is more important than weight with regard to the ability to feed and digest. Babies who are born before 36 weeks' gestation nearly always need some help with feeding. Breast milk is ideal, and everything possible should be done to help the mother to sustain her lactation until the baby is ready to feed reliably from the breast. A limited ability to suck and swallow usually appears from 32 weeks' gestation, but it remains unpredictable, unreliable and uncoordinated until 36 weeks' gestation. In the event that breastfeeding cannot be initiated immediately after birth, the mother should be encouraged to start expressing breast milk, to be given by nasogastric tube or cup and spoon. Partial breastfeeding can also help the mother to sustain her lactation, but in any event she should regularly express milk.

Further information on care of the prematurely born infant can be found in Section 3.

2.6.G Prolapsed umbilical cord

Incidence

Prolapse of the umbilical cord occurs in approximately 0.2% of all births, mostly in multiparous mothers. There is a significant risk of fetal death due to mechanical compression of the cord, and spasm of the cord vessels when they are exposed to cold air.

Risk factors for cord prolapse

The presenting part does not remain in the lower uterine segment due to any of the following causes.

Fetal causes

- Malpresentations (e.g. complete or footling breech, transverse and oblique lie).
- Prematurity or low birth weight.
- Polyhydramnios.
- Multiple pregnancy.
- Anencephaly.
- High head.

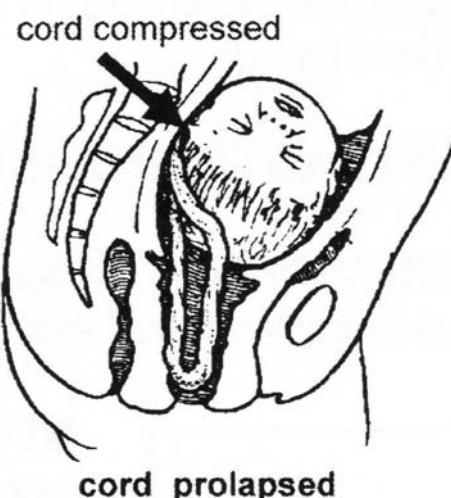


FIGURE 2.6.G.1 Sagittal view showing compressed cord.



FIGURE 2.6.G.2 Prolapsed cord presenting. Reproduced with permission from Macdonald S, Magill-Cuerden J (ed.) *Mayes' Midwifery: a textbook for midwives*. Elsevier Health Sciences; 2010. © Elsevier

Maternal causes

- Contracted pelvis.
- Pelvic tumours.

Other predisposing factors

- Low-grade placenta praevia.
- Long cord.
- Sudden rupture of membranes in polyhydramnios.
- Artificial rupture of membranes (ARM).
- Manual rotation of the fetal head.

Management of cord prolapse

The longer the time between diagnosis of cord prolapse and delivery, the greater the risk of stillbirth and neonatal death.

If the baby is dead, deliver in the safest way for the mother.

- 1 Assess fetal viability. If the baby is alive and of a viable gestation, and fetal heart sounds are heard with a Pinard's stethoscope or ideally a hand-held ultrasound fetal heart rate detector (e.g. Sonicaid), urgently relieve pressure on the cord by placing the woman in the knee-elbow or exaggerated Sims' position (Figure 2.6.G.3). Care should be taken not to stimulate the cord by handling it. Exposure to low temperatures should also be prevented if possible. This gives time for decision making.
- 2 Discontinue oxytocin if it is being used. You can buy time to allow the baby to be delivered by giving tocolysis with terbutaline 250 micrograms every 6 hours subcutaneously.

- 3 If the fetus is alive, prepare for either emergency vaginal delivery or emergency Caesarean section (if this can be undertaken safely).
- 4 If the cervix is fully dilated, and delivery is likely to be achievable within 5 minutes, encourage the patient to push and prepare to expedite the delivery by use of forceps or ventouse. The choice of instrument will depend on availability, operator experience and the position of the fetal head. If appropriate, forceps delivery is usually the most rapid method of achieving delivery, but must not be used by inexperienced staff. Rapid delivery is far more likely to be achieved in a multiparous woman.
- 5 If Caesarean section is safe and the only option (i.e. the cervix is not fully dilated, and the fetus is alive and viable), fill the bladder to raise the presenting part off the compressed cord for an extended period of time, so that the woman or girl can be transferred to the operating theatre. Insert 500 mL of sterile IV fluid into the bladder using an IV giving set attached to a Foley catheter. Inflate the balloon of the Foley catheter, clamp it and attach drainage tubing and a urine bag. The full bladder may also decrease or inhibit uterine contractions. The bladder must be emptied by unclamping the catheter before opening the peritoneal cavity for Caesarean section.
- Mark the mother's abdomen to ensure that this is not forgotten. At skin incision, the bladder clamp must be released and the bladder emptied.**
- 6 Ensure that venous access is in place with a reliable IV cannula.
- 7 Transfer the woman or girl to the operating theatre in the exaggerated Sims' position on a trolley.

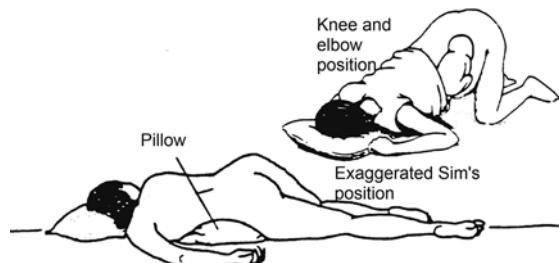


FIGURE 2.6.G.3 Maternal positions for immediately relieving pressure on prolapsed cord.

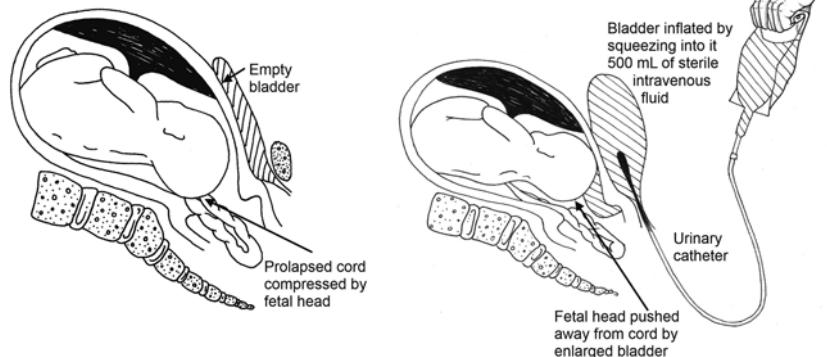
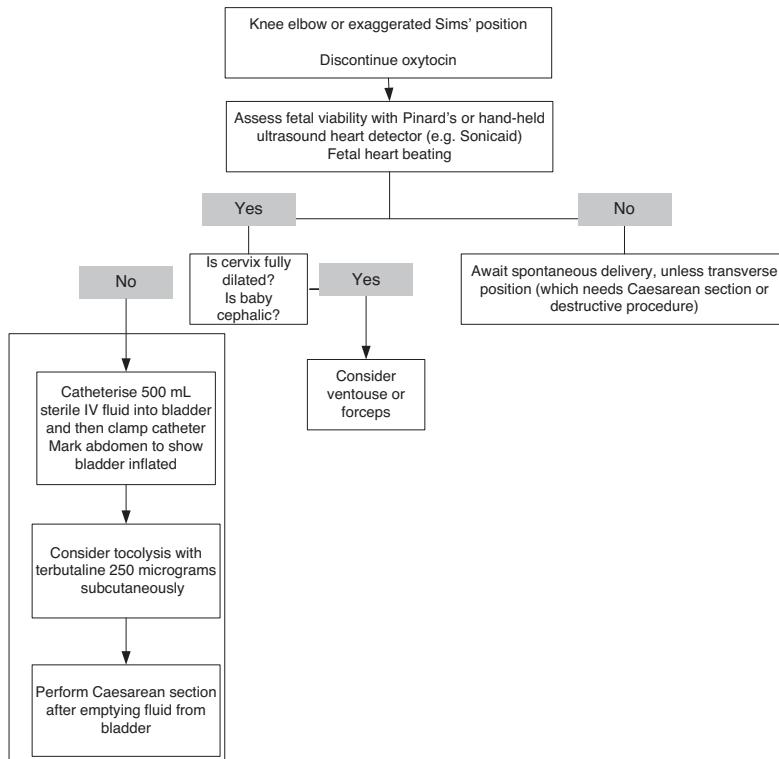


FIGURE 2.6.G.4 Treating prolapse of the cord by elevation of the fetal presenting part by inflating the bladder with sterile IV fluid.

**FIGURE 2.6.G.5** Pathway of care for prolapsed cord.

2.6.H Inverted uterus

Introduction

Definition

This occurs when the uterus, after or during delivery of the placenta, is inverted and may appear at the introitus. The inverted uterus has the endometrium and sometimes the placenta 'on the outside'.

Prevention

Prevent an inverted uterus by avoiding cord traction until the uterus is contracted and placental separation has occurred, and ensuring that the uterus is held back with one hand during cord traction.

Clinical signs

An inverted uterus most commonly presents as a pelvic mass, sometimes protruding from the vagina. If the inverted uterus does not protrude from the vagina, it may go undetected, resulting in a sub-acute or chronic inversion which is very dangerous and may even present as a sudden unexpected maternal death.

Symptoms and signs include severe lower abdominal pain in the third stage of labour, haemorrhage, shock out of proportion to blood loss, the uterus not being palpable on abdominal examination, and vaginal examination revealing a mass in the vagina.

Early recognition is vital, as **shock** is the most common complication. Shock out of proportion to blood loss may be due to increased vagal tone, which may also produce

a **bradycardia** (< 60 beats/minute), worsening the shock and confusing its diagnosis. Inversion is associated with haemorrhage in over 90% of cases. Alternatively, concealed bleeding may produce tachycardia and other signs of shock.

Incomplete inversion presents more subtly with continuing postpartum haemorrhage despite a contracted uterus. The fundus of the uterus may feel dimpled.

Suspect a diagnosis of inverted uterus if there is:

- shock with little obvious bleeding
- continuing postpartum haemorrhage despite an apparently well-contracted uterus
- associated lower abdominal pain
- a dimpled uterine fundus
- a fundus that is not palpable abdominally.

Management

The uterus must be replaced as soon as inversion is recognised, as a matter of urgency, as this becomes more difficult over time. Call for help and try to push it back while ABC resuscitation is being undertaken.

Primary assessment and resuscitation

Call for senior help, including a surgeon and an anaesthetist.

If shock is present, manage ABC as described below.

Manual replacement of the uterus

As soon as possible, and **wearing sterile gloves**, attempt manual replacement of the uterus by pushing the fundus

back through the cervix (the longer the delay, the more difficult it will be to achieve resolution).

It is important that the part of the uterus that came out last (the part closest to the cervix) goes in first.

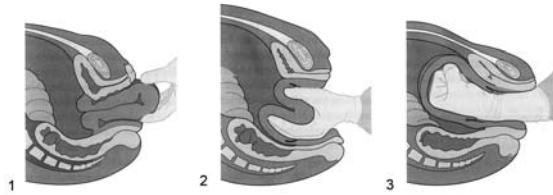


FIGURE 2.6.H.1 Bimanual replacement of inverted uterus.
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Do not attempt to separate the placenta until the inversion has been corrected.

However, if the inversion has been present for some time (e.g. if it occurred at home), and replacement is not possible without placental removal, then be prepared for possible severe bleeding if this is undertaken.

Hydrostatic correction

- If manual replacement is unsuccessful, hydrostatic correction should be attempted.
- Place the woman in the steep Trendelenburg position (lower her head about 0.5 metres below the level of the perineum).
- Prepare a high-level sterile douche system with a large nozzle, long tubing (2 metres) and a reservoir (1–2 litres of sterile Ringer-lactate or Hartmann's solution at room temperature, not from a refrigerator).
 - Note:** This can also be done using Ringer-lactate or Hartmann's solution and an ordinary IV administration set.
- Identify the posterior fornix. This is easily done in partial inversion when the inverted uterus is still in the vagina. In other cases, the posterior fornix is recognised by the place where the ridged vagina becomes the smooth vagina.
- Place the nozzle of the douche in the posterior fornix.
- At the same time, with the other hand hold the labia sealed over the nozzle and use the forearm to support the nozzle.
- Ask an assistant to start the douche at full pressure (raise the water reservoir to at least 2 metres). Ringer-lactate or Hartmann's solution will distend the posterior fornix of

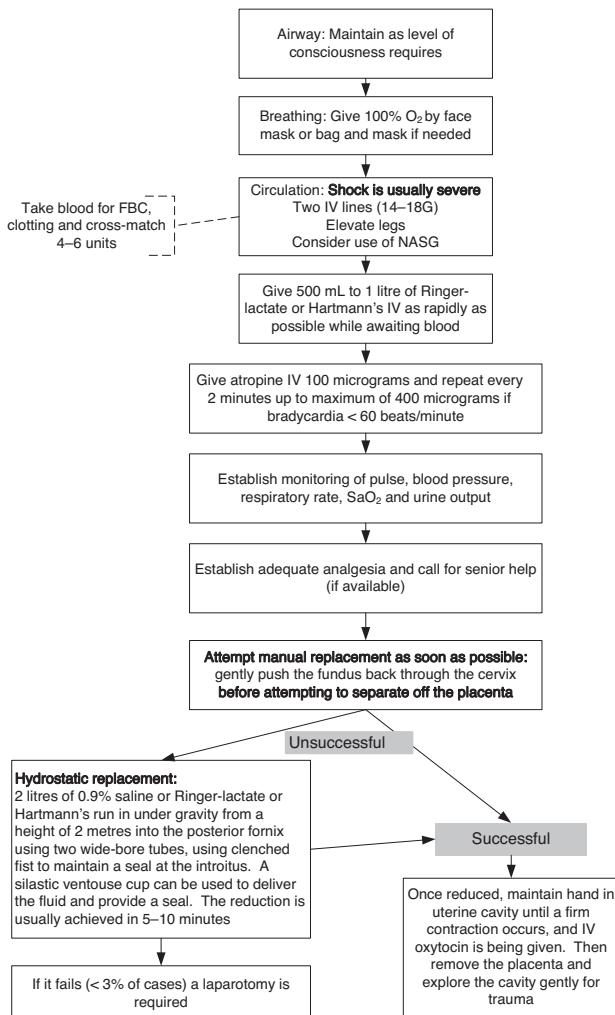


FIGURE 2.6.H.2 Pathway of care for inverted uterus. FBC, full blood count; NASG, non-pneumatic anti-shock garment.

- the vagina gradually so that it stretches. This causes the circumference of the orifice to increase, relieves cervical constriction, and results in correction of the inversion.
- If a Silc Cup ventouse is available, this can be used to occlude the vagina and give a seal. Two IV infusion sets are inserted into the narrow end while the wide end lies against the inverted uterus vaginally.
 - Terbutaline, 250 micrograms subcutaneously, may help to stop any uterine contractions that prevent correction of the inversion.

Manual correction under general anaesthesia

If hydrostatic correction is not successful, try manual repositioning under general anaesthesia, using halothane. Halothane is recommended because it relaxes the uterus, but be aware of the risk of possible atonic uterus and haemorrhage.

Airway

- Use an opening manoeuvre if the airway is not open or is partially obstructed. Keep the airway open. If there is an improvement but the airway closes without active opening support, consider using an airway adjunct to support the airway.
- Suction only under direct vision and only if necessary.
- The airway may need to be secured by intubation using experienced senior help (if available).

Breathing

Provide a high concentration of oxygen through a face mask with a reservoir bag if there is adequate spontaneous respiration. Give 100% oxygen (mask with reservoir and a flow rate of at least 6 litres/minute) regardless of SaO₂.

For inadequate ventilation or depressed conscious level (P or U on the AVPU scale), respiration should be supported with oxygen via a **bag-mask**, and experienced senior help should be summoned (if available).

Circulation

Primary assessment suggesting shock:

- **Fast, weak pulse** (≥ 100 –110 beats/minute). Normal heart rates in a pregnant mother at rest are 60–90 beats/minute. Tachycardia is the first sign of shock.
- **Bradycardia** (< 60 beats/minute) may occur as a result of increased vagal tone due to the inversion.
- **Low-volume (weak) pulse.**
- Pallor (especially of the inner eyelid, palms or around the mouth).
- Sweatiness or cold clammy skin.
- **Prolonged capillary refill time** (> 3 seconds).
- **Rapid breathing** (> 30 breaths/minute). Normal respiratory rates in a pregnant mother at rest are 15–20 breaths/minute. Tachypnoea can be due to acidosis.

- **Low blood pressure** (systolic < 90 –100 mmHg) **is a very late sign.** Healthy women and girls can maintain a normal or even high blood pressure while large volumes of blood are lost.
- Anxiety, reduced conscious level, confusion or unconsciousness.

If the woman or girl is shocked, obtain vascular access to give large volumes quickly. Insert two wide-bore IV cannulae (14- to 16G) and send blood for a full blood count, cross-matching (2 units) and clotting. If peripheral veins are difficult to access, the external jugular vein or long saphenous vein cut-down are good alternatives.

- Give an initial **rapid** bolus of 500 mL to 1 litre of Ringer-lactate or Hartmann's solution **or blood if available.** It is essential that the bolus is given as rapidly as possible. In the absence of syringe pumps, they should be pushed in manually using a 20- to 50-mL syringe (using a three-way tap and link to an IV giving set).
- Further 500- to 1000-mL boluses may be required in the first hour. Once more than 2 litres have been given IV, complications such as pulmonary or cerebral oedema may occur. If available, expert help, including CVP monitoring, is valuable.
- A blood pressure cuff can be used to speed up infusions in emergency situations. Wrap the cuff around the blood/fluid bag and place it inside a non-compressible bag.
- Keep the patient warm but do not overheat them, as this will cause peripheral vasodilatation and reduce the blood supply to vital centres. Hypothermia will exacerbate poor peripheral perfusion, acidosis and coagulation abnormalities.
- **Elevate the legs (raise the foot of the bed).**
- Give O-negative or group-specific blood if there is not time for full cross-matching. Have O-negative blood ready in the ward at all times if possible.
- Consider giving atropine 100 micrograms IV, and repeat every 2 minutes up to a maximum of 400 micrograms IV if bradycardia is < 60 beats/minute.
- Consider using the non-pneumatic anti-shock garment (NASG).

Post-procedure care

Once the inversion is corrected, infuse IV oxytocin, 40 units in 500 mL of Ringer-lactate or Hartmann's solution, over 4 hours. If **the uterus does not contract after oxytocin**, give misoprostol 3 tablets each of 200 micrograms orally or 600 micrograms of powder sublingually if the patient is conscious, or 4 × 200 micrograms rectally if she is drowsy.

The patient must be observed closely for haemorrhage.

Give a single dose of prophylactic antibiotics after correcting the inverted uterus. Use ampicillin 2 grams IV plus metronidazole 500 mg IV, and give appropriate analgesia.

2.6.1 Hyperemesis gravidarum

Introduction

Some nausea and vomiting is common in early pregnancy, with nausea affecting 70–85% of women. Around 50% of pregnant women experience vomiting. However, in a small proportion of patients severe vomiting (hyperemesis) can occur. This condition is more common if there is a larger than normal placental mass (e.g. in multiple pregnancy and molar pregnancy). Hyperemesis peaks at 11 weeks, with 90% of cases resolved at 16 weeks.

Associated conditions

Severe hyperemesis requiring hospital care is associated with the following:

- depression and severe stress
- multiple pregnancy
- molar pregnancy.

Consequences of hyperemesis

Consequences that are severe enough to require hospital care include the following:

- ketosis
- hypochloraemic alkalosis, hypokalaemia and hyponatraemia
- malnutrition with anaemia and hypoalbuminaemia
- ulcerative oesophagitis
- Wernicke's encephalopathy from thiamine deficiency
- worsened depression, may result in the patient seeking a termination of pregnancy
- hyperemesis is dangerous in type 1 diabetes and can result in ketoacidosis.

Investigations

- Ultrasound examination to exclude molar or multiple pregnancy.
- Urine for ketones and to exclude urinary tract infection.
- Blood for haemoglobin, urea and electrolytes.
- Special investigations as indicated to exclude serious medical problems affecting the gastrointestinal, genitourinary, neurological, metabolic or endocrine and psychological systems.

Treatment of severe hyperemesis

Intravenous 0.9% saline, 1 litre given over 4 hours initially and then repeated as required, is the most effective treatment for severe hyperemesis with dehydration.

Small volumes (100–200 mL every 2–3 hours) of WHO oral rehydration salts (ORS) powder dissolved in 1 litre of water giving Na^+ 75 mmol/litre, K^+ 20 mmol/litre and glucose 75 mmol/litre can be given in addition to IV fluids until vomiting settles and if tolerated.

After IV fluids have been started, anti-emetic drugs may not be required, but if vomiting continues try prochlorperazine 12.5 mg IM and then orally 5 to 10 mg three times daily. Alternatives include cyclizine, 50 mg IM, IV or orally TDS domperidone 10 mg orally or 30–60 mg rectally four times a day, and metoclopramide 10 mg IM, IV or orally three times

a day. If suppositories are available, rectal administration is ideal as it can be self administrated and avoids the oral route in the nauseous and vomiting patient. It is often necessary to use a combination of anti-emetics. If this is done it is often best to combine drugs with different mechanisms of action (e.g. cyclizine and metoclopramide) and to stagger their administration.

Supplements with thiamine should be given (IV if available) if there is evidence suggesting a severe deficiency may be present (Wernicke–Korsakoff syndrome). It should also be used prophylactically if the vomiting has been severe and/or protracted. See below for dosing.

If available, urea and electrolytes should be monitored (ideally daily) in women with severe hyperemesis. Women are at particular risk of hypokalaemia if the vomiting is severe and protracted. In a vomiting patient who is not tolerating any diet, potassium replacement should be considered even where blood measurement is not available. The daily requirement of potassium is approximately 60 mmol in a 60 kg woman, and will be higher in the vomiting patient.

Replacement should be undertaken with great care as too rapid replacement is dangerous.

A reasonable approach would be to add 20 mmol to 1 litre of 0.9% saline and to administer over 8 hours (42 dpm when using a standard giving set with a drop factor of 20). This provides a large margin of error as the infusion could be increased to >100 dpm before becoming hazardous.

Ringer's lactate does contain 5 mmol of potassium/litre and will provide some replacement if potassium is not available.

Hyperemesis is a risk factor for venous thromboembolism (DVT and PE). If a patient is admitted with severe hyperemesis she should be treated with anti-embolic stockings (if available).

Wernicke–Korsakoff syndrome

Symptoms of Wernicke's encephalopathy include the following:

- confusion
- loss of muscle coordination (ataxia)
- leg tremor
- vision changes
- abnormal eye movements (back-and-forth movements called nystagmus)
- double vision
- eyelid drooping.

Symptoms of Korsakoff syndrome include the following:

- inability to form new memories
- loss of memory, which can be severe
- making up stories (confabulation)
- seeing or hearing things that are not really there (hallucinations).

Treatment of severe hyperemesis where possible symptoms or signs of Wernicke–Korsakoff syndrome are present

Give an IV infusion of 10 mL of Pabrinex (Vials 1+2) in 100 mL of 0.9% saline over 1 hour (vials contain thiamine, ascorbic acid, nicotinamide, pyridoxine and riboflavin).

Subsequently, give oral thiamine 50 mg three times daily until vomiting has stopped.

Other management on discharge from hospital

Withhold iron tablets until vomiting has resolved, but ensure that they are taken subsequently, as iron-deficiency

anaemia may have been an important consequence of the hyperemesis.

Try to help with any depression that is present and also, if resources to address intimate partner violence are available in the community, make sensitive inquiries of the woman or girl in case this is a contributing factor.

2.7

Medical disorders complicating pregnancy and delivery

2.7.A Heart failure during pregnancy, including rheumatic heart disease

BOX 2.7.A.1 Minimum standards

- Oxygen.
- Furosemide.
- Digoxin.
- Nitroglycerine sublingual tablets.
- Blood transfusion.
- Morphine.

- raised jugular venous pressure
- gallop rhythm/murmur
- enlarged liver
- basal lung crepitations.

Jugular venous pressure

Normal levels of jugular venous pressure (JVP) are 4–5 cm above the sternal angle. In heart failure the JVP can be raised so that the external jugular vein is filled up to or above the angle of the jaw (see Figure 2.7.A.1).

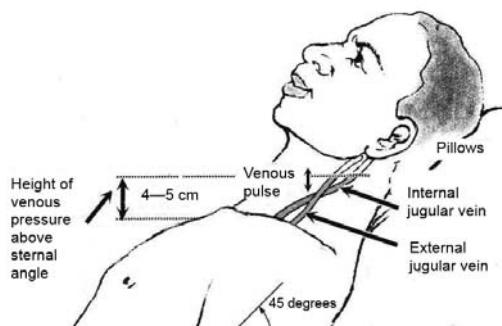


FIGURE 2.7.A.1 Clinical measurement of central venous pressure.

Introduction

Serious cardiac pathology may present either as heart failure where respiratory distress is the most obvious finding, or as cardiogenic shock (see shock section later).

Causes of heart failure during pregnancy

There are five main causes of heart failure in pregnancy:

- 1 severe anaemia
- 2 structural heart disease
- 3 circulatory overload (e.g. excessive IV fluids)
- 4 hypertension in severe pre-eclampsia
- 5 hypertrophic cardiomyopathy (HCM) and peripartum cardiomyopathy.

Heart failure can result from:

- left ventricular volume overload (aortic and mitral valve incompetence) or excessive pulmonary blood flow (e.g. congenital heart defects)
- left heart obstruction (aortic stenosis, mitral stenosis, hypertension)
- primary pump failure (severe anaemia, myocarditis, cardiomyopathy or arrhythmia)
- over-transfusion (a particular risk in hospital with IV blood or fluid infusions, especially in the anaemic mother).

Clinical signs

These include the following:

- respiratory distress (raised rate and some chest wall recession)
- tachycardia out of proportion to respiratory difficulty

Treatment of severe decompensated heart failure

- Assess ABC.
- Sit the patient upright and **ensure bed rest**.
- Give a high concentration of **oxygen** via face mask with reservoir bag.
- If there are signs of shock (poor pulse volume or low blood pressure with extreme pallor and depressed conscious level), treat for **cardiogenic shock** with inotropes (if available).
- If there are signs of pulmonary oedema, give IV **furosemide 40mg** (and repeat as required).

- Provided the patient is not hypotensive (systolic blood pressure > 90 mmHg) and has no serious obstructive valvular disease, give a **glyceryl trinitrate** tablet 500 micrograms sublingually and repeat up to a total of 3 tablets.
- Give **morphine** 3mg over 5 minutes, and consider repeating after 15 minutes. Morphine is effective in reducing the afterload and, in addition, will reduce anxiety and pain both of which are likely to make heart failure worse.
- For patients with persisting heart failure load with **digoxin IV**, 250–500 micrograms over 10 minutes, then after 6 hours 125–250 micrograms over 10 minutes, then after a further 6 hours 125–250 micrograms over 10 minutes.

Or give an **oral digoxin** loading dose (instead of IV) of 375–750 micrograms, then after 6 hours 187.5–375 micrograms, then after a further 6 hours 187.5–375 micrograms.

- **Maintenance digoxin dose IV or oral:**
 - 125–750 micrograms once daily.
 - Reduce the dose in renal impairment. Be alert for low K⁺ levels.
- Consider thromboprophylaxis. This treatment must take into account any bleeding risk and the timing of delivery.
- Check for severe anaemia (especially if the haemoglobin concentration is < 5.0 g/dL), for which partial exchange transfusion may be helpful. **Partial exchange transfusion can be achieved with a cannula in a large vein in the antecubital fossa. Withdraw 25 mL of anaemic blood and infuse 50 mL of new blood over 5 minutes, and repeat up to 10 times.** An alternative is careful transfusion of packed cells (hang the bag vertically for 15 minutes) to allow the red blood cells to separate from the plasma. Transfuse only the red blood cell component with 40mg IV furosemide for each unit of 500mL infused.

The following are useful investigations if available:

- full blood count (to exclude severe anaemia)
- serum urea and electrolytes
- infection screen, including blood cultures
- 12-lead electrocardiogram
- chest X-ray
- echocardiogram.

Subsequent treatment of heart failure

- Dietary sodium restriction.
- Loop diuretics (furosemide) for moderate/severe pulmonary oedema,
- Treatment with oral hydralazine or oral nifedipine (modified release version) as a vasodilator (instead of glyceryl trinitrate used in the acute scenario above).
- Treatment with a B-blocker (preferably a B1 cardio-selective B-blocker such as atenolol) can be beneficial. They are NOT used in the acute presentation of a patient with severe decompensated heart failure. They are contraindicated in asthma and may be associated with intra-uterine growth restriction, but are not associated with congenital malformations.
- Continued treatment with digoxin (as above) should be considered if significant symptoms persist.

- Treatment of any underlying anaemia or poor nutritional status.
- Once the baby is delivered, treatment with hydralazine or nifedipine may be replaced with an ACE inhibitor such as enalapril or lisinopril. ACE inhibitors cause congenital abnormalities and therefore should not be used antenatally. They are contraindicated if the patient is hypovolaemic and in renal artery and aortic stenosis.

Management of heart failure during labour

- The mother must deliver sitting up.
- Give oxygen from a face mask throughout labour.
- Limit infusion of IV fluids to decrease the risk of circulatory overload, and maintain a strict fluid balance chart.
- Ensure adequate analgesia.
- If an **oxytocin IV infusion is required**, use a higher concentration at a slower rate while maintaining a fluid balance chart (e.g. the concentration may be doubled if the number of drops per minute is decreased by half).
 - Increase the rate of oxytocin infusion until regular strong contractions are established, and then maintain infusion at that rate.
- Avoid sustained, bearing-down efforts during the second stage if possible.
- If it is necessary to decrease the woman's workload during delivery, perform an episiotomy and assist delivery by vacuum extraction or forceps.
- Ensure active management of the third stage of labour. Oxytocin given on delivery of the baby must be given very slowly IV (5 units diluted in 20mL of 0.9% saline over 5–10 minutes) to avoid hypotension.
- **Do not give ergometrine.**

Note: Heart failure is not an indication for Caesarean section.

Management of anaesthesia if Caesarean section is needed

It is assumed that epidural anaesthesia/analgesia is unlikely to be possible or appropriate in low-resource settings. Avoid spinal anaesthesia if there is a fixed cardiac output, such as aortic/mitral stenosis or heart failure associated with valvular disease. If you are giving a general anaesthetic, take precautions against aspiration and minimise the risk of an increase in blood pressure associated with intubation by premedication with either morphine (5mg initially IV) or lignocaine (1mg/kg IV). If the patient is considered to have insufficient cardiovascular stability for general anaesthetic, undertake Caesarean section under local infiltration anaesthesia.

In all of the above situations the surgeon should be ready to start operating **immediately** when anaesthesia is established, so that the operating time is as short as possible. As above, oxytocin given for active management of third stage must be given very slowly IV (5 units diluted in 20mL of 0.9% saline over 5–10 minutes) to avoid hypotension.

Post-operative management must ensure adequate analgesia with morphine.

Cardiac consequences of rheumatic heart disease and their effects on pregnancy

Introduction

After an episode of acute rheumatic fever, there may be permanent valve damage. Rheumatic heart disease occurs when acute valve inflammation is followed by scarring and fibrosis, resulting in various degrees of shortening, thickening, rigidity, deformity, retraction and fusion of the valve cusps. The commonest valve lesions are mitral regurgitation, mitral stenosis and aortic regurgitation. Rheumatic heart disease is most severe and progressive in the following:

- patients who initially have severe carditis
- patients who have recurrent episodes of acute rheumatic fever. The prognosis is more favourable if recurrences are prevented. After single episodes, residual cardiac disease may disappear or improve, and valve damage only worsens in a few cases. It is therefore crucial to maintain continuous antibiotic prophylaxis to prevent further valve damage.
- Asymptomatic rheumatic valve disease often becomes clinically relevant during pregnancy. A history of rheumatic fever should be sought at booking and ideally the heart auscultated for murmurs. It should be remembered as a differential diagnosis in a women presenting with shortness of breath, a cardiac arrhythmia or heart failure.

When a cardiology referral and/or surgical intervention is not available

- Medical management is supportive, aiming to maximise cardiac function. The most dangerous period is delivery and shortly afterwards. In general, the more normal the delivery the less stress there is on the heart.
- Regular follow-up and rational drug therapy can make a significant difference. Use routine medications (diuretics, B-blocker, digoxin and nitrates) to maximum effect.
- Bed rest and the avoidance of heavy work are essential.
- Treat anaemia and any other coexisting conditions.
- Advise hospital delivery.
- Venesection can be used to decrease venous load for the patient in life-threatening situations where preload is high.

Note that there is a risk of teratogenicity with ACE inhibitors during the first trimester, and problems with placental and renal function later in pregnancy. There is also diminished placental perfusion with diuretics although these should not be withheld if clinically indicated. ACE inhibitors may be used after delivery and during breastfeeding.

Effects of rheumatic heart disease

Mitral regurgitation

Mitral regurgitation is the commonest valve lesion.

Clinical features

These include the following:

- easy fatigue (caused by low cardiac output)
- shortness of breath on exertion (caused by pulmonary oedema and inability to increase cardiac output)
- orthopnoea, paroxysmal nocturnal dyspnoea and haemoptysis
- hyperdynamic apical impulse

- apical impulse displaced laterally and inferiorly
- a blowing apical pansystolic murmur radiating to the left axilla; there may be a third heart sound and a short low-frequency mid-diastolic murmur from increased trans-mitral flow
- there may be basal crepitations
- chest X-ray demonstrates cardiomegaly and left atrial enlargement (a double density on the right heart border and elevation of the left main bronchus)
- the ECG demonstrates left atrial enlargement (broad bifid P waves in lead II and a prominent negative component to the P in V1) and left ventricular hypertrophy
- signs of pulmonary hypertension.

Management

- Urgent referral for a cardiology opinion, as surgery is likely to be necessary (if available).
- Annual echocardiograph (if available), as progressive left heart dilation may result in irreversible left ventricular dysfunction if referral is delayed until symptoms develop.
- Medical treatment for heart failure, but patients who are unwell enough to require this may be more appropriately treated by mitral valve repair or mitral valve replacement with a mechanical valve or bioprosthesis, if possible locally.

Mitral stenosis

Features

- Mild stenosis does not cause symptoms, moderate stenosis causes shortness of breath on exertion, and severe stenosis causes easy fatigue, shortness of breath at rest, orthopnoea (shortness of breath on lying down), paroxysmal nocturnal dyspnoea and haemoptysis.
- There is a low-frequency mid-diastolic murmur that is maximal at the apex, accentuated by exercise.
- There is a loud first heart sound and diastolic opening snap.
- The murmur becomes longer as the severity of stenosis increases.
- In severe cases, there are signs of pulmonary hypertension.
- Chest X-ray and ECG show left atrial enlargement when there is moderate mitral stenosis, and chest X-ray shows pulmonary oedema when stenosis is severe.

Management

- Symptoms are treated with diuretics and a low-sodium diet. Digoxin is indicated only in rare cases where there is atrial fibrillation secondary to left atrial enlargement.
- Symptomatic patients and those with pulmonary hypertension should be referred for cardiology review (if available), as surgery is often necessary (open or closed mitral commissurotomy, mitral valve replacement and percutaneous catheter balloon mitral commissurotomy).

Aortic regurgitation

- This is less common than mitral regurgitation, and frequently occurs in combination with mitral valve disease.
- Symptoms occur when left ventricular dysfunction develops secondary to chronic left ventricular volume overload.
- Once the symptoms have appeared, deterioration is often rapid.
- Symptoms include exercise intolerance, shortness of

- breath on exertion, orthopnoea (shortness of breath on lying down), paroxysmal nocturnal dyspnoea, haemoptysis and chest pain.
- Examination reveals a blowing decrescendo early diastolic murmur that is maximal at the mid to lower left sternal border. The murmur is loudest when sitting forward with the breath held in expiration.

Signs of moderate to severe aortic regurgitation

- The murmur lengthens and may be present throughout diastole.
- Hyperdynamic apex.
- Apical impulse displaced laterally and inferiorly.
- Wide pulse pressure.
- Collapsing pulses.
- Basal crepitations.
- Visible pulsations in the suprasternal notch and neck vessels.
- Systolic murmur at the upper right sternal border (from increased aortic valve flow).

Management

- Cardiology assessment, as surgery may be necessary (if available). Marked cardiomegaly on chest X-ray or multiple ventricular ectopics on the ECG should prompt referral.
- An echocardiogram is needed at least annually (if available), as it is important to assess left ventricular dilation and function to ensure that surgery is performed before irreversible left ventricular dysfunction develops.
- Exercise tolerance may be improved by medical treatment for heart failure.

- Surgical options include aortic valve reconstruction, aortic valve replacement with an aortic homograft or mechanical valve, and transferring the patient's own pulmonary valve to the aortic position (Ross procedure).

Aortic stenosis

The two commonest causes of aortic valve stenosis are progressive wear of a congenital bicuspid aortic valve and rheumatic fever (the most common cause in developing countries, and usually also with aortic regurgitation).

Clinical features

- Chest pain (angina from inadequate coronary artery perfusion).
- Fainting, usually with exertion or excitement.
- Shortness of breath due to heart failure.
- Sudden death.
- On examination, delayed upstroke and reduced magnitude of the carotid pulse and an ejection systolic heart murmur.
- The ECG shows left ventricular hypertrophy and sometimes ST changes of myocardial ischaemia.
- The chest X-ray shows a normal sized heart, dilated aortic root and pulmonary venous congestion. Sometimes there is calcification of the aortic valve.

Management

- Avoid strenuous exercise.
- Avoid endocarditis.
- Refer for a specialist opinion if possible.
- Diuretics can be helpful, but surgery is usually required.

2.7.B Asthma

BOX 2.7.B.1 Minimum standards

- Oxygen.
- Salbutamol by metered-dose inhaler and nebuliser.
- Aminophylline.
- Magnesium sulphate.
- Adrenaline.
- Prednisolone/hydrocortisone.

Assessment

Features of severe asthma

- Too breathless to feed or talk.
- Recession/use of accessory muscles.
- Respiratory rate > 40 breaths/minute.
- Pulse rate > 120 beats/minute.

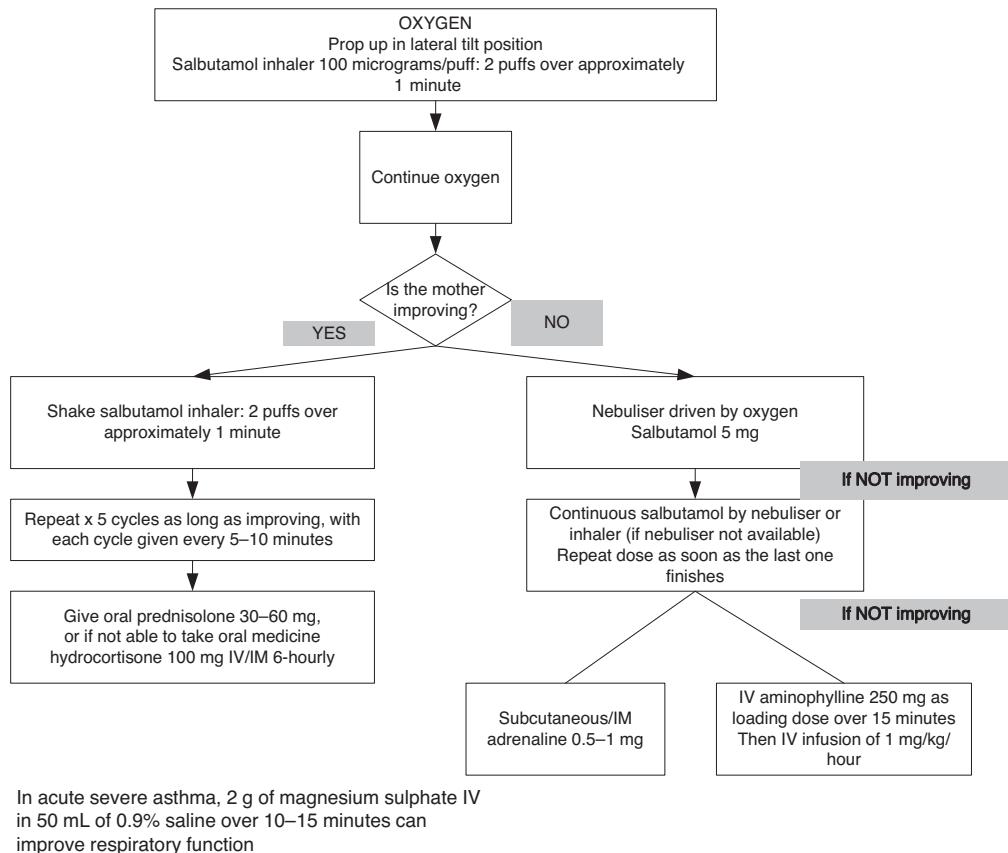
Features of life-threatening asthma

- Conscious level depressed/agitated.
- Exhaustion.
- Poor respiratory effort.
- $\text{SaO}_2 < 85\%$ in air/cyanosis.
- Silent chest.

Asthma complicates 3–4% of pregnancies. Pregnancy is

associated with worsening of the symptoms in one-third of affected mothers.

- A chest X-ray is indicated only if there is severe dyspnoea, uncertainty about the diagnosis, asymmetry of chest signs (possible pneumothorax) or signs of severe infection.
- Transcutaneous PCO_2 , arterial or capillary blood gases (if available) can be helpful in very severe asthma.
- Continuous pulse oximetry is valuable (if available), as hypoxaemia is a major feature of all severe asthma attacks.
- Do not give prostaglandins other than misoprostol (the latter is safe in pregnancy).** For the prevention and treatment of postpartum haemorrhage, give oxytocin 10 units IM or ergometrine 500 micrograms IM or both (Syntometrine IM).
- Do not give labetalol for hypertension in patients with asthma.**
- The priority of treatment is to maintain good control of the patient's asthma. This will reduce the likelihood of acute exacerbations which can be life-threatening. In order that control is maintained the following are recommended:
 - It should be emphasised that inhaled salbutamol and steroids are not harmful to the fetus and should be continued in pregnancy.

**FIGURE 2.7.B.1** Pathway of care for pregnant mother with severe asthma.

- The aim should be for the patient to need her salbutamol inhaler no more than 1–2 times/day. If use in excess of this occurs, the patient should be commenced on inhaled steroids or have her current dose of inhaled steroids increased.
- If the maximum dose of inhaled steroids is reached, then long acting β_2 -agonists and slow release theophylline should be considered if available.
- If not available, or ineffective, oral prednisolone can be added at the lowest dose required to maintain control. Oral prednisolone is associated with an increased risk of infection and gestational diabetes, and complicates control of established diabetes. Its long term use has other potential side-effects for the mother, such as osteoporosis, but it should not be withheld if required to maintain control of maternal disease.

Emergency treatment of severe asthma

- Assess ABC and resuscitate as needed.
- Give a high concentration of **oxygen** via a face mask with reservoir bag or nasal cannula. Attach a pulse oximeter and maintain SaO_2 in the range 94–98%.
- Sit the patient up.
- Give nebulised salbutamol 5 mg driven with oxygen half-hourly to 4-hourly via a nebuliser (or 10–20 puffs of a beta-2-agonist inhaler, such as salbutamol or terbutaline, giving one puff at a time through a spacer with a mouthpiece or face mask).
- Give oral prednisolone 30–60 mg, or if the patient is vomiting, IV/IM hydrocortisone 100 mg, followed by

100 mg 6-hourly. (**Note:** steroids will not show benefits for a number of hours.)

If the patient is not responding, or their condition is deteriorating:

- **Nebulised salbutamol** may be given continuously.
- In acute severe asthma, 2 g of **magnesium sulphate** IV in 50 mL of Ringer-lactate or Hartmann's solution over 10–15 minutes can produce significant bronchodilatation.
- As an alternative to magnesium sulphate, and if the patient is not already on oral theophylline or other methylxanthines, give a loading dose of IV **aminophylline** 250 mg over 15 minutes, monitoring the ECG for arrhythmias (if possible), followed by 1 mg/kg/hour by IV infusion.
- **IV salbutamol** 250 micrograms over 10 minutes **is an alternative** to magnesium sulphate or aminophylline, followed by IV infusion of 1–5 micrograms/kg/minute (but monitoring ECG and checking K^+ levels regularly is necessary; extra potassium may be needed, and monitoring of plasma K^+ levels is essential if this drug is given IV).
- In severe cases in the absence of other measures, **adrenaline** can be effective. It should be given subcutaneously or IM (dose = 500 micrograms to 1 mg), but may be given IV in life-threatening asthma as follows.
 - Place 1 mg of adrenaline in 10 mL of 0.9% saline and give 1 mL of this solution. Wait for 1 minute and then keep on repeating 1 mL doses IV every minute until the patient improves or the whole 1 mg (10 mL) has

- been given. The risk of cardiac side effects (tachycardia, cardiac arrhythmias) is low if adrenaline is given in this way.
- In patients with poor respiratory effort, depressed conscious level and poor oxygenation despite maximum oxygen therapy:
 - Attempt to support ventilation with a bag-valve-mask.
 - Summon experienced support (an anaesthetist) if available, and consider intubation for mechanical ventilation with IV ketamine or halothane induction.

Indications for intubation and positive pressure ventilation (if available)

These include the following:

- increasing exhaustion
- progressive deterioration in clinical condition (e.g. a silent chest)
 - oxygenation decreasing and/or oxygen requirement increasing
 - pCO_2 increasing (if measurable from arterial/capillary gas)
- sudden deterioration
- massive atelectasis
- pneumothorax.

If the patient is responding and improving, continue inhaled salbutamol as often as indicated.

Other measures

- Reassure the patient, and avoid upsetting them by performing unnecessary invasive procedures.
- Give IV steroids to cover labour/delivery for prevention of Addisonian crisis in patients with a history of taking significant doses of oral steroids in the recent past, especially if long term.
- Restrict IV fluids to two-thirds of the normal requirements.

- Give antibiotics only if there are signs of infection (fever and other signs of pneumonia; chest X-ray may be helpful).
- When the patient has recovered, review their maintenance treatment and inhaler technique.

How to give drugs such as aminophylline or magnesium sulphate safely IV without syringe drivers or pumps

- Bolus doses:
 - The safest way to give these is slowly by hand using the syringe.
- IV infusions:
 - Where volume overload is not an issue, the simplest method is to add the drug (e.g. aminophylline) to 500-mL bags of Ringer-lactate or Hartmann's solution or other available/appropriate fluid and run over 12–24 hours.
 - Where volume overload is an issue, a microburette (if available) can be used to give small volumes of IV fluids or drugs safely (see Figure 2.7.B.2). The chamber in the figure holds 100mL (1 drop/second = 1 mL/minute).



FIGURE 2.7.B.2 Burette for careful infusion.

2.7.C Anaphylaxis

BOX 2.7.C.1 Minimum standards

- Adrenaline.
- Hydrocortisone and prednisolone.
- Nebulised adrenaline.
- Antihistamine.
- Nebulised or inhaled salbutamol.

Introduction

Anaphylaxis is an allergic reaction to ingested, inhaled or topical substances, which may present as one or more of **stridor, shock or respiratory distress**. Common causes include allergy to penicillin, to radiographic contrast media, to blood transfusion, to insect bites and to certain foods, especially nuts. Anaphylaxis can occur with any drug.

Clinical features

Consider the possibility of anaphylaxis in a patient with any of the symptoms and signs listed in Table 2.7.C.1, especially when any of the following are present:

- a history of previous severe reaction
- rapidly progressive or increasingly severe symptoms
- a history of asthma, eczema or rhinitis (atopy)
- current treatment with beta-blockers.

This condition is potentially life-threatening, and may result in a change in conscious level, collapse, and respiratory or cardiac arrest. Some patients carry their own adrenaline.

Treatment

- Remove or stop the allergen if possible.
- Adrenaline 1 mg is given IM, unless there is intractable shock or cardiac arrest on presentation, in which case give adrenaline IV as follows:
 - Place 1 mg of adrenaline in 10 mL of 0.9% saline and give 0.5–1 mL of this solution. Wait for 1 minute and then keep on repeating 1 mL doses IV every minute until the patient improves or the whole 1 mg (10 mL) has been given.
- IV/IM hydrocortisone, 100–300 mg (if IV by slow injection) or oral prednisolone 40 mg stat.
- Nebulised adrenaline if there is stridor.
- Nebulised salbutamol 5 mg by oxygen driven nebulizer or adrenaline if there is wheezing.
- Antihistamine: chlorphenamine 10–20 mg by slow intravenous injection.
- Intubation and ventilation (if available) will be required for severe cases.

TABLE 2.7.C.1 Anaphylaxis: symptoms and signs

| Mild | |
|-----------------|--|
| Symptoms | Burning sensation in mouth Itching of lips, mouth and throat Feeling of warmth Nausea Abdominal pain |
| Signs | Urticarial rash Angio-oedema Conjunctivitis |
| Moderate | |
| Symptoms | Coughing and/or wheezing Loose bowel movements Sweating Irritability |
| Signs | Bronchospasm Tachycardia Pallor |
| Severe | |
| Symptoms | Difficulty breathing Collapse Vomiting Uncontrolled defecation |
| Signs | Severe bronchospasm Laryngeal oedema Shock Respiratory arrest Cardiac arrest |

Mild anaphylaxis can lead to moderate and then severe anaphylaxis, and then to death, unless treated.

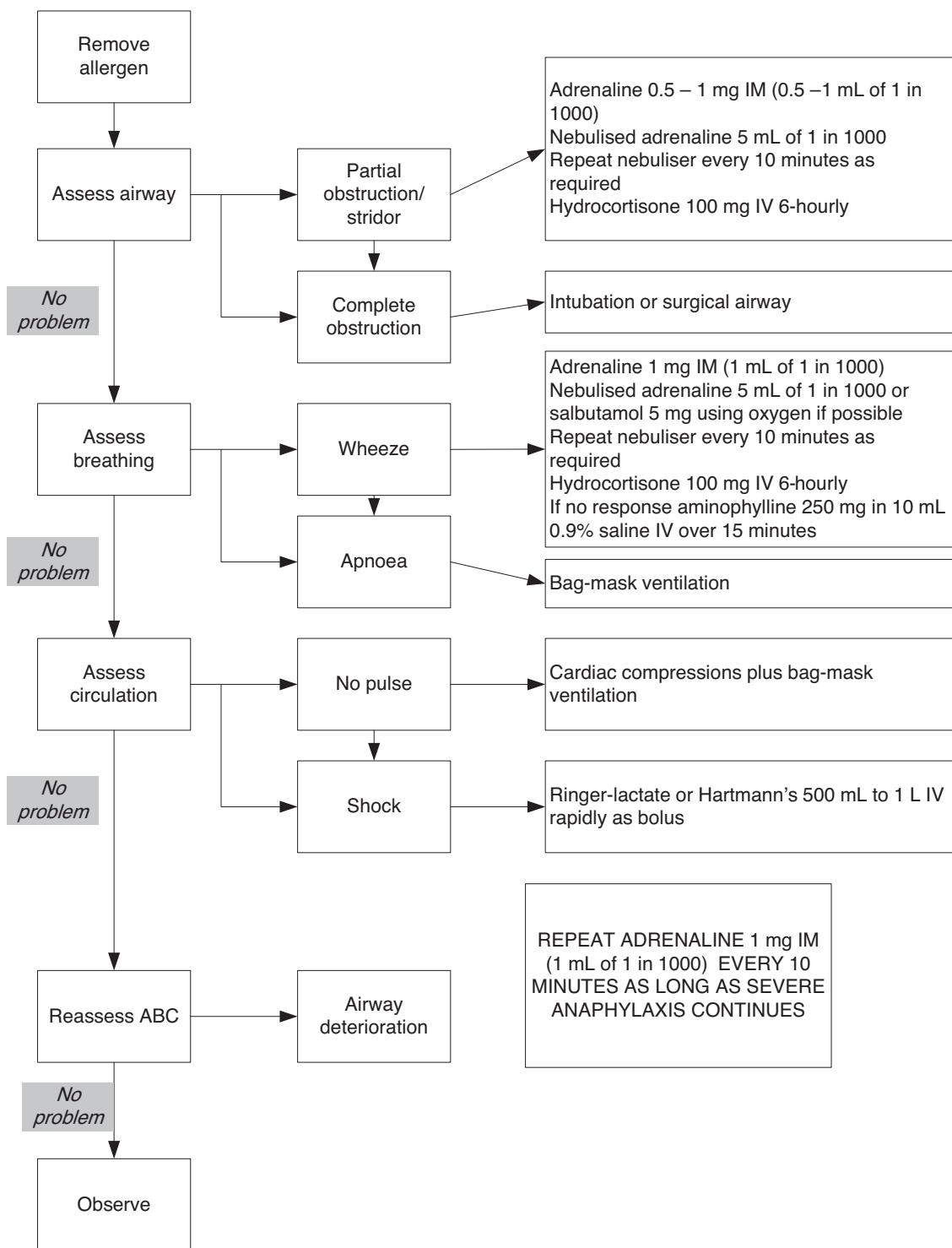


FIGURE 2.7.C.1 Pathway of care for anaphylaxis in pregnancy. ABC, airway, breathing and circulation.



Two children with pneumonia receiving oxygen from one oxygen concentrator; the only one available in a ward of 26 beds.



Two senior midwives in Liberia trained in advanced obstetrics undertaking an emergency Caesarean section.

2.7.D Diabetes mellitus

BOX 2.7.D.1 Minimum standards

- Insulin.
- Blood glucose measurements.
- 0.9% saline or Plasma-Lyte 148.
- Oral and IV potassium.
- Mannitol.
- Nasogastric tube.

Introduction

Diabetes mellitus is associated with increased maternal mortality and morbidity, as well as increased perinatal mortality and morbidity, including congenital malformations. Pregnancy causes changes in the maternal physiology to make it a diabetogenic state. Women who have pre-existing diabetes have an increased insulin requirement in pregnancy. Previously healthy women may develop gestational diabetes. Both type 2 diabetes and gestational diabetes are more common in certain ethnic groups, including South Asians, and are more common in those with a high body mass index (BMI).

Before the discovery of insulin, maternal mortality in diabetics and perinatal mortality in their infants were extremely high. Insulin has led to a dramatic improvement in maternal survival, but in comparison with non-diabetic pregnancy there is still a three- to fivefold increase in perinatal mortality, and an increase in congenital malformations. These risks can be reduced by strict attention to the control of the diabetes both before and during pregnancy.

Diabetes predisposes to pre-eclampsia.

Management

Before pregnancy

- Advise any diabetics of reproductive age about the importance of close monitoring and modified treatment in pregnancy.
- Obesity: give dietary advice.
- Tight control of diabetes: aim for blood glucose levels of less than 7.5 mmol/litre and HbA_{1c} levels within normal limits.
- The mother should take folic acid 5 mg daily if planning pregnancy.

In early pregnancy

- Nausea and vomiting are common.
- Hypoglycaemia is common in insulin-treated diabetes. Provide glucagon at home if possible, and explain its use to other household members. Alternatively, counsel the patient to keep sugar-containing foods close by. Inform the patient and others about the signs of hypoglycaemia.
- It is not always necessary to convert mothers treated with oral hypoglycaemic agents to insulin. Metformin is commonly used in these circumstances (initially 500mg with breakfast for 1 week, then 500 mg twice daily with breakfast and tea, and then 500 mg three times daily with breakfast, lunch and tea).
- As soon as possible, assess the gestational age. Early ultrasound scan can detect anencephaly, but 20 weeks'

gestation is usually the best time to look at the spine and heart if facilities are available.

During pregnancy

Type 1 diabetes (insulin dependent)

Close control of diabetes is needed. Expect insulin requirements to increase by up to 50% above pre-pregnant levels. There is an increased risk of congenital abnormalities, macrosomia, polyhydramnios, preterm labour and pre-eclampsia. Plan delivery with care. The risks of infection and development of diabetic ketoacidosis are high. Signs of hyperglycaemia include a gradual onset of drowsiness and polyuria, dehydration, hypotension, difficulty breathing, and a ketotic smell to the breath. Signs and symptoms of hypoglycaemia may be of rapid onset, leading to unconsciousness, particularly if the mother has taken insulin but has not taken her usual food. Awareness of impending hypoglycaemia in those with type 1 diabetes is often reduced in pregnancy. These patients must be advised about the possible effects on safety during driving.

The insulin requirement often escalates rapidly, especially in the late second and early third trimester, and in order to maintain control of the blood glucose, frequent medical review every 1 to 2 weeks coupled with frequent self-assessment of blood glucose levels, is likely to be required for women with type 1 diabetes.

Type 2 diabetes

Women who are diet-controlled before pregnancy require careful monitoring of blood sugar levels in pregnancy, and may need metformin and/or insulin.

Gestational diabetes

This is often undiagnosed, and should be suspected if any of the following are present:

- a family history of diabetes
- a past history of a large baby, stillbirth or gestational diabetes
- recurrent glycosuria
- a high BMI (overweight)
- a relevant ethnic background.

All women with diabetes should ideally be monitored more regularly in the antenatal clinic for complications such as

Diagnosis of diabetes with a glucose tolerance test

TABLE 2.7.D.1 Seventy-five-gram oral glucose loading dose results

| | Fasting plasma glucose concentration (mmol/litre) | 2-hour plasma glucose concentration (mmol/litre) |
|--|---|--|
| Diabetes | > 8 | > 11 |
| Gestational impaired glucose tolerance | 6–8 | 9–11 |
| Normal | < 6 | < 9 |

pre-eclampsia, polyhydramnios and a large or small for gestational age infant.

Management of delivery in women with diabetes

For spontaneous labour, induction of labour and elective Caesarean section:

- 1 Measure glucose on admission and hourly during labour.
- 2 Site an IV line with 500 mL of 0.9% saline containing 10% dextrose and potassium chloride 10 mmol, and give at a rate of 60 mL/hour.

Avoid the routine use of insulin in labour in low resource settings because of lack of experience and lack of blood glucose stick tests. In mothers who were using insulin during pregnancy and those where blood glucose is > 7 mmol/litre on two successive occasions one hour apart in labour, the insulin requirements shown in Table 2.7.D.2 below can be used.

TABLE 2.7.D.2 Insulin requirements

| Blood glucose concentration (mmol/litre) | Hourly subcutaneous injections of insulin |
|--|---|
| < 2.0 | No insulin; dextrose only |
| 2.0–4.0 | 1 unit |
| 4.1–9.0 | 2 units |
| 9.1–11.0 | 3 units |
| 11.1–16.9 | 4 units |

NOTE: for blood glucose, 1 mmol/litre = 18 mg/dL

- If the glucose level is > 17 mmol/litre, expert advice should be sought.
- Aim for a glucose level of 4–9 mmol/litre.
- Reduce insulin by half at delivery, and aim to resume the pre-pregnancy insulin dosage 24 hours after delivery. If the mother is breastfeeding, her insulin requirement may be lower.
- Women who have developed gestational diabetes usually have normal blood glucose levels soon after the delivery of the placenta. Their diabetic medication should be stopped postnatally, and their blood sugar levels should be monitored.
- Mothers who have had gestational diabetes should have a glucose tolerance test at 6 weeks postnatally. They are at risk of developing type 2 diabetes, and appropriate dietary and lifestyle advice should be provided. A fasting blood glucose test annually should also be recommended.

Diabetic ketoacidosis (DKA)

DKA is the commonest endocrine emergency, and should be suspected in patients with any of the following:

- dehydration
- abdominal pain
- ketone smell on the breath
- acidosis
- acidotic breathing
- unexplained coma.

Patients die from hypokalaemia and cerebral oedema.

Patients who are 5% dehydrated or less and are not

clinically unwell usually tolerate oral rehydration and subcutaneous insulin.

Patients who are more than 5% dehydrated, or who are vomiting or drowsy or clinically acidotic, need emergency care as follows.

Primary assessment and resuscitation

Airway

- If the airway is not open, use an airway-opening manoeuvre, and consider an airway adjunct such as an oropharyngeal airway or intubation (if available and subsequently supported).
- The nares and oropharynx may need gentle suctioning under direct observation.
- If the patient is unconscious and the airway is unprotected, the recovery position should be adopted to minimise the risk of aspiration of vomit.

Breathing

Give a high concentration of oxygen through a face mask with a reservoir, if the airway is adequate.

If breathing is inadequate, ventilate with oxygen via a bag-valve-mask-reservoir device, and ask for experienced senior help to intubate (if this is available and sustainable).

Circulation

- Gain IV access using a short wide-bore cannula (14- to 16G).
- External or internal jugular vein access is an option if peripheral access is impossible. Long saphenous vein cut-down may also be considered.
- Take blood for a full blood count, urea and electrolytes, blood culture, cross-matching, glucose stick test and laboratory blood glucose (if available).
- Give a 500-mL rapid IV bolus of 0.9% saline or Plasma-Lyte 148.
- An antibiotic such as cefotaxime 1 gram IV 6-hourly, or the locally available equivalent, is an appropriate antibiotic for those in whom an infection is likely to have precipitated the DKA. Although, of course, antibiotic therapy must be tailored to the specific cause.

Diagnosis

- History:
 - polydipsia
 - polyuria
 - weight loss.
- Clinical:
 - acidotic respiration
 - dehydration
 - drowsiness
 - abdominal pain and/or vomiting.
- Biochemical:
 - high blood glucose on finger-prick test
 - ketones and glucose in urine.

Secondary assessment and emergency treatment

The following in particular need to be assessed.

Degree of dehydration

- 3%: dehydration is only just clinically detectable
- 3–5%: dry mucous membranes and reduced skin turgor

- 5–8%: as above, with sunken eyes and poor capillary return
- >8% with shock: severely ill with poor perfusion, thready rapid pulse and reduced blood pressure.

Conscious level

- Assess AVPU.
- Institute hourly neurological observations.
- If the patient is less than Alert on admission, or their conscious level deteriorates, record the Glasgow Coma Scale score.
- Consider instituting cerebral oedema management (if available).

Cerebral oedema

Look for irritability, slow pulse, high blood pressure and papilloedema (a late sign).

Infection

DKA can cause a leucocytosis but not fever. If fever is present, look for and treat infection.

Ileus

- Insert a nasogastric tube.
- Ensure by clinical assessment, and by abdominal X-ray if appropriate, that there is no other cause of the acute abdomen, including intestinal obstruction.

Observations

- Strict fluid balance and urine testing of every sample.
- Hourly capillary blood glucose measurements.
- Twice daily weights.
- Initially hourly or more frequent neurological observations.
- Report immediately to medical staff (even at night) symptoms of headache or any change in either conscious level or behaviour.
- Report any changes in the ECG trace, especially T-wave changes (monitoring for hypokalaemia).

Investigations

- When it is safe to do so, weigh the patient. If this is not possible, use recent clinic weight or an estimated weight.
- Blood glucose.
- Urea and electrolytes (if available).
- Bicarbonate or arterial blood gases (if available).
- Haematocrit and full blood count.
- Blood culture.
- Urine microscopy, culture and sensitivity; check for ketones.
- Monitor the ECG to observe T waves (if available):
 - **hypokalaemia** causes flat T waves
 - **hyperkalaemia** causes peaked T waves.
- Other investigations if indicated (e.g. if fever is present).

Additional emergency treatment

General

- After resuscitation with fluid boluses, calculate the fluid requirement (see below).
- Avoid excessive fluid replacement, as this is a risk factor for cerebral oedema.
- **Do not give hypotonic IV solutions** (e.g. 0.18% saline with 4% glucose, or 5% glucose): they are risk factors for cerebral oedema.
- Continue to give IV fluids until the patient is drinking.

- After fluids are running, calculate the rate of insulin infusion (blood glucose levels will already be falling).
- Use a continuous low-dose IV infusion of insulin (there is no need for an initial bolus), or in resource-limited situations use regular subcutaneous injections of short-acting insulin based on a sliding scale according to blood glucose measurements. Details below.
- Continue to give IV fluids until the patient is tolerating enteral fluids.

Fluid and electrolyte management

- Calculate the patient's fluid requirement. This is equal to maintenance plus deficit (see Figure 2.7.D.1).
 - Maintenance
 - Deficit (litres) = percentage dehydration × body weight (kg)/100
 - Only plan to correct up to an 8% deficit, as any more risks over-infusion.
- Ignore the volume of fluids used to resuscitate/treat shock.
- Give the total fluid requirement over 24 hours:

Glucose > 12 mmol/litre: give 0.9% saline or Plasma-Lyte 148.

Glucose < 12 mmol/litre: give 0.9% saline or Plasma-Lyte 148 containing 5% dextrose (by adding 100mL of 50% glucose to 900mL of 0.9% saline or Plasma-Lyte 148).

Sodium 135–155 mmol/litre: correct by rehydration over 24 hours.

Sodium > 155 mmol/litre: correct by rehydration over 48 hours using 0.9% saline or Plasma-Lyte 148.

Expect the sodium level to rise initially as the glucose level falls and water is removed from the circulation.

If the plasma sodium level initially falls (as well as the glucose level), this may precipitate cerebral oedema.

Bicarbonate

- **Administration of bicarbonate is rarely, if ever, necessary.**
- Continuing acidosis usually indicates insufficient fluid resuscitation.
- Consider the use of bicarbonate in patients who are profoundly acidotic (pH < 7.0 if measurable) and shocked. Its only purpose is to improve cardiac contractility in severe shock.

The maximum volume of 8.4% sodium bicarbonate for half-correction of acidosis is calculated according to the following formula, and given over 60 minutes:

$$\text{Volume (mL } 8.4\% \text{ NaHCO}_3) = \frac{1/3 \times \text{weight (kg)} \times \text{base deficit (mmol/litre)}}{2}$$

If blood gas analysis cannot be undertaken:

- The kidneys will resolve the acidosis (if they are working) if the patient receives adequate fluid and insulin therapy.
- If you cannot measure pH, then do not give bicarbonate except in extremis.

Potassium

In diabetic ketoacidosis there is always massive depletion of total body potassium, although initial plasma levels may

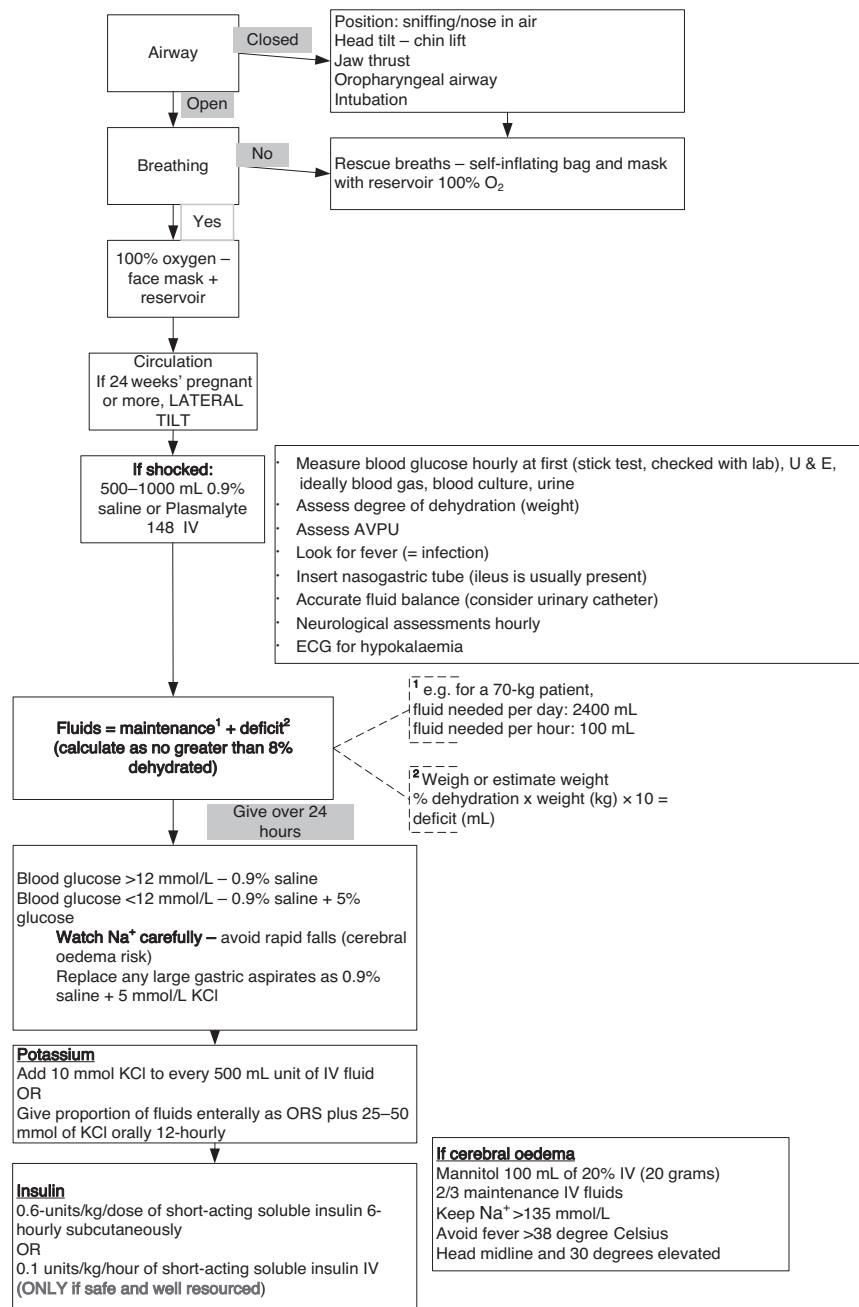


FIGURE 2.7.D.1 Pathway of care for severe diabetic ketoacidosis in pregnancy. AVPU scale: alert, responds to verbal stimulus, responds to pain, unresponsive; ORS, oral rehydration solution.

be low, normal or even high. Levels in the blood will fall once insulin is started.

- Do not give potassium if any of the following are present:
- anuria
- peaked T waves on the ECG
- serum potassium level > 7.0 mmol/litre.

If biochemical assessment of the K⁺ is not possible, it should be assumed that K⁺ replacement is necessary as long as the urine output is adequate, and there are no peaked T-waves present on the ECG (where available).

- In resource-limited settings, hypokalaemia is most safely corrected enterally using ORS with or without

additional oral potassium supplements (aim for a total of 100 mmol/day).

- Potassium rich foods may also be given, e.g. coconut milk and bananas.
- If oral supplementation is not possible or the patient is severely ill: start IV potassium supplements with 20 mmol/litre of IV fluid given after the start of initiating therapy with insulin and fluids as long as sufficient urine is being passed at > 30 mL/hour.
- Run the IV infusion (20 mmol in 1 litre over 4 to 8 hours (42 to 84 drops per minute (dpm) if using a standard IV giving set with a drop factor of 20). It should not be given at a rate exceeding 20 mmol in 2 hours (126 dpm) as this is dangerous. Given the difficulty in accurately

- monitoring transfusion rates without an electronic pump, a large margin of error should be used.
- Stop IV supplementation when the patient can take oral supplements.

Insulin

In **resource-limited settings**, give subcutaneous doses of short-acting soluble insulin 6-hourly at 0.6 units/kg/dose (i.e. 0.1 units/kg/hour). Give half the dose if the blood sugar level is falling too fast.

Always have an IV glucose solution (10% or 50%) available to treat any hypoglycaemia that develops.

In **well-resourced settings**, make up a solution of 1 unit/mL of human soluble insulin (e.g. Actrapid) by adding 50 units of insulin to 50 mL of 0.9% saline or Plasma-Lyte 148 in a syringe pump. Using a Y-connector, attach this to the IV fluids that are already running. Do not add insulin directly to the fluid bags. The solution should then run at 0.1 units/kg/hour (0.1 mL/kg/hour).

- If the blood glucose level falls by more than 5 mmol/litre/hour, reduce the infusion rate to 0.05 units/kg/hour.
- If the blood glucose level is less than 12 mmol/litre, and a dextrose-containing fluid has been started, consider reducing the insulin infusion rate.
- Do not stop the insulin infusion while dextrose is being infused, as insulin is required to switch off ketone production.
- If the blood glucose level falls below 7 mmol/litre, consider adding extra glucose to the infusion.
- If the blood glucose level rises out of control, re-evaluate the patient for sepsis or another condition.
- Discontinue the insulin infusion 30 minutes after the first subcutaneous injection, to avoid rebound hyperglycaemia.

Other management

Urine output

- Urinary catheterisation may be useful in patients with impaired consciousness.
- Document all fluid input and output.
- Test all urine samples for glucose and ketones.
- If a massive diuresis continues, the fluid input may need to be increased.

Gastric aspirate

- If large volumes of gastric aspirate occur, replace these volume for volume with 0.9% saline or Plasma-Lyte 148 plus 5 mmol/litre potassium chloride (KCl).

Biochemistry

- Check urea and electrolytes, blood pH/bicarbonate (if available), and laboratory blood glucose 2 hours after the start of resuscitation, and then at least 4-hourly.
- Do not expect ketones to have disappeared completely before changing to subcutaneous insulin.

Never give an IV insulin infusion without a syringe driver.

This is not safe. It is better to use a sliding scale of subcutaneous rapid-acting insulin.

Cerebral oedema

Cerebral oedema in DKA:

- is unpredictable
- occurs more often in new diabetics
- has a mortality of around 80%.

Signs and symptoms

These include the following:

- headache
- confusion
- irritability
- reduced conscious level
- fits
- small pupils
- increasing blood pressure
- slowing pulse
- possible respiratory impairment.

Management

- Exclude hypoglycaemia.
- Give 20 grams of 20% mannitol over 15 minutes **as soon as cerebral oedema is suspected**. Repeat every 4–6 hours.
- Restrict IV fluids to two-thirds maintenance, and replace the deficit over 72 hours rather than 24 hours.
- Arrange for the patient to be intubated. Keep the PaCO₂ in the range 3.5–5.0 kPa (if this is possible and sustainable).
- Keep the sodium (Na⁺) concentration higher than 135 mmol/litre.
- Keep the head in the midline and 30-degrees elevated.

If there is a fever, treat it actively with environmental measures, or with paracetamol, if more than 38.0°C.

2.7.E Reduced consciousness and coma

Introduction

In resource-limited countries, severe pre-eclampsia, eclampsia, malaria, meningitis (including TB), HIV infection, head injury and drug ingestion are the most common causes of reduced consciousness and coma in pregnancy.

Pathophysiology

Raised intracranial pressure (ICP) is an important component of the most severe cases. This can occur gradually

or rapidly (e.g. due to intracranial bleeding or cerebral oedema). The initial physiological compensating mechanisms include a reduction in the volume of cerebrospinal fluid and in the volume of venous blood within the cranium. However, when these fail, the cerebral perfusion pressure (CPP) falls and arterial blood flow to the brain is reduced.

Cerebral perfusion pressure (CPP) = mean arterial pressure (MAP) – intracranial pressure (ICP).

A severely increased pressure within the skull will

cause pressure effects which are classically recognised in two main sites where brain tissue is pushed against the bone:

- 1 **Central syndrome:** cerebellar tonsils herniate through the foramen magnum. This is known as **coning**. The syndrome consists of slowing pulse, rising blood pressure and irregular respiration.
- 2 **Uncal syndrome:** the uncus (part of the hippocampal gyrus) is pushed through the tentorium. It may be unilateral. This leads to third cranial nerve compression and ipsilateral dilated pupil, followed by oculomotor palsy and failure of lateral gaze. Later effects include hemiplegia.

Raised intracranial pressure (RICP)

In a patient with impaired conscious level or with a Glasgow Coma Scale score of < 9, who was previously well and is not post-ictal, the following signs indicate raised ICP:

Absolute signs of raised ICP:

Papilloedema

Absence of pulsation of retinal vessels

Signs suggesting raised ICP:

| | |
|---|--|
| Abnormal oculocephalic reflexes Do not test patients with neck injuries in this way | (a) Rotation of the head to the left or right normally causes the eyes to move in the opposite direction; abnormal if there is no response or a random response (b) Flexure of neck usually causes eye gaze deviation upwards; abnormal if there is loss of this reflex |
| Abnormal posture May need to be elicited by a painful stimulus | (a) Decorticate: arms flexed, legs extended (b) Decerebrate: arms extended, legs extended (see Figure 5.16.A.3) |
| Abnormal pupillary responses | Unilateral or bilateral suggests raised ICP |
| Abnormal breathing patterns | Ranges from hyperventilation to Cheyne–Stokes breathing to apnoea |
| Cushing's triad | Slow pulse, raised blood pressure and abnormal pattern of breathing – a late sign of raised ICP |

Primary assessment and resuscitation ABC

Call for help. Ideally an anaesthetist should be present to manage the airway and support breathing.

The first steps in the management of the patient with decreased conscious level are to assess and if necessary support airway, breathing and circulation.

Airway

The patient with a reduced level of consciousness is more likely to have a compromised airway as the tongue falls into the back of the mouth. There is also a risk of aspiration.

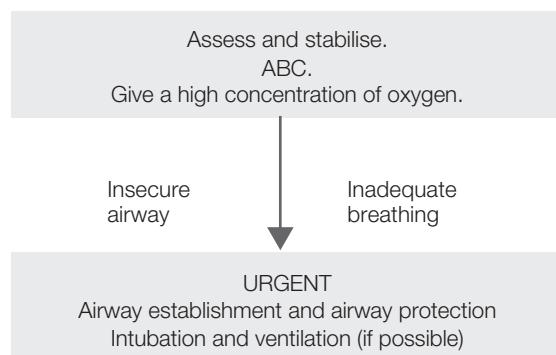
Look, listen and feel

Assess the airway, open it if closed and keep it open, either by assigning someone to continue airway-opening



FIGURE 2.7.E.1 The semi-prone or recovery position.

manoeuvres or by using adjuncts such as an oropharyngeal airway (see Section 1.13). Never use such an airway if the patient is conscious enough to have a gag reflex, as it may worsen airway obstruction and cause vomiting. Give oxygen at a rate of 15 litre/minute or as high a flow rate as is available, via a tight-fitting face mask with a reservoir bag. If an anaesthetist is present, intubation can be performed to protect the airway; otherwise adopt the recovery position (see Figure 2.7.E.1). Careful suction of the nose and/or mouth may be helpful.



The patient will require support if:

- breathing is insufficient
- gag or cough reflex is absent
- GCS score is < 9, or AVPU score is P or U
- there is impending herniation due to raised ICP
- there is evidence of effects of inadequate breathing on other systems.

If the airway is adequate, give high concentration O₂ and support breathing if required.

Breathing

Assess the breathing for depth and frequency, and give high-flow oxygen via a face mask and reservoir bag. If breathing is absent or inadequate (gasping or agonal breaths only), provide assisted ventilation using a bag-valve-mask with a reservoir and oxygen.

Inadequate airway and breathing in coma can lead to a rise in arterial pCO₂ that can cause a dangerous rise in intracranial pressure.

Circulation

Inadequate perfusion of blood to the brain initially produces confusion and later causes coma. Measurement of the blood pressure in addition to other markers for shock is

crucial in recognising hypovolaemia after haemorrhage, or unconsciousness after an eclamptic fit with hypertension.

If the intracranial pressure is high, cerebral perfusion will be compromised if hypotension occurs. However, excessive fluid administration should be avoided.

- Establish IV access quickly.
- Take blood samples and send them to the lab for a full blood count, blood smear for malarial parasites, electrolytes, liver function tests, blood glucose and blood culture.

Neurological failure

Assess neurological failure as follows:

- Use the AVPU scale.
- Check blood glucose levels: **If the blood sugar level is low or suspected to be low (< 2.5 mmol/litre or < 45 mg/dL)**, give 100 mL of 25% glucose IV over 15 minutes (dilute 50 mL of 50% glucose with 50 mL of Ringer-lactate or Hartmann's solution) and then give 10% dextrose in Ringer-lactate or Hartmann's solution over 4 hours (add 100 mL of 50% glucose to each 400 mL of Ringer-lactate or Hartmann's solution infused).
- Check the pupils for **signs suggesting raised intracranial pressure (RICP) or opiate overdose**.
- Check for **neck stiffness** which may suggest meningitis.
- Look for other signs of raised intracranial pressure, as outlined above.

Further assessment of conscious level can be aided by the Glasgow Coma Scale score and documentation of pupil function.

TABLE 2.7.E.1 Glasgow Coma Scale (GCS)

| Response | Score |
|--|-------|
| <i>Eye opening</i> | |
| Spontaneously | 4 |
| To verbal stimuli | 3 |
| To pain | 2 |
| No response to pain | 1 |
| <i>Best motor response</i> | |
| Obeys verbal command | 6 |
| Localises to pain | 5 |
| Withdraws from pain | 4 |
| Abnormal flexion to pain (decorticate) | 3 |
| Abnormal extension to pain (decerebrate) | 2 |
| No response to pain | 1 |
| <i>Best verbal response</i> | |
| Orientated and converses | 5 |
| Disorientated and converses | 4 |
| Inappropriate words | 3 |
| Incomprehensible sounds | 2 |
| No response to pain | 1 |
| <i>Total</i> | |

A GCS score of < 9 is likely to need airway protection by intubation if skills are available to undertake this safely.

TABLE 2.7.E.2 Pupillary changes

| Pupil size and reactivity | Causes |
|---------------------------|--|
| Small reactive pupils | Metabolic disorders Medullary lesion |
| Pinpoint pupil | Metabolic disorders Narcotic/organophosphate ingestion |
| Fixed mid-sized pupils | Midbrain lesion |
| Fixed dilated pupils | Hypothermia Severe hypoxaemic/ischaemic brain injury Barbiturate ingestion (late sign) During and post seizure Anticholinergic drugs |
| Unilateral dilated pupil | Rapidly expanding ipsilateral lesion Tentorial herniation Third cranial nerve lesion Epileptic seizures |

Secondary assessment and emergency treatment

Secondary assessment occurs after stabilisation of ABCD. During secondary assessment, continue to monitor the patient, and if there is any change, reassess ABC and treat any residual problems.

Diagnostic pointers

As soon as possible during resuscitation, gain as much information about the history as possible:

- the possibility of eclampsia, which means that magnesium sulphate may be required
- recent trauma
- endemic area for infections such as malaria, sleeping sickness and encephalitis
- pre-existing neurological problem
- past history of epilepsy
- ingestion of poisons
- underlying chronic condition (renal, cardiac, diabetes).

Remember to treat the treatable components. The cause of coma may not be certain, so it is always important to address ABC. If the patient's condition is unstable or deteriorating, return to ABC.

Always consider the possibility of eclampsia and the need for magnesium sulphate.

If there is no other clear cause for the coma treat with antibiotics for presumed meningitis (usually a third-generation cephalosporin, or whatever is locally available and appropriate), and in endemic areas, also treat as for cerebral malaria (see Section 2.8.D).

Take the patient's temperature (core and peripheral).

- **Fever** may be associated with sepsis (but lack of fever does not exclude sepsis) or poisoning (ecstasy, cocaine or salicylates).
- **Hypothermia** is found in poisoning with ethanol or barbiturates.

Rash: **purpura** suggests meningococcal disease; **bruises** suggest trauma (consider domestic violence).

Evidence of **poisoning**, ingestion or drug use: smell, residue around nose/mouth, needle tracks.

Other issues in addition to ABC regarding the management of coma

The prognosis depends on the cause of coma and the state of the patient, in particular the level of consciousness on admission, and the initial response to appropriate interventions. The presumptive cause of coma guides the treatment. Consider the following interventions:

- Assess and **maintain electrolyte balance** (avoid **hyponatraemia**: use Ringer-lactate or Hartmann's solution plus added 5% glucose, **not 1/5 N dextrose saline**. Add 50mL of 50% glucose to each 450mL of Ringer-lactate or Hartmann's solution infused). If possible keep the serum sodium level in the normal range (135–145 mmol/litre).
- Treat seizures if present, and give prophylactic **anticonvulsants** if the patient has repeated seizures.
- Insert a **nasogastric tube** to aspirate the stomach contents. Perform gastric lavage in circumstances such as drug ingestion.
- Regulate the body temperature, and **avoid hyperthermia** (i.e. temperatures above 37.5°C).
- Undertake appropriate medical management of **RICP**, if noted:
 - Support ventilation (maintain a pCO₂ of 3.5–5.0 kPa, if measurable).
 - Give mannitol, 20 grams of 20% mannitol IV over 15 minutes, 2-hourly as required, provided that the serum osmolality is not greater than 325 mOsm/litre (if measurable).
 - Give dexamethasone (for oedema surrounding a space-occupying lesion) 10mg initially IV, then 4mg IV 6-hourly for 48 hours.
- **Catheterisation** is needed for bladder care and output monitoring, as well as for avoidance of retention, which can worsen RICP.
- Plan for continued **regular clinical assessment**, mainly nursing observations.
- Prevent the patient from falling out of the bed.
- Provide nutritional support: parenteral and/or oral feeding to prevent malnutrition during the period of unconsciousness.
- Skin care: prevent bed sores by turning the patient.
- Eye padding: to avoid xerophthalmia.
- Family counselling, support and consent in the case of invasive procedures.
- Appropriate surgical intervention if indicated.
- Chest physiotherapy to avoid hypostatic pneumonia.
- Restrict fluids to 60% of maintenance if evidence of water retention is seen.
- Prevent deep vein thrombosis by physiotherapy.
- Maintain oral and dental hygiene.
- Give appropriate care for central and peripheral venous access to **avoid infection** by maintaining sterility when handling the sites.
- Prevent hospital-acquired infection.

Reassessment

When the patient is stable, undertake a full examination of systems and neurological examination.

- Skin: rash, bruising, haemorrhage, neurocutaneous stigmata.

- Scalp: trauma.
- Ears/nose: discharge (blood, serous fluid, infection).
- Neck: tenderness, stiffness/rigidity.
- Odour: poisoning, ingestion, metabolic disorders.
- Abdomen: liver, spleen.
- Eyes: pupils, fundi (papilloedema, retinal haemorrhages, sub-conjunctival haemorrhages), movements.

Also assess the following:

- AVPU and Glasgow Coma Scale scores: re-evaluate regularly.
- Posture/tone: lateralisation.
- Deep tendon reflexes: lateralisation.
- If there are lateralising signs, and if the patient is stable enough, consider a CT scan (if available).

The CT scan may show cerebral oedema, haemorrhages, or hypoxic/ischaemic encephalopathy.

Specific topics in coma

Meningitis or encephalitis

The following organisms cause meningitis:

- *Neisseria meningitidis*:
 - risk of mortality (> 5%) and permanent serious neurological sequelae.
- *Haemophilus pneumonia*:
 - less common where routine Hib vaccination is available.
- *Streptococcus pneumoniae*:
 - common in resource-limited countries
 - occurs with underlying immune compromise, especially HIV infection

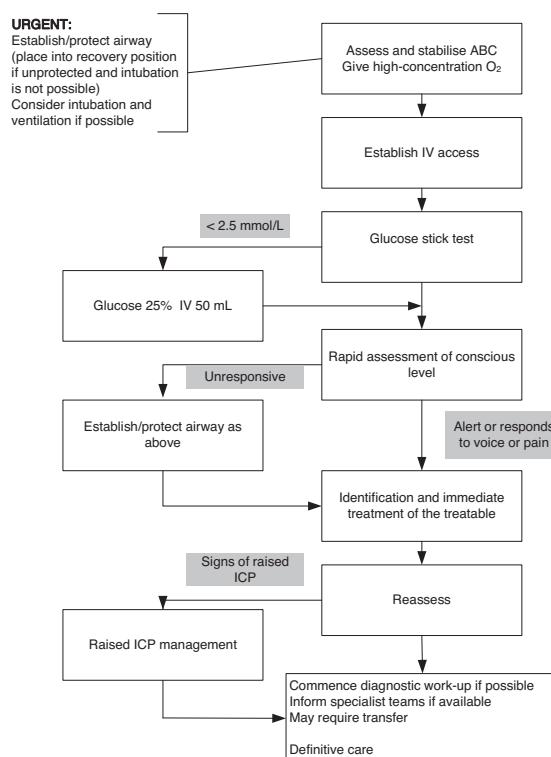


FIGURE 2.7.E.2 Pathway of care in coma. ABC, airway, breathing and circulation; ICP, intracranial pressure.

- may follow a head injury if there is damage to the dura and/or meninges.

There is a risk of coning and death if a diagnostic lumbar puncture is performed in a patient with significantly raised intracranial pressure.

- vomiting
- neck stiffness
- opisthotonus
- photophobia
- rash
- altered consciousness.

Diagnosis of meningitis or encephalitis

Classic signs and symptoms include the following:

- headache

Poisoning (see Section 7.4).

Malaria in pregnancy (see Section 2.8.D).

Eclamptic coma (see Section 2.5.E).

2.8

Infections complicating pregnancy, delivery and after birth

2.8.A Pneumonia

BOX 2.8.A.1 Minimum standards

- Oxygen.
- Antibiotics (IV and oral).
- Chest X-ray.

Clinical findings

A high fever is usually associated with pneumonia and bacterial tracheitis. In the absence of stridor and wheeze, breathing difficulties in association with a significant fever are likely to be due to **pneumonia**.

Examination of the chest may show reduced air entry, bronchial breathing and crepitations. Pleuritic chest pain, neck stiffness and abdominal pain may be present if there is pleural inflammation. Pleural effusions and empyema are complications.

Always consider HIV infection and TB.

Emergency treatment of pneumonia

- Assess ABC.
- Give oxygen through nasal cannulae or mask depending on flow rate required to maintain saturation (if available) as below.
- Attach a pulse oximeter (if available).
- Maintain SaO_2 in the range 94–98%, with nasal cannulae at a flow rate usually up to 5 litres/minute or if necessary by face mask with higher flow rates.

- Give antibiotics for 7 days:
 - ampicillin 2 grams IV/IM 6-hourly *plus* gentamicin 80 mg IV/IM 8-hourly or 5 mg/kg IV/IM every 24 hours for most cases of community-acquired pneumonia
 - cefuroxime 500 mg IV/IM 8-hourly or flucloxacillin 500 mg IM or IV slowly every 6 hours for suspected or bacteriologically diagnosed *Staphylococcus aureus*
 - erythromycin 500 mg every 6 hours orally for *Chlamydia* or *Mycoplasma pneumoniae*
 - or whatever is available locally and appropriate.
- Sit the patient upright.
- Maintain hydration.
 - Extra fluid may be needed to compensate for fluid loss from fever.
 - Fluid restriction may be needed because of inappropriate ADH secretion, revealed by oliguria < 30 mL per hour or rising blood urea levels.
- Chest X-ray is indicated.
- Large pleural effusions/empyemas should be diagnosed where possible by ultrasound, and pleural drainage undertaken under ultrasound cover (do not place a chest drain into the heart, liver or an undiagnosed tumour or hydatid cyst) (see Section 8.3). **Remember that in advanced pregnancy the diaphragm is elevated.**
 - Effusions/empyemas adjacent to the heart on the left side may cause pericarditis and cardiac arrhythmias. (Listen regularly for a pericardial rub, and ideally monitor an ECG if available until the patient is stable.)

2.8.B Severe dehydration and gastroenteritis

BOX 2.8.B.1 Minimum standards

- IV fluids containing appropriate amounts of sodium.
- Low-osmolarity oral rehydration solution (ORS).
- Nasogastric tubes.
- Urea and electrolyte measurements.
- Accurate weighing scales.

Introduction

Dehydration is loss of water, sodium and other essential electrolytes from the body. It causes death as a result of **shock** and **electrolyte emergencies** (see Section 2.5.A).

Dehydration is a common cause of hospital admission, most commonly due to **acute gastroenteritis** and **diabetic ketoacidosis** (see Section 2.7.D).

A rapid clinical assessment (with support from biochemical tests, if rapidly available) in the very sick is the

basis for treatment. The majority of patients can be treated with low-osmolarity oral rehydration solution (ORS) (by mouth or by nasogastric tube).

In patients with coincidental severe malnutrition, it is safer to use ORS with a lower sodium content, such as ReSoMal.

Classification of dehydration

Dehydration is classified according to clinical criteria. This may not apply in **severe malnutrition**, where caution is needed as signs may overlap and be misleading (see Section 5.10.B).

No dehydration (< 3% weight loss)

There are no clinical signs with this degree of dehydration, although there will be thirst in the fully conscious patient. The woman or girl who is not fully conscious will not feel thirsty.

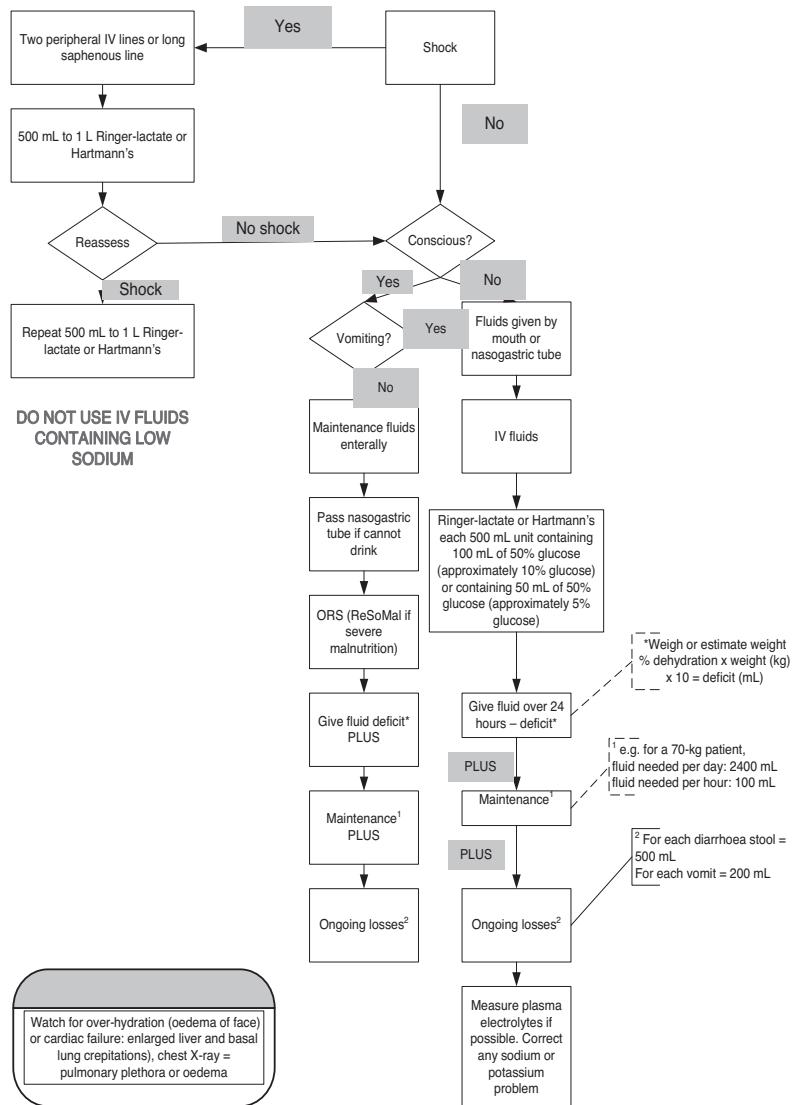


FIGURE 2.8.B.1 Pathway of care for gastroenteritis with severe dehydration (10% or more). ORS, oral rehydration solution.

Some dehydration (3–9% weight loss)

The following clinical signs are seen:

- increased thirst
- dry mucous membranes
- loss of skin turgor, tenting when pinched
- sunken eyes
- restless or irritable behaviour.

Severe dehydration ($\geq 10\%$ weight loss)

The following clinical signs are seen:

- more pronounced effects of the signs seen in moderate dehydration
- lack of urine output
- hypovolaemic shock, including:
 - rapid and feeble pulse (radial pulse may be undetectable)
 - low or undetectable blood pressure
 - cool and poorly perfused extremities
 - decreased capillary refill time (> 3 seconds): test this on the sternum of patients with light skins and on the thumbnail of those with dark skins
 - peripheral cyanosis
- rapid deep breathing (from acidosis)
- altered level of consciousness or coma.

Emergency treatment of severe dehydration

- Treat **shock** with an initial bolus of 1000mL of Ringer-lactate or Hartmann's solution (see Section 2.5.A).
- Decide on the cause (e.g. acute gastroenteritis, diabetic ketoacidosis).
- Classify the extent of dehydration (see above).
- Calculate the **fluid deficit** (see below), add this to the maintenance and ongoing losses and give over 24 hours.
- The major danger in rehydration (once shock has been treated) is causing the plasma sodium level to fall rapidly. This may increase the transfer of water into the brain and result in **cerebral oedema**.
- Before the electrolyte results are known, or if such testing is not available, the safest fluid to give is Ringer-lactate or Hartmann's solution.

If the serum sodium level is higher than 155 mmol/litre, aim to lower it slowly over 48 hours or longer.

Calculating fluid requirements**Deficit**

If an accurate recent pre-illness weight is available, subtract the current weight to estimate lost fluid (1 kg = 1 litre of fluid).

For example, a mother who weighed 70kg is seen with diarrhoea and a weight of 65kg.

In this case the estimated fluid loss is $(70 - 65)$ kg = 5 kg = 5000mL deficit (i.e. 7% dehydrated).

If no recent weight is available, or the weight value given is considered to be unreliable:

- Decide the degree of dehydration.
- Weigh the patient.
- Use the formula: **percentage dehydration \times weight (kg) $\times 10 =$ deficit (in mL)**.

For example, a mother whose weight is estimated to be 70kg is 8% dehydrated.

In this case the estimated fluid loss is $8 \times 70 \times 10 = 5600$ mL (233mL/hour if replaced over 24 hours).

Maintenance

Estimated maintenance fluid requirements are **2400mL/day** and **100mL/hour**.

Ongoing losses

- **For each diarrhoeal stool:** 500mL of ORS after each stool.
- **For each vomit:** 200mL of ORS after each vomit. Give small frequent volumes (e.g. 20mL every minute) with a spoon or syringe or cup.

Add deficit to maintenance and ongoing losses and aim to replace these over 24 hours.

For example, for a 70kg mother who is 8% dehydrated, maintenance is 100mL/hour, if there are no ongoing losses.

Total fluids needed per hour = 233mL/hour (deficit) + 100mL/hour (maintenance) = 333mL/hour.

Severe acute gastroenteritis in pregnancy

Gastroenteritis is a common cause of dehydration and shock. Management starts with ABC, followed by assessment of the fluid deficit (extent of dehydration) and ongoing losses of fluid. Weigh the patient and keep an accurate fluid balance chart.

It is important to give fluids that:

- correct the deficit
- provide maintenance
- replace ongoing losses.

Differential diagnosis

Look for an abdominal mass or abdominal distension.

Consider the following:

- HIV infections
- surgical conditions, such as acute appendicitis, peritonitis or bowel obstruction (if suspected, resuscitate and call for surgical opinion)
- typhoid (high-grade fever, rash, hepatosplenomegaly and toxicity)
- antibiotic-associated colitis
- (rarely) inflammatory bowel disease.

Treatment if not shocked

- Start low-osmolarity oral rehydration solution (ORS) with 1–2 litres over 2–4 hours.
- The carer should give small amounts of ORS (e.g. using a small cup) frequently.
- Gradually increase the amount as tolerated, using a tablespoon, cup or glass.
- After 12–24 hours, review progress with regard to rehydration and progress to the maintenance phase or continue rehydration.

Severe dehydration ($\geq 10\%$ fluid deficit with or without clinical signs of shock)

- If the patient is shocked, assess and manage ABC, give oxygen if available, and start IV fluids immediately (use two intravenous lines if possible: use long saphenous vein cut-down or the external jugular vein if venous access is difficult).

- Give a 500 mL or 1-litre bolus of Ringer-lactate or Hartmann's solution IV as rapidly as possible.
- Reassess pulse, perfusion (capillary refill time) and mental status, and repeat the bolus if these are still abnormal.
- Do not use low-sodium-containing IV fluids such as 0.18% saline with 4% glucose, which can be dangerous (they can cause hyponatraemia and cerebral oedema).** Instead use Ringer-lactate or Hartmann's solution, ideally also containing 10% glucose (obtained by adding 100 mL of 50% glucose to each 500 mL).
- Hypokalaemia is a major complication which needs urgent attention.** Ideally measure serum K⁺ levels frequently. Provided that the patient is passing urine and IV potassium can safely be given, it should be added to the IV fluids given subsequent to the boluses given to treat shock. Ideally and if tolerated, potassium should be corrected by giving low osmolarity ORS enterally as soon as possible.

If it is necessary to add potassium to IV fluids given to correct dehydration, particularly if diarrhea is continuing and if measured serum K⁺ is < 2.0 mmol/litre or there are ECG signs of hypokalaemia, namely ST depression, T-wave reduction and prominent U waves, and only if safe to do so, great care must be taken.

In acute depletion, an infusion at the rate of 0.1 to 0.2 mmol/kg/hour (6 to 12 mmol/hour for a woman weighing 60 kg) of IV potassium can be used and the serum K⁺ level checked after 3 hours. The potassium for injection **must** be diluted before use and thoroughly mixed before being given. **The maximum concentration of potassium that can be given through a peripheral vein is 40 mmol/litre. The maximum infusion rate of potassium is 0.5 mmol/kg/hour.** Remember that Ringer-lactate or Hartmann's solution both already contain 5 mmol/litre of potassium.

Note: The injectable form of KCl usually contains 1.5 grams (i.e. 20 mmol of potassium in 10 mL), and can be given orally. The daily potassium requirement is 1–2.5 mmol/kg.

When shock has resolved, and the patient's level of consciousness has returned to normal, the remaining estimated deficit **must be taken by mouth or by gastric tube**, especially if **severe malnutrition** and/or **anaemia** is present (giving large fluid volumes IV can precipitate heart failure).

Assess the patient's hydration status frequently.

Oral fluids

Recommendations for oral replacement therapy in gastro-enteritis are as follows:

- Give low-osmolarity ORS (containing 75 mmol/litre of sodium) or, if the latter is unavailable, ORS containing 90 mmol/litre of sodium with an additional source of low-sodium fluid (e.g. water).
- The amount given should be in the range 300–500 mL/hour.
- Giving high-osmolarity fluids may contribute to hyponatraemia, whereas giving water alone, or low-salt drinks, may cause hyponatraemia.
- Oral glucose within ORS enhances electrolyte and water uptake in the gut.
- 'Home-made' ORS can be prepared by adding a pinch of salt (1 mL) and a handful of sugar (5 mL) to a glass of clean potable water (250 mL).

Intravenous fluids

- Even in patients who are drinking poorly, try to give enteral fluids by mouth or by gastric tube until the IV infusion is running.
- Use Ringer-lactate or Hartmann's solution, which contains Na⁺ 131 mmol/litre, K⁺ 5 mmol/litre, HCO₃⁻ 29 mmol/litre and Ca²⁺ 2 mmol/litre.
- Hartmann's solution has no glucose to prevent hypoglycaemia. This can be corrected by adding 100 mL of 50% glucose to 500 mL of Ringer-lactate or Hartmann's, giving approximately a 10% glucose solution (adding 50 mL to 450 mL of Ringer-lactate or Hartmann's gives a 5% solution).
- Ringer-lactate or Hartmann's solution with 5% dextrose added has the advantage of providing glucose to help to prevent hypoglycaemia.
- See above regarding potassium supplementation.
- It is dangerous to use plain 5% glucose solutions, or 0.18% saline plus 4% glucose. They do not contain adequate electrolytes, do not correct the acidosis or hypovolaemia, and can cause dangerous hyponatraemia.**
- All patients should start to receive some ORS (at the rate of about 300 mL/hour) when they can drink without difficulty, which is usually within 1–2 hours. This provides additional base and potassium, which may not be adequately supplied by the IV fluid. Alternatively, give as soon as possible by gastric tube.

Over-hydration

Signs of over-hydration include the following:

- oedematous eyelids and generalised oedema, particularly ankle, facial and sacral oedema
- cardiac failure, especially in severe malnutrition or protein-losing enteropathy.
 - respiratory distress (raised rate and some chest wall recession)
 - tachycardia out of proportion to respiratory difficulty
 - raised jugular venous pressure
 - gallop rhythm/murmur
 - enlarged liver
 - basal lung crepitations.

A chest X-ray may be helpful for showing pulmonary plethora or oedema.

Management of over-hydration

- Stop giving ORS, but give plain water and food.
- Do not give a diuretic unless the patient is in cardiac failure.

When the oedema has resolved, resume giving ORS.

Reassess the following:

- ABC
- circulatory and hydration status
- plasma electrolytes if possible
- urine output and urine electrolytes
- give fluid according to plan; do not forget ongoing losses
- reassess regularly (including biochemistry if possible)
- do not forget glucose.

2.8.C HIV/AIDS

BOX 2.8.C.1 Minimum standards

- Prevention of mother-to-child transmission (PMTCT).
- Antiretroviral therapy (ART) for HIV-infected women.
- Health education and community support.

Introduction

Prevention of mother-to-child transmission (PMTCT) of the human immunodeficiency virus (HIV) is possible, even in resource-limited settings, and the World Health Organization guidance (*Recommendations for a Public Health Approach*) published in 2010 on antiretroviral drugs for treating pregnant women and preventing HIV infection in infants suggests that elimination of mother-to-child transmission of HIV (MTCT) is a realistic public health goal.

Since the previous WHO guidance was published in 2006, new evidence has emerged on the use of antiretroviral prophylaxis to prevent MTCT, on the optimal time to initiate antiretroviral therapy (ART), and on safe feeding practices for HIV-exposed infants. This section draws heavily from the WHO 2010 and 2013 guidelines, which should be used and adapted within local settings. Once implemented, these recommendations could reduce the risk of MTCT to less than 5% in breastfeeding populations (from a background risk of 35%), and to less than 2% in non-breastfeeding populations (from a background risk of 25%), and will ensure increased maternal and child survival.

A woman will only know her HIV status if she has had an HIV test. HIV tests may be performed as a bedside point of care test (using capillary blood) or within a laboratory. An HIV-positive mother will pass her antibodies to her baby. These are harmless and are usually cleared by 18–24 months of age. It is transmission of the HIV virus that causes infection. An infant will have circulating maternal antibodies until 18–24 months of age, so the HIV antibody test is often not useful before this time, as it remains positive until the maternal antibodies have cleared.

When HIV infection is recent or the CD4 count is high, and a pregnant woman has no symptoms, HIV has little effect on pregnancy, and pregnancy has little effect on HIV. However, when HIV infection is advanced or the CD4 count is low, a woman is at risk of opportunistic infections, and HIV can directly affect the pregnancy, including increasing the risk of premature delivery, severe malaria and puerperal sepsis.

MTCT can occur when the baby is in the uterus, during delivery or during breastfeeding. Pregnant women should be encouraged to be tested for HIV because, if they are found to be HIV-positive, there are interventions at each of these stages that reduce the risk of MTCT, and there is also treatment to preserve the mother's own health. A negative HIV test provides an opportunity for health education, including promoting safer sex (e.g. use of condoms) to avoid the woman becoming HIV infected, particularly during pregnancy. Acquiring HIV during pregnancy carries a high risk of transmitting HIV to an unborn baby. HIV-negative women should be offered a repeat HIV test in the third trimester.

'Adult-to-child transmission' or 'vertical transmission' are other ways of describing MTCT, and are sometimes felt to imply less blame.

Prevention of mother-to-child transmission and ART in pregnancy

The WHO 2010 guidelines state that a woman with a CD4 count of ≤ 350 cells/mm³ (regardless of WHO clinical staging) or WHO clinical stage 3 or 4 (irrespective of CD4 count) (*WHO Case Definitions of HIV for Surveillance and Revised Clinical Staging and Immunological Classification of HIV-Related Disease in Adults and Children*, published in 2007) requires lifelong ART.

Updated consolidated ART guidelines published by the WHO in 2013 (www.who.int/hiv/pub/guidelines/arv2013/art/artadults/en/index1.html) now recommend that all pregnant and breastfeeding women should be commenced on ART (one simplified triple regimen), and that this should be maintained for at least the duration of MTCT risk (i.e. throughout breastfeeding). They suggest that, particularly in generalised epidemics, all pregnant and breastfeeding women with HIV should initiate ART as lifelong treatment. In pregnancy the focus is no longer on 'when or what to start' but on 'whether to stop' treatment after delivery. Ideally, a CD4 count should be obtained before deciding whether ART for PMTCT only (i.e. stopping after delivery) is an option.

As most women should continue ART following delivery, an effective link with HIV treatment programmes is essential.

The WHO 2013 guidelines are simplified, and they harmonise the approach to ART in adults and pregnancy. National programmes are encouraged to move from the previous Option 'A' to Option 'B' or 'B+'.

Option B+: all pregnant and breastfeeding women infected with HIV should be started on ART as lifelong treatment. This is particularly important in generalised epidemics where high fertility, long duration of breastfeeding, limited access to CD4 to determine ART eligibility, and high partner serodiscordance rates all increase the risks of transmission to the woman's partner and babies.

Option B: in some countries (e.g. where CD4 counts are available), in the case of women who are not eligible for ART for their own health, consideration can be given to stopping the ARV regimen after the period of risk of mother-to-child transmission has ended.

Single-dose nevirapine (sdNVP) for women in labour is no longer recommended (unless it is combined with other ART) because it causes the virus to develop high levels of drug resistance.

Option A (from the 2010 WHO guidelines) is no longer recommended, although some countries may not have the resources necessary to use options B or B+.

The treatment focus is shifting to consider ART for the mother's health, to utilise more effective ART drugs, and to extend coverage throughout the MTCT risk period. **All women should be started on ART in pregnancy.**

TABLE 2.8.C.1 WHO guidelines for ART in pregnancy for HIV-infected women who have not had previous ART

| | For pregnant women for PMTCT only | For infants of mothers given a short course of ART for PMTCT |
|-----------------------------------|--|---|
| Option A (WHO 2010 guidelines) | AZT twice a day from 14 weeks sdNVP at onset of labour, and start AZT + 3TC for 7 days | Baby being breastfed: daily NVP from birth until at least 4–6 weeks of age <i>and</i> until 1 week after breastfeeding has stopped Baby being bottle-fed: daily NVP or sdNVP + AZT twice a day until 4–6 weeks |
| Option B | Preferred regimens: TDF + 3TC (or FTC) + EFV (as fixed-dose combination) Alternative regimens: AZT + 3TC + EFV or TDF + 3TC (or FTC) + EFV | Baby being breastfed: daily nevirapine (NVP) for 6 weeks Baby being bottle-fed: daily nevirapine (NVP) for 4–6 weeks or AZT twice a day for 4–6 weeks |
| | For pregnant women being given lifelong ART | For infants of mothers on lifelong ART |
| Option B+ | Preferred regimens: TDF + 3TC (or FTC) + EFV (as fixed-dose combination) Alternative regimens: AZT + 3TC + EFV or AZT + 3TC + NVP or TDF + 3TC (or FTC) + NVP | Baby being breastfed: daily nevirapine (NVP) for 6 weeks Baby being bottle-fed: daily nevirapine (NVP) for 4–6 weeks or AZT twice a day for 4–6 weeks |

Women diagnosed with HIV during labour or immediately postpartum

If a woman is diagnosed with HIV infection during labour or immediately postpartum, ART should be commenced immediately for PMTCT. This regimen can be modified later when the woman has been assessed (with CD4 count) with regard to whether she requires lifelong ART for herself.

Postpartum, women should be assessed and a CD4 count obtained. Ideally they should continue their triple-drug ART regimen lifelong unless their CD4 count is > 500 cells/mm³.

It will take weeks for the maternal viral load to be reduced, and therefore it is important to give the mother ART in labour which will cross the placenta (and enter the baby) in addition to starting ART prophylaxis in the infant.

TABLE 2.8.C.2 WHO guidance for ART for women diagnosed with HIV in labour/immediately postpartum

| | For the mother | For the infant |
|-----------|---|--|
| Option A | sd-NVP in labour and AZT + 3TC twice a day for 1 week | Baby being breastfed: |
| Option B | Start (triple) ART immediately. Continue until 1 week after exposure to breast milk has ended | Daily NVP from birth for 6 weeks, consider extending to 12 weeks Baby being bottle-fed: Daily NVP from birth for 6 weeks |
| Option B+ | Start (triple) ART immediately. Continue lifelong | |

If a woman is diagnosed with HIV infection postpartum and plans replacement (formula or bottle) feeding, refer her for HIV care and evaluation for treatment.

HIV-exposed infants (children born to women with HIV) should be given co-trimoxazole prophylaxis from 4–6 weeks of age, and this should be continued until HIV infection has been excluded and the infant is no longer at risk of acquiring HIV through breastfeeding (World Health Organization, *Guidelines on Co-Trimoxazole Prophylaxis for HIV-Related Infections among Children, Adolescents and adults: recommendations for a public health approach*, published in 2006).

are given her baby is more likely to be HIV-negative than infected.

Get close to her, greet her and be seen to shake hands with her, to help to reduce the stigma around touching those infected with HIV. Support her relatives, and encourage her to tell her partner so that he can be tested for HIV. Promote safer sex and advise her to use condoms to prevent transmission of HIV.

Standard precautions should be used when caring for women in labour, whether or not they have HIV infection. Always wear gloves when touching body fluids, and dispose of single-use syringes and needles safely.

During delivery, to reduce MTCT:

- **avoid artificial rupture of membranes**
- **avoid prolonged rupture of membranes**
- **avoid unnecessary episiotomy, but also avoid a tear.**

Both blood and placenta will contain HIV, so wear gloves, an apron and eye protection. Avoid direct contact of blood on your skin. Blood on intact skin should be washed off

Delivery

Labour can be a worrying time for the HIV-positive woman, particularly because of possible underlying fears about her own HIV infection and the risk of infecting her baby. She will need reassurance and support, and it is important to ensure she knows that with all of the interventions that

immediately. HIV-positive blood on an open wound or splashed into the eye can transmit HIV and should be washed immediately (use soap and water for a wound, and water for an eye) and managed in the same way as a needlestick injury (with post-exposure prophylaxis with ART).

Other considerations for managing HIV infection in pregnancy

Anaemia

Screening for and treatment of anaemia should be routine in antenatal care for all pregnant women (World Health Organization, *Pregnancy, Childbirth, Postpartum and Newborn Care: a guide for essential practice*, 2nd edn, published in 2009). Iron supplements and folate supplements in areas with a high prevalence of iron deficiency are indicated for all pregnant women regardless of haemoglobin levels. Iron should be continued for 3 months after delivery. If possible, antenatal screening for anaemia should include laboratory measurement of haemoglobin levels, but anaemia can be assessed clinically if this is not available.

In women with severe anaemia, AZT should be avoided, and TDF or stavudine (d4T) should be used instead.

Malaria and worm infestations

The prevention and treatment of malaria and worm infestations is necessary in high-prevalence areas (see Sections 2.8.D and 6.3.C).

HIV-2 infection

HIV-2 is much less transmissible than HIV-1 (the MTCT risk is 0–4%).

Non-nucleoside reverse transcriptase inhibitors (NNRTIs) such as NVP and EFV are not effective against HIV-2, and a triple nucleoside reverse transcriptase inhibitor (NRTI) combination is recommended.

BOX 2.8.C.2 Treatment of HIV-2 infection

Mother requires treatment: AZT + abacavir (ABC) + 3TC

PMTCT only: AZT from 14 weeks and continued until delivery

Infant of mother with HIV-2: AZT twice a day until 4–6 weeks

Tuberculosis

The risk of active TB increases in pregnancy, and is around 10 times higher in HIV-infected women. It is associated with increased maternal mortality, premature labour, low birth weight and tuberculosis in the infant. HIV-infected women must be assessed for TB at each visit; any woman with a cough, fever, night sweats and weight loss should be evaluated for TB and started on TB treatment. ART is also required regardless of the CD4 count. Commence TB treatment first, followed by ART as soon as clinically possible (within 8 weeks of starting TB treatment).

Rifampicin interacts with many antiretroviral drugs, especially the boosted protease inhibitors. As is the case for all adults, EFV is the preferred NNRTI for HIV/TB co-infected pregnant women (starting after the first trimester).

For those women on TB therapy who are unable to tolerate EFV, give a NVP-based regime or a triple NRTI regimen such as AZT + 3TC + ABC or AZT + 3TC + TDF. In the presence of rifampicin, start full-dose NVP (a lead-in dose is not required).

Summary

Interventions during pregnancy, labour and delivery and postpartum can all significantly reduce the risk of MTCT of HIV. Therefore all pregnant women should be tested for HIV. The WHO 2007 guidelines (www.who.int/hiv/pub/mtct/pmtct_scaleup2007/en/index.html) summarise the essential services required for good-quality antenatal care, and these are listed below.

Package of routine quality antenatal and postpartum care for all women, regardless of HIV status

- 1 Health education, information on HIV and sexually transmitted infection (STI) prevention and care including safer sex practices, pregnancy including antenatal care, birth planning and delivery assistance, malaria prevention, optimal infant feeding; family planning counselling and related services.
- 2 Provider-initiated HIV testing and counselling, including HIV testing and counselling for women of unknown status at labour and delivery, or postpartum.
- 3 Couple and partner HIV testing and counselling, including support for disclosure.
- 4 Promotion and provision of condoms.
- 5 HIV-related gender-based violence screening.
- 6 Obstetric care, including history taking and physical examination.
- 7 Maternal nutritional support.
- 8 Infant feeding counselling.
- 9 Psychosocial support.
- 10 Birth planning, birth preparedness (including pregnancy/postpartum danger signs), including skilled birth attendants.
- 11 Tetanus vaccination.
- 12 Iron and folate supplementation.
- 13 Syphilis screening and management of STIs.
- 14 Harm reduction interventions for injecting drug users.

Additional package of services for HIV-positive women

- 1 Additional counselling and support to encourage partner testing, adoption of risk reduction and disclosure.
- 2 Clinical evaluation, including clinical staging of HIV disease.
- 3 Immunological assessment (CD4 cell count) where available.
- 4 ART when indicated.
- 5 Infant feeding counselling and support based on knowledge of HIV status.
- 6 ART prophylaxis for PMTCT provided during the antepartum, intrapartum and postpartum periods.
- 7 Co-trimoxazole prophylaxis where indicated.
- 8 Additional counselling and provision of services as appropriate to prevent unintended pregnancies.
- 9 Supportive care, including adherence support.
- 10 TB screening and treatment when indicated; preventive therapy (INH prophylaxis) when appropriate.

- 11 Advice and support on other prevention interventions, such as safe drinking water.
- 12 Supportive care, including adherence support, and palliative care and symptom management.

Essential postnatal care for HIV-exposed infants

- 1 Completion of ART prophylaxis regimen.
- 2 Routine newborn and infant care, including routine immunisation and growth monitoring.
- 3 Co-trimoxazole prophylaxis.
- 4 Early HIV diagnostic testing and diagnosis of HIV-related conditions.
- 5 Continued infant feeding counselling and support, especially after early HIV testing.

- 6 Nutritional support throughout the first year of life, including support for optimal infant feeding practices, and provision of nutritional supplements and replacement foods if indicated.
- 7 ART for HIV-infected children when indicated.
- 8 Treatment monitoring for all children receiving ART.
- 9 INH prophylaxis when indicated.
- 10 Adherence support counselling for caregivers.
- 11 Malaria prevention and treatment where indicated.
- 12 Diagnosis and management of common childhood infections and conditions, and integrated management of childhood illness (IMCI).
- 13 Diagnosis and management of TB and other opportunistic infections.

2.8.D Malaria

Introduction

Malaria, particularly falciparum malaria, is an important cause of maternal mortality and postpartum morbidity, severe anaemia, miscarriage, intrauterine growth retardation, intrauterine death, stillbirth, premature delivery, low birth weight (LBW), and perinatal and neonatal morbidity.

Plasmodium falciparum malaria is the most dangerous type. *P. vivax* malaria is less dangerous. Malaria destroys red blood cells and can harm the placenta. The main danger with falciparum malaria is cerebral malaria, which causes coma and death.

In most endemic areas of the world, pregnant women are the main adult risk group for malaria. The burden of malaria infection during pregnancy is chiefly caused by *Plasmodium falciparum*, the most common malaria species in Africa. The impact of the other three human malaria parasites (*P. vivax*, *P. malariae* and *P. ovale*) is less clear. Every year at least 30 million pregnancies occur among women in malarious areas of Africa, most of whom reside in areas of relatively stable malaria transmission.

In sub-Saharan Africa, poor nutrition, micronutrient imbalances (particularly vitamin A, zinc, iron and folate), HIV co-infection, poverty and limited access to effective primary healthcare and emergency obstetric services exacerbate the impact of pregnancy-associated malaria.

In Africa, perinatal mortality due to malaria is around 1500 deaths per day. In areas where malaria is endemic, 20–40% of all babies born may have a low birth weight, increasing the likelihood of infant mortality.

Malaria in pregnancy is a particular problem for women in their first and second pregnancies, and for women who are HIV-positive.

Studies have shown that in high transmission zones more than 50% of women have placental malaria infections at birth. This increases the risk of HIV viral transfer (especially if the parasite load is high), and prevents the transfer of maternal antibodies protecting against measles.

Malaria in pregnancy in low versus high transmission areas

The clinical presentation and severity of malaria in pregnancy differ in areas of high and low transmission due

to differences in the level of immunity of the population. Although these settings are presented as two distinct epidemiologic conditions, in reality the intensity of transmission and immunity in pregnant women occurs on a continuum, with potentially diverse conditions occurring within a country.

In areas of epidemic or low (unstable) malaria transmission, adult women have not acquired any significant level of immunity and usually become ill when infected with *P. falciparum* malaria. Pregnant women resident in areas of low or unstable malaria transmission are at a two- or three-fold higher risk of developing severe disease as a result of malaria infection than are non-pregnant adults living in the same area. In these areas, maternal death may result either directly from severe malaria or indirectly from malaria-related severe anaemia. In addition, malaria infection of the mother may result in a range of adverse pregnancy outcomes, including spontaneous abortion, neonatal death, and low birth weight (LBW).

In areas of high and moderate (stable) transmission of malaria, most adult women have developed sufficient immunity that, even during pregnancy, *P. falciparum* infection does not usually result in fever or other clinical symptoms. In these areas, the principal impact of malaria infection is associated with malaria-related anaemia in the mother, and with the presence of parasites in the placenta. The resulting impairment of fetal nutrition contributing to low birth weight is a leading cause of poor infant survival and development. In areas of Africa with stable malaria transmission, *P. falciparum* infection during pregnancy is estimated to cause as many as 10 000 maternal deaths each year, 8–14% of all low-birth-weight babies, and 3–8% of all infant deaths.

The strategy for management of malaria in the pregnant population in **areas of high transmission** should include screening and treating of positive cases, intermittent presumptive treatment (IPTp) for rapid diagnostic test (RDT)-negative cases and use of insecticide-treated bed nets (ITNs).

In high transmission areas, in women who are known to be HIV-positive, or where the prevalence of HIV exceeds 10%, IPTp should be given monthly (and at least four times during pregnancy), see below.

In **areas of low transmission** the risk of malaria infection during pregnancy is greater, and can result in maternal death, and in spontaneous abortion in up to 60% of cases. Silent malaria is rare. The strategy in these areas involves

ITNs, screening and treatment of positive cases, chemoprophylaxis if possible, and early diagnosis and prompt effective treatment of malaria.

TABLE 2.8.D.1 Comparison of occurrence of complications in areas of high and low transmission

| Complication | Hyper-endemic areas | Low transmission |
|---------------------|---------------------|------------------|
| Hypoglycaemia | – | ++ |
| Severe anaemia | +++ | +++ |
| Pulmonary oedema | – | ++ |
| Acute renal failure | – | ++ |
| Hyperpyrexia | + | +++ |
| Placental malaria | +++ | +++ |
| LBW babies | +++ | +++ |
| Abortions | – | +++ |
| Congenital malaria | – | +++ |

A pregnant woman who has not lived in a malarious area has no immunity. Therefore if she goes to a malarious area she is at risk of developing severe malaria. She must take tablets to prevent malaria before she goes to that area and throughout her pregnancy, and sleep under a bed net when she gets there.

If a mother has had malaria before, she will have some immunity. Unfortunately, pregnancy reduces immunity. She is at risk from severe anaemia, but the other complications are unusual. Often her blood film will be negative, and she will have few symptoms. If she has fits they will probably be caused by eclampsia or meningitis, not malaria.

Partially immune primigravid mothers are at particular risk, especially during the last trimester. Early teenage primigravida are at greatest risk. This risk decreases with further pregnancies.

Screening and treating pregnant women during antenatal care

Since in most African countries over 70% of pregnant women make multiple antenatal clinic visits, these provide a major opportunity for prevention of malaria, along with other important diseases that affect pregnant women.

The rationale for screening and treating all pregnant women for malaria during routine antenatal care is that **even one attack at any time during pregnancy can have serious consequences** (i.e. low birth weight and maternal anaemia).

There is a four-pronged approach to malaria prevention and control during pregnancy:

- 1 intermittent preventive treatment (IPTp)
- 2 insecticide-treated bed nets (ITNs), or preferably long-lasting insecticide-treated bed nets (LLINs)
- 3 indoor residual spraying (IRS) with insecticides
- 4 case management of malaria illness.

Intermittent preventive treatment (IPTp)

This involves providing all pregnant women with preventive treatment doses of an effective antimalarial drug during routine antenatal clinic visits. This approach has been shown to be safe, inexpensive and effective. A study in Malawi evaluating IPT showed a decline in placental infection (from

32% to 23%) and in the number of low-birth-weight babies (from 23% to 10%). It also found that 75% of all pregnant women took advantage of IPTp when it was offered.

The drug recommended at present is sulphadoxine/pyrimethamine (SP, also called Fansidar). Starting as early as possible in the second trimester, IPTp-SP is recommended for all pregnant women in Africa at each scheduled antenatal care (ANC) visit (four visits are recommended by WHO during every pregnancy) until the time of delivery, provided that the doses are given at least one month apart. SP should not be given during the first trimester of pregnancy; however, the last dose of IPTp-SP can be administered up to the time of delivery without safety concerns.

IPTp-SP should ideally be administered as directly observed therapy (DOT) of three tablets sulfadoxine/pyrimethamine (each tablet containing 500 mg/25 mg SP) giving the total required dosage of 1500 mg/75 mg SP.

In areas where malaria is very common and antenatal clinic attendance is poor, all mothers, especially all primigravida, should be given a dose of SP when they first come to the antenatal clinic after quickening (when the mother first feels the fetus moving).

Although high levels of resistance to SP occur in many countries, it is not known at what level of SP resistance IPTp still gives a positive outcome in terms of improved haemoglobin levels in the mother and higher birth weights. A preventative effect provided by SP seems to exist even at relatively high levels of resistance.

For pregnant women who are HIV-positive, the dosage schedule for IPT should be augmented to at least four doses of SP, starting in the second trimester, the doses being given at least 1 month apart. This increased frequency is also recommended for all pregnant women with unknown HIV status living in areas of high HIV prevalence (over 10%).

Women who are HIV-positive experience increased vulnerability to malaria in all pregnancies, not just the first two pregnancies.

Note: HIV patients who are receiving co-trimoxazole preventive therapy should not take IPTp as adverse effects can occur.

Research to assess the safety, efficacy and programme feasibility of other antimalarial drugs for use in IPTp is ongoing.

Weekly chloroquine has in the past been shown to be effective in preventing malaria in pregnancy, especially in the case of *P. vivax* malaria. Adherence to this regime and loss of efficacy in the case of *P. falciparum* malaria make this regime less appropriate.

Insecticide-treated bed nets (ITNs) and long-lasting insecticide-treated bed nets (LLINs)

Nets decrease both the number of malaria cases and the malaria death rates in pregnant women. A study in an area of high malaria transmission in Kenya has shown that women who are protected by ITNs every night during their first four pregnancies produce 25% fewer underweight or premature babies. In addition, ITN use benefits the infant who sleeps under the net with the mother, by decreasing their exposure to malaria infection. ITNs should be provided to pregnant women as early in pregnancy as possible, and their use should be encouraged for women throughout pregnancy and during the postpartum period. Health education programmes, social marketing and lobbying to reduce the prices of ITNs and re-treatments are helping to encourage the use of ITNs by pregnant women.

Indoor residual spraying (IRS) with insecticides

IRS involves applying a long-lasting (residual) insecticide to the inside walls of houses and other structures where people sleep, to kill mosquitoes when they rest on the walls. It is a highly effective malaria prevention method in settings where it is epidemiologically and logistically appropriate. IRS must be applied prior to the transmission season (either annually, or twice a year if there are continuous or multiple seasons of transmission), and is carried out by a trained cadre of workers who move through a community spraying all appropriate structures. Its full potential is realised when at least 80% of houses in targeted areas are sprayed. Indoor spraying is effective for 3–6 months, depending on the insecticide used and the type of surface on which it is sprayed. DDT can be effective for 9–12 months in some cases. Longer-lasting forms of IRS insecticides are under development. The WHO approves the following pyrethroid class of pesticides; lambda-cyhalothrin, bifenthrin, alpha-cypermethrin, deltamethrin, cyfluthrin and etofenprox.

Case management of malarial illness

In areas of unstable (infrequent) *P. falciparum* malaria transmission, non-immune pregnant women exposed to malaria require prompt case management of febrile illness. Although at present there are no fully effective tools to prevent malaria among non-immune women, ITNs will decrease exposure to infective mosquito bites, and thus would be expected to be of benefit in decreasing symptomatic infections. Essential elements of the antenatal care package should therefore include malaria diagnosis, where available and needed, and treatment with antimalarial drugs that have an adequate safety and efficacy profile for use in pregnancy.

In view of the increasing evidence of the severe effects of malaria in pregnancy on both the woman and her unborn child, even when asymptomatic, all pregnant women presenting for antenatal care or delivery should be tested using an RDT. Since the sensitivities of both RDT and smear to detect low parasitaemias in pregnancy are not infallible, **both are recommended** where this is programmatically possible. Where this is not possible, RDTs are to be preferred.

All women who are found to be positive should receive an effective antimalarial drug, namely quinine in the first trimester and artemisinin-combination therapies (ACT) in the second and third trimesters. If they are found to be negative, they should receive a dose of SP as IPTp. Women should not be screened more often than monthly in the absence of signs or symptoms of malaria.

Patients with severe anaemia (haemoglobin < 7 g/dL) in a high transmission zone are in all probability infected, and should be treated with an effective antimalarial drug as well as iron/folic acid even if there are no other signs of malaria and negative smear or RDT, or if laboratory tests cannot be undertaken.

All patients with a positive biological test (RDT and/or microscopy) should be treated with an effective antimalarial drug. If you suspect malaria, but cannot examine a blood film or do an RDT, treat the mother anyway.

Asymptomatic (placental) malaria has the same implications in pregnant women as symptomatic malaria. Asymptomatic women should be routinely tested and treated.

In high transmission zones, many women suffer minor attacks of malaria for which they do not seek treatment. However, the placenta can still be infected. Women should be advised at each antenatal visit to come for treatment even if their symptoms are minor. **Both RDTs and smears may miss cases of placental malaria.** Because of the inability of biological tests to reliably detect placental malaria, patients with a negative biological test should receive SP as IPTp both to treat an undetected infection and to prevent further infection.

In low transmission zones, anaemia without a positive biological test and without symptoms or signs of malaria such as fever is probably due to other causes, and such patients should not automatically receive an antimalarial drug, but should be treated for the underlying cause (including treatment with iron and folate tablets).

RDTs versus microscopy in pregnancy

There is indirect evidence that only 30% of cases with placental malaria show peripheral parasitaemias. Although there is little evidence, it is more likely that RDTs will detect sequestered parasites because of accumulated antigenic product.

In Thailand and Assam, studies found that RDTs missed cases of parasitaemia found on slides (2.5% of patients in Assam). This is a much lower number of cases than the number missed by smears.

Ideally, use of both RDT and microscopy would detect most cases. However, this is usually impractical in the field setting. RDTs are preferable to microscopy in this setting for the detection of subclinical infections.

In cases of *P. vivax* malaria, placental malaria is difficult to detect. However, placental *P. vivax* malaria occurs infrequently because vivax malaria does not sequestrate. Detection of parasites in vivax is best done by microscopy.

Treatment of malaria

Drug safety in pregnancy

Guidelines on the treatment of malaria in pregnancy are made difficult by the lack of evidence about the safety of ACTs in pregnancy.

The recommendation is to ask the woman if she is

pregnant, and if she is not, to treat her with ACT. This is a pragmatic recommendation based on the fact that no serious adverse effects have yet been recorded in women who were inadvertently given ACT in the first trimester, and the fact that a 7-day course of quinine is rarely adhered to.

As a change from previous recommendations, the combination of artemether and lumefantrine (AL) is now considered as safe (or as unsafe) as the other combinations of AS + AQ, AS + SP and AS + MQ.

Drug resistance of *P. falciparum* to chloroquine and the antifolates has arisen throughout malaria-endemic areas.

Combination therapy (**artemisinin-combination therapies, or ACTs**) is considered best for malaria management (artemisinin-based compounds in combination with other classes of antimalarial drugs).

ACTs are highly effective and may help to delay development of resistance. It is important to ensure wide access to these drugs through effective delivery systems and affordable cost.

The risks of ACT in the **second and third trimester** are low. During these phases of pregnancy, ACTs should be used to treat both clinical and subclinical infections, due to the serious outcomes of these infections.

Quinine should always be used in the **first trimester**. However, if the life of the woman is threatened (i.e. when the risk to the mother outweighs the theoretical risk to the fetus), an ACT should be prescribed. Malaria is less often resistant to **quinine** than it is to other drugs, and this drug may be safely used throughout pregnancy if ACTs are not available.

ACTs in pregnancy: the use of ACTs in pregnancy has not been widely studied, but all of the current evidence points to their relative safety, even in the first trimester. Research into the safety and pharmacokinetics of antimalarial drugs in pregnancy is ongoing.

The following ACTs (arranged in alphabetical order) are currently recommended by the WHO for the treatment of uncomplicated *P. falciparum* malaria:

- artemether (ATM) + lumefantrine (LM): combined (fixed-dose combination, FDC) tablets ATM 20mg/LM 120mg in blister packs.
 - **Dose:** On day 1 give 4 tablets and then repeat 4 tablets between 8 and 12 hours later. Then give 4 tablets twice daily in the morning and evening on days 2 and 3.
 - Advise the patient to take doses with food, preferably fatty food. Consider supplying dried milk powder or Plumpy'Nut® to take with tablets.
- artesunate (AS) + amodiaquine (AQ): combined (fixed-dose combination, FDC) tablets AS 100mg/AQ 270mg in colour-coded blister packs.
 - **Dose:** 2 tablets per day for 3 successive days.
- artesunate (AS) + mefloquine (MQ): AS = 50mg tablets, MQ = 250mg tablets as base.
 - **Dose:** give 4 tablets of AS on days 1, 2 and 3, and 6 tablets of MQ on day 1 **and** 2 tablets of MQ on day 2 (or 8 tablets on day 1 only).
- artesunate (AS) + sulfadoxine + pyrimethamine (SP): AS = 50mg tablets, SP = 25mg (S) + 500mg (P).
 - **Dose:** give 4 tablets of SP on days 1, 2, 3 and 4 **and** 3 tablets of SP on day 1.
- dihydroartemisinin (DHA) + piperaquine (PQP): combined (fixed-dose combination, FDC) tablets DHA 40mg/PQP 320mg.

- **Dose:** mother weighing 50–60 kg, 1 tablet three times a day for 1 day; mother weighing 60–70 kg, 1 tablet three times a day for 1 day plus additional ½ tablet at onset of day 1.

- quinine = usually 200 mg and 300 mg tablets.
 - **Dose:** give 600 mg 8-hourly over the first 24 hours or 30 mg/kg/day in three divided doses at 8-hourly intervals.
 - In South-East Asia where quinine sensitivity appears to be reduced, add clindamycin 7–13 mg/kg every 8 hours for 5 days.

Most pregnant women with malaria also lack folate, so give them folate tablets 5 mg daily.

If a pregnant woman is not immune, that is if she comes from an area without malaria transmission, she must have regular malaria tablets throughout pregnancy, especially in the last trimester.

Severe complicated malaria

This is usually *P. falciparum* malaria.

Severe malaria is a complex multi-system disease, and is a medical emergency.

Mortality approaches 100% without treatment, and death often occurs within the first few hours. Prompt initiation of antimalarial treatment in peripheral healthcare facilities and comprehensive management in hospital are necessary to prevent deaths.

Care should be provided within 15 minutes of arrival at a healthcare facility. **Triage systems** should be in place to pick up severely ill patients, referral should be rapid, and emergency facilities should be instituted in hospitals, with a high standard of medical and nursing care available 24 hours a day.

Any seriously ill or unconscious patient in a malaria endemic area must be tested for malaria by RDT (remember that parasites may not be present in the peripheral blood of a patient with cerebral malaria).

Even if a diagnostic test is not available, **the patient should be given an antimalarial drug (IV, IM or rectally, depending on the skill of the staff in the facility) before transfer to the hospital.** This can be repeated if transfer is impossible or is delayed for more than 12 hours. **A note of what has been given should be sent with the patient as soon as transfer can be arranged.**

Clinical features of severe malaria (WHO 2013)

- impaired consciousness (including unrousable coma)
- prostration, i.e. generalised weakness so that the patient is unable to sit, stand or walk without assistance
- multiple convulsions: more than two episodes within 24 hours
- deep breathing and respiratory distress (acidotic breathing)
- acute pulmonary oedema and acute respiratory distress syndrome
- circulatory collapse or shock, systolic blood pressure < 80 mmHg in adults and < 50 mmHg in children
- acute kidney injury
- clinical jaundice plus evidence of other vital organ dysfunction
- abnormal bleeding.

If any doubt exists about the diagnosis, it is safer to treat than not to treat before transfer.

Immediate measures (in hospital)

- Vital signs: temperature, pulse, blood pressure, and rate and depth of respiration.
- State of hydration.
- Estimation or measurement of body weight.
- Level of consciousness (AVPU or Glasgow Coma Scale scores).
 - The depth of coma may be assessed rapidly by observing the response to standard vocal or painful stimuli (rub your knuckles on the woman's sternum; if there is no response, apply firm pressure on the thumbnail bed).
- RDT and malaria smear (thick and thin film) for diagnosis and for continued monitoring of the progress of the disease. **Do not wait for a malaria smear result before initiating treatment, as it can take up to an hour.** If the RDT is positive, commence treatment immediately.
- Perform a lumbar puncture if the patient is unconscious, to eliminate meningitis.
- Measurement of glucose (finger prick test), haemoglobin, haematocrit and packed cell volume (PCV).
- Group and cross-match blood and **search for a suitable donor if there are no blood banking facilities.**
- Parenteral treatment (see below for details):
 - First choice: IV artesunate (2.4 mg/kg by slow IV injection at 0, 12 and 24 hours).
 - Second choice: IM artemether (loading dose of 3.2 mg/kg followed by 1.6 mg/kg every 24 hours).
 - If artemisinins are not available or the Ministry of Health has not authorised their use, commence with a loading dose of quinine 20 mg/kg (generally given in 10% dextrose to reduce the risk of hypoglycaemia) by slow infusion over 4 hours, followed by 10 mg/kg over 4 hours, every 8 hours for a minimum of 3 doses and continued until the patient is able to tolerate oral drugs. A full course of oral antimalarials must be completed once IV quinine has been discontinued. The loading dose of quinine may be omitted if the patient has definitely received a treatment dose of quinine within the previous 12 hours.

Every effort should be made to convince the Ministry of Health to allow the use of artemisinins to treat severe malaria in hospital, as mortality may be reduced by up to 30% over the use of quinine.

Additional measures where needed

- Insert a nasogastric tube to minimise the risk of aspiration pneumonia if the patient's level of consciousness is low. This can also be used to give food to prevent hypoglycaemia if the patient is unconscious for a long period and is unable to eat.
- Monitor for hypoglycaemia by laboratory or bedside testing if available (see below for more detailed advice).
- Insert an IV cannula and restore circulating volume.
 - Fluids should be given with caution and the need for them assessed on an individual basis after ascertaining the nutritional status and degree of dehydration present (see below for more details).
- In general, patients with metabolic acidosis who have not previously received parenteral fluids are dehydrated

and should be managed accordingly (see below for more details).

- Give oxygen, especially if metabolic acidosis is suspected or shock is present.
- Treat severe anaemia with a safe blood transfusion if the patient is showing signs of decompensation.
- Give anticonvulsants (diazepam is preferred initially, then phenytoin if convulsions persist) if the patient is fitting, to prevent long-term neurological damage (see below for more details).

Convulsions are common before or after the onset of coma. They are significantly associated with morbidity and sequelae. They may present in a very subtle way. Important signs include intermittent nystagmus, salivation, minor twitching of a single digit or a corner of the mouth, and an irregular breathing pattern.

- Prophylactic anticonvulsants have been recommended in the past, but recent evidence suggests that **phenobarbital is harmful.**
- IV broad-spectrum antibiotics should be given routinely in an unconscious patient.

The patient will need intensive nursing care at least until they regain consciousness. They may urgently need glucose or a blood transfusion if hypoglycaemia or haemolysis is severe.

Special issues with regard to severe malaria in pregnancy

Severe malaria is malaria with severe drowsiness, coma, vomiting, inability to walk, jaundice, fits or pulmonary oedema. These women are usually non-immune multi-gravida, or semi-immune primigravida, with *P. falciparum* malaria.

Severe malaria in pregnancy may be misdiagnosed as eclampsia. **If a pregnant woman living in a malarial area has fever, headaches or convulsions and malaria cannot be excluded, it is essential to treat the woman for both malaria and eclampsia.**

Pregnant women with severe malaria are particularly prone to hypoglycaemia, pulmonary oedema, anaemia and coma.

Malaria is especially dangerous during the last trimester.

Malaria drug treatment in pregnancy

Treat malaria in pregnancy urgently and early!

Calculate the dose in mg/kg. If you cannot weigh the patient, an average pregnant woman weighs about 60 kg, a small woman weighs around 50 kg and a large woman in resource limited settings around 80 kg.

Where available, artesunate IV/IM or artemether IM are the drugs of choice in the second and third trimesters. Their use in the first trimester must balance their advantages over quinine (better tolerability and less hypoglycaemia) against the limited documentation of pregnancy outcomes. **Artemesinin and artesunate** may be given rectally.

IV/IM artesunate

Artesunate IV/IM: 2.4 mg/kg by direct IV injection (over 5 minutes) or IM injection at 0, 12 and 24 hours, then once daily until oral therapy is possible.

A solution for parenteral use should be prepared for either IV (10 mg/mL) or IM (20 mg/mL) use, following the

manufacturer's instructions, using the sodium bicarbonate and saline solution supplied to dilute the concentrated artesunate.

For a small pregnant woman (estimated body weight 50kg), each dose would be 12mL IV (10mg/mL) or 6mL IM (20mg/mL).

Artesunate IM should be administered in the antero-lateral thigh, drawing back before injection to ensure that the needle is not in a vein.

IM artemether

Artemether IM: loading dose is 3.2 mg/kg on day 0, followed by 1.6 mg/kg daily for at least two more doses; then continue until oral therapy is possible. A full course of oral therapy should be taken once IM therapy is discontinued.

An 80mg/mL presentation is preferred to reduce the volume of the injection.

For a small pregnant woman (estimated body weight 50 kg) each dose would be 2mL IM (80 mg/mL).

Artemether IM should be administered in the antero-lateral thigh, drawing back before injection to ensure that the needle is not in a vein.

Artemether is not well absorbed in shock, and in this situation an alternative treatment (parenteral or rectal artesunate, or IV quinine) should be chosen.

Rectal artesunate

- It is recommended that this should be available in all rural settings, including those with trained village healthcare workers.
- It can be given at 12-hourly intervals.
- The minimum dose is 10mg/kg. Larger doses are not harmful, but are not more effective.
- It can also be given to vomiting patients, or those unable to tolerate oral drugs.
- Rectal artesunate must always be followed by a full course of ACT when the patient is able to take oral drugs.

At present the WHO only recommends rectal artesunate as a pre-referral treatment. Where referral is not possible, ensure that a full course of ACT is given as soon as the patient is able to take oral treatment.

Artesunate is available as a rectal capsule: Rectocaps (Mepha), 50mg and 200mg.

A WHO-approved rectal capsule is to be available soon, as 100mg and 400mg presentation.

The dose is 10mg/kg, and therefore an average-sized mother needs 600mg per dose. Give three 200mg rectal suppositories at 0, 12, 24, 36, 48 and 60 hours.

Follow-on treatment

When the patient has received at least three parenteral doses of artesunate or artemether, and is able to tolerate oral intake, give a full course (3 days) of **ACT** orally.

Quinine dihydrochloride

Always give quinine with glucose.

Do not confuse doses of salt and base. Quinine is usually prescribed as the salt (10mg of quinine dihydrochloride = 8.3mg of base).

Loading dose

Infuse quinine dihydrochloride 20 mg/kg body weight (usually 1.2 grams for the average 60kg pregnant woman) in

500mL of IV fluids (Ringer-lactate or Hartmann's solution plus 5% or 10% glucose) over 4 to 8 hours. Do not let it go in too quickly. Quinine is usually available in 2-mL ampoules of 150mg/mL, where 1.2g thus corresponds to 8mL.

Do not give quinine in 5% dextrose solutions, as there is a danger of hyponatraemia. Add 50mL of 50% glucose to 500mL of Ringer-lactate or Hartmann's solution to produce Ringer-lactate or Hartmann's plus 5% glucose solutions. Add 100mL of 50% glucose to 500mL of Ringer-lactate or Hartmann's solution to give 10% glucose solutions.

Never give an IV bolus injection of quinine, as it is likely to cause cardiac arrest.

- If it is definitely known that the mother has taken an adequate dose of quinine (1.2 grams) within the preceding 12 hours, do not give the loading dose. Proceed with the maintenance dose (see below).
- If the history of treatment is not known or is unclear, give the loading dose of quinine.

Alternatively, omit the loading dose if the patient has received three or more doses of oral quinine in the last 48 hours, or mefloquine or halofantrine within the last 3 days.

- Wait 8 hours before giving the maintenance dose.

Maintenance dose

Infuse quinine dihydrochloride 10mg/kg body weight (usually 600mg for the average pregnant woman) in 500mL of fluids (as above) IV over 4 hours. Repeat every 8 hours (i.e. quinine infusion for 4 hours, no quinine for 4 hours, quinine infusion for 4 hours, etc.) for 24 hours and then change to oral medication if the woman is conscious and able to swallow safely.

For follow-on oral treatment, give a **3-day course of ACT or 7 days of oral quinine**. If the combination AS + MQ is used, wait 12 hours after the last dose of quinine before giving MQ. Do not use AS + MQ if the patient developed neurological signs during the acute phase.

The dose of oral quinine dihydrochloride or quinine sulphate is 10mg/kg body weight (usually 600mg for the average size of pregnant woman) by mouth every 8 hours to complete 7 days of treatment. Ask the patient to swallow the tablets quickly with milk.

Monitor blood glucose levels for hypoglycaemia every hour while the patient is receiving quinine IV.

Quinine may increase the risk of hypoglycaemia, and it may cause haemolysis in patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency, which may result in the passage of haemoglobin in the urine (this is called **blackwater fever**).

Make sure that plenty of fluids are given so that the urine output is adequate. Keep a strict fluid balance chart. Monitor the volume of fluid that you give, and the urine output. Do not overload with fluid.

If the haemoglobin level falls below 6g/dL, try to give blood, but observe closely for fluid overload. When the patient is improving, give iron and folate tablets.

Intramuscular quinine

If you cannot place an IV line, you can give quinine IM, at a strength of not more than 60mg/mL. Some ampoules are 60mg/mL (usually 10-mL ampoules). Some ampoules are 300mg/mL or 600mg/mL. Dilute these in 0.9% saline or Ringer-lactate or Hartmann's solution to a concentration of

60 mg/mL (e.g. 600 mg of quinine in 10 mL of saline). If you do not dilute quinine, the mother may develop an injection abscess. Use the same dose as you would give IV. Give half the dose into each anterior thigh.

When giving quinine by IM injection, regularly draw back to ensure that the needle is not in a vein, as an IV injection of quinine is likely to cause cardiac arrest.

Fluid replacement

If the patient is unable to drink, maintain daily fluid requirements using the nasogastric (preferred) or IV (greater risk of fluid overload) route. Do not use 0.9% saline as it is an acid solution: use Ringer-lactate or Hartmann's solution. Measure urine output (a Foley catheter should be used in unconscious patients).

| Weight | Daily fluid requirement | Hourly fluid requirement |
|--------------|-------------------------|--------------------------|
| In pregnancy | 50 mL/kg | 2.0 mL/kg |

IV fluids

A Ringer-lactate or Hartmann's solution plus glucose mix is commonly recommended. Use a 10% glucose mix with Ringer-lactate or Hartmann's solution if hypoglycaemia is identified. Monitor carefully for fluid overload, especially when the IV route is used. Switch to the oral route as soon as possible. Fluids given should be included in the daily fluid requirement totals to avoid over-hydration.

Antibiotics

All patients who are in shock or who remain severely ill following resuscitation should receive a presumptive treatment with broad-spectrum IV antibiotics. Unconscious patients should have a lumbar puncture to exclude meningitis. Where this is not possible a presumptive treatment with a suitable antibiotic should be given.

Continuing hospital care of pregnant women with severe malaria

This should include the following:

- Nurse in the lateral position if the woman is more than 20 weeks' pregnant, to avoid inferior vena caval compression.
- If the patient is unconscious, nurse her in the recovery position, alternating sides frequently.
- Observe hourly pulse, blood pressure, respiratory rate and level of consciousness (using the AVPU scale: see Section 1.11).
- Frequently measure blood glucose levels (every hour if the patient has a reduced conscious level, especially when they are receiving quinine and/or where the level of consciousness does not improve).
- If the patient is conscious, regularly (4-hourly) determine blood glucose levels to exclude hypoglycaemia particularly if the patient is not eating well. This is especially important in pregnant women, particularly those receiving quinine therapy.
- A daily microscopic blood slide to determine the level of parasitaemia and to follow treatment efficacy.
- Regular haemoglobin measurement. The frequency will depend on the rate of red blood cell breakdown. This may be very rapid in cases of high parasite density.

- Blood transfusion where necessary with careful monitoring to prevent fluid overload. Packed cells should be used where possible. If overload is suspected, give a single dose of 20 mg IV.
- If the patient is unconscious or in shock, administer IV broad-spectrum antibiotics to manage septicaemia, pneumonia or meningitis, which are often associated with cerebral malaria.
- Oxygen is needed for patients in respiratory distress.
- Blood gases and urea and electrolytes should be measured where possible.
- Controlled IV fluids.
- Fluid balance charts: unconscious patients should be catheterised to measure urine output, facilitate correct fluid balance and detect possible renal failure.

Management of life-threatening complications of severe malaria

Severe anaemia (due to haemolysis)

Monitor haemoglobin levels daily.

Severe haemolytic anaemia: haemoglobin < 5 g/dL or haematocrit < 15%.

Severe anaemia may be the presenting feature in malaria.

Patients with severe anaemia, especially pregnant women, should be tested for malaria.

- Establish safe transfusion as soon as possible.
- Transfuse with screened blood only if the patient is severely symptomatic. For patients with haemoglobin < 5 g/dL or haematocrit < 15%, recheck haemoglobin levels at least every 4 hours. Transfuse if haemoglobin levels start to fall or symptoms develop.
 - Packed cells are preferred for transfusion in pregnancy. Allow red blood cells to settle at the bottom of the bag, and stop the infusion when all of the cells have been used.
 - Perform microscopy following transfusion, and repeat or extend antimalarial treatment if parasitaemia is increasing.
- **Transfusion rates** may depend on the status of the patient. Exercise caution with malnourished patients.
- **Suggested rates:** two 500-mL units over 4–6 hours giving IV 20 mg of furosemide with each 500 mL.
- If the patient shows signs of fluid overload, give additional furosemide 20 mg IV, and repeat after 1–2 hours if indicated.

Give ferrous sulphate or ferrous fumarate 60 mg by mouth *plus* folic acid 5 mg by mouth once daily upon discharge.

Hypoglycaemia

This is defined as glucose levels of less than 2.5 mmol/litre (< 45 mg/dL).

Check for hypoglycaemia in patients who are unconscious, in shock or deteriorating, especially if they are malnourished, and in all patients receiving quinine. Often hypoglycaemia causes no symptoms until it results in coma and death. Watch for abnormal behaviour, sweating and sudden coma. Always give glucose with quinine. If the mother is drowsy, delirious or unconscious, do not assume that she has cerebral malaria; she is probably hypoglycaemic.

Treat with an IV glucose infusion over 15 minutes.

- If you give 50% glucose it irritates the veins, so dilute

- 50mL of 50% glucose with 50mL of Ringer-lactate or Hartmann's solution to make a 25% solution.
- Then give 500mL of 5% dextrose in Ringer-lactate or Hartmann's solution over 8 hours (see above for details of how to prepare this).

If you do not have IV glucose, give sugar water by mouth or by nasogastric tube. Dissolve 4 level teaspoons (20 grams) in a 200mL cup of clean water.

Retest 15 minutes after completion of infusion, and repeat the infusion if blood glucose levels remain low. Repeat until blood glucose levels recover, and then infuse with 5–10% glucose in Ringer-lactate or Hartmann's solution (according to hypoglycaemia risk) to prevent recurrence. Ensure regular feeding when oral intake can be sustained. Fluids used to treat hypoglycaemia must be included in the daily fluid requirements.

Hypoglycaemia is a major cause of death in patients with severe malaria, especially those who are pregnant. Remember that quinine will potentiate hypoglycaemia. Patients should receive regular feeding, including by nasogastric tube, when they are unable to take oral foods.

Fluid balance problems

Maintain a strict fluid balance chart and monitor the amount of fluids administered and urine output to ensure that there is no fluid overload. Assess the patient's clinical status regularly.

Note: Pregnant women with severe malaria are prone to fluid overload.

Acute renal failure (ARF)

This is defined as an abrupt decline in the renal regulation of water, electrolytes and acid-base balance, and continues to be an important factor contributing to the morbidity and mortality of malaria patients.

Oliguria or anuria is often associated with jaundice, anaemia and bleeding disorders.

Note: Dehydration is a common cause of low urine output.

- The basic principles of management are avoidance of life-threatening complications, maintenance of fluid and electrolyte balance, and nutritional support.
- The patient must be catheterised so that urine output can be accurately measured.
- Acute renal failure is suspected when the hourly urine output is < 30mL/hour (over 4 hours). Blood concentrations of urea and creatinine are usually raised (> 2.9mg/dL that is > 256mmol/litre).
- Make sure that the patient is adequately hydrated, but avoid overload.
- If possible, monitor plasma electrolytes, especially serum potassium levels.

If urine output continues to be low despite adequate hydration, peripheral perfusion and normal blood pressure, give furosemide 40mg IV.

If renal failure is established, restrict fluid to insensible loss (30mL/hour) plus urine output. If possible, refer the mother to a tertiary care centre for management of renal failure. Consider peritoneal dialysis (if available).

Convulsions

If there are **convulsions**, consider whether the mother has

eclampsia. Test the urine for protein and measure the blood pressure (see Section 2.5.E).

If the mother has eclampsia, treat this with magnesium sulphate. If she does not have eclampsia, prevent more convulsions with anticonvulsants.

Note: seizure activity in cerebral malaria needs to be looked for carefully, as it may just appear as a twitching of the thumb or mouth.

Give diazepam, 10mg rectally or by slow IV injection over 2 minutes.

Do not exceed 10mg per dose. Always have a bag-valve-mask of a suitable size available in case the mother stops breathing.

Alternatively, paraldehyde 0.1mL/kg of body weight may be given by deep IM injection (usually 6mL total dose) or 0.4mL/kg of body weight (usually 24mL) intra-rectally using a sterile glass syringe (a disposable plastic syringe may be used provided that the injection is given immediately after the paraldehyde is drawn up, and the syringe is never reused).

Consider preventing subsequent convulsions with phenytoin (see below).

Phenytoin

Loading dose

Infuse phenytoin 1 gram (approximately 18mg/kg body weight) in 50–100mL of 0.9% saline over 30 minutes (the final concentration should not exceed 10mg/mL).

Note: Only 0.9% saline can be used to infuse phenytoin. All other IV fluids will cause crystallisation of phenytoin.

Flush the IV line with 0.9% saline before and after infusing phenytoin.

Do not infuse phenytoin at a rate exceeding 50mg/minute, due to the risk of irregular heartbeat, hypotension and respiratory depression. Complete administration within 1 hour of preparation.

Maintenance dose

Give phenytoin 100mg IV slowly over 2 minutes or by mouth every 8 hours beginning at least 12 hours after the loading dose.

Respiratory distress

Rapid laboured breathing: check for and treat secondary pneumonia (give antibiotics and oxygen) or anaemia (transfuse), or pulmonary oedema, which may occur with or without fluid overload. Check the fluid balance (reduce IV fluids), supply oxygen, nurse the patient in a semi-sitting position, and do a trial of furosemide, 40mg IV, repeating this after 1–2 hours if indicated.

Slower laboured breathing (acidotic) (Kussmaul breathing): ensure appropriate fluid replacement (plus transfusion if indicated), and treat associated conditions and infections.

Metabolic acidosis

Deep breathing with a clear chest is a sensitive and specific sign for the presence of metabolic acidosis. It is the single most important determinant of survival, and can lead to respiratory distress syndrome. Metabolic (lactic) acidosis has been identified as an important cause of death in severe malaria.

Metabolic acidosis in severe malaria has been attributed to the combined effects of several factors that reduce oxygen delivery to tissues:

- 1 increased production of lactic acid by parasites (through direct stimulation by cytokines)
- 2 decreased clearance by the liver
- 3 a marked reduction in the deformability of uninfected red blood cells, which may compromise blood flow through tissues
- 4 dehydration and hypovolaemia, which can exacerbate microvascular obstruction by reducing perfusion pressure
- 5 destruction of red blood cells and anaemia, which further compromise oxygen delivery.

Management

- Maintain airway patency and oxygen delivery; intubate if the patient is unconscious, in severe shock, or otherwise unstable.
- Establish an IV line; replace an adequate intravascular fluid volume if the patient has tachycardia, hypotension or other signs of poor tissue perfusion, such as poor capillary refill time. **IV normal (0.9%) saline can be harmful in severe malaria, when there is frequently acidosis. Normal saline is a strongly acidotic solution and can make the acidosis much worse.** Therefore use Ringer-lactate or Hartmann's solution for IV fluid replacement or in shock.
- Monitor for cardiac arrhythmias.
- The use of sodium bicarbonate is controversial and generally should be avoided.

Pulmonary oedema is very dangerous. The mother may have it on admission, or it may develop after several days. Fast difficult breathing is the first sign. Frothy (bubbly) fluid may be coming from the mouth. Pulmonary oedema causes hypoxia, fits, coma and death. It can also be caused by too much fluid. Sometimes it is caused by malaria and too much IV fluid, so watch the jugular venous pressure regularly and ideally, if skilled, measure central venous pressure.

- Keep the patient upright; prop them up with pillows and lower the foot of the bed.
- Give high concentrations of oxygen using a face mask and reservoir.
- Give furosemide 40mg IV. If there is no response (i.e. no increase in urine output), increase the dose progressively, every 4 hours, up to a maximum of 200mg.
- If the woman might be receiving too much IV fluid, stop all drips.
- If the woman does not improve, withdraw 250mL of blood into a transfusion bag. Give it back to her later.

Shock

Although severe malaria alone may cause shock (algid malaria), it is uncommon and bacterial sepsis often coexists, which must be treated.

Management includes initial assessment for severe anaemia, which can also be the cause of shock due to lack of oxygen-carrying capacity in severe anaemia. The management of severe anaemia, if this is responsible, is described above.

If the patient is not severely anaemic, and particularly if they are dehydrated, give rapid fluid replacement provided that there are no signs of pulmonary oedema:

- Ringer-lactate or Hartmann's solution IV, 500mL over 30 minutes, then reassess. If there is no improvement

in capillary refill or tachycardia, repeat the infusion once or twice more, as required.

Give IV broad-spectrum antibiotics to treat septicaemia and any associated infections.

Abnormal bleeding

- Transfuse with fresh blood.
- Give vitamin K 10mg IV or orally.
- Avoid IM injections and non-steroidal anti-inflammatory drugs (NSAIDs).

Coexisting infections

Treat any associated pneumonia, dysentery or endometritis (see Sections 2.8.A, 2.8.B and 2.5.G).

Congenital malaria

Congenital malaria is relatively rare; it occurs in up to 10% of affected pregnancies. This is because the placental barrier and maternal IgG antibodies that cross the placenta protect the fetus to some extent. All four species can cause congenital malaria, but *P. malariae* causes proportionately more than the other species.

Congenital malaria is much more common in non-immune populations, and the incidence increases during epidemics of malaria.

Fetal plasma quinine levels are about one-third of simultaneous maternal levels, and this sub-therapeutic drug level does not cure the infection in the fetus.

The newborn child can manifest with fever, irritability, feeding problems, hepatosplenomegaly, anaemia and jaundice. The diagnosis can be confirmed by a smear from cord blood or a heel prick, any time within 1 week after birth (HRP2 tests may not be relevant in the early days after birth, as the infant blood may include HRP2 from the mother). The risk of congenital malaria is higher in children born to mothers who have malaria during or shortly before delivery.

Prevention, diagnosis and treatment of non-falciparum malaria

Other forms of malaria are found all over the world and need to be prevented, diagnosed and treated.

***P. vivax* and *P. ovale* malaria**

P. vivax and *P. ovale* malaria are recurrent due to the fact that the parasites can conceal themselves as the hypnozoite form in the liver. They can emerge and cause new attacks of malaria at regular intervals for up to 30 years. Most medications (except primaquine) only act on the erythrocyte stage of the parasite and therefore do not affect the hypnozoites.

Prevention

Long Lasting Impregnated Bednets (LLINs) with appropriate information should be supplied to prevent initial infection (and co-infection with other parasite species), but they will not prevent recurrent attacks once the infection is established. **Indoor residual spraying** should be used.

Diagnosis

The following methods can be used:

- microscopy
- RDTs: **HRP2 tests such as Paracheck will only detect *P. falciparum*. pLDH tests such as CareStart will detect**

other species. At present the sensitivity and specificity of pLDH in detecting *P. vivax* and other species of malaria are not clearly defined

- **Polymerase chain reaction (PCR)** can be used to distinguish between new and recurrent infections.

Treatment

At present, the treatment for *P. vivax* malaria (and the other non-falciparum species) is **chloroquine (CQ)**.

This should only be used for CQ-sensitive non-falciparum malaria.

It is available in the following formulations:

- 100 mg base tablets (chloroquine phosphate)
- 150 mg base tablets
- 50 mg base/5 mL syrup.

Chloroquine is sometimes found as a salt, but the WHO recommends use of the base product.

The regime described below is recommended by the WHO for use in settings where compliance may be difficult and dosing regimes need to be simplified.

Dose: 6 tablets 100 mg on days 1 and 2, then 3 tablets 100 mg on day 3 or 4 tablets 150 mg on days 1 and 2, then

2 tablets 150 mg on day 3. **Total dose** = 1500 mg base (= 2500 mg salt).

There is some evidence of resistance to chloroquine in India and Indonesia, but it is difficult to determine whether apparent failure of the treatment is due to recurrence from hypnozoites or to drug failure. There has been little evidence from efficacy studies.

Note: ACTs cure all types of malaria, but chloroquine is still effective (and cheaper) for treating most cases of *P. vivax*, *P. malariae* and *P. ovale*.

As mentioned above, chloroquine only kills the parasites in the red blood cells, and does not kill the pre-erythrocyte forms or the hypnozoites of the recurrent malarias *P. vivax* and *P. ovale* in the liver.

At present **primaquine** is the only drug available to tackle the hypnozoites and prevent recurrence.

Treatment with primaquine

Primaquine is the only drug at present available to prevent recurrent attacks of *P. vivax* and *P. ovale*. However, it is not recommended for pregnant women, so treatment with this drug should wait until the pregnancy has ended.

2.8.E Acute appendicitis

Introduction

Appendicitis should be suspected in any woman or girl with abdominal pain, whether she is pregnant or not. The diagnosis of appendicitis can be more difficult in pregnancy, due to the possibility of pregnancy-related conditions, including ectopic pregnancy, abruptio placentae, torsion of an ovarian cyst and pyelonephritis.

As pregnancy advances, the enlarging uterus displaces the appendix from its usual position, shifting the site of maximal tenderness towards the right upper quadrant (see Figure 2.8.E.1). In the third trimester, it may consequently mimic cholecystitis. The site of an incision for appendicectomy should be over the point of maximum tenderness.

If there are **signs of peritonitis** (fever, rebound tenderness and guarding), give antibiotics above as for peritonitis but continue until the infection has fully resolved (usually following surgery) and there has been no fever for 48 hours.

If **appendicitis occurs in late pregnancy**, the infection may be walled off by the gravid uterus. As the uterus rapidly decreases in size (involutes) after delivery, the infection may spill into the peritoneal cavity. In these cases, appendicitis then presents as generalised peritonitis.

Clinical management

If appendicitis is suspected clinically, give a combination of antibiotics before surgery, and continue until the woman is post-operative and fever-free for 48 hours:

- ampicillin 2 grams IV every 6 hours
- plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours
- plus metronidazole 500 mg IV every 8 hours.

Morphine 10 mg IV or IM may be administered as analgesia (see Section 1.16).

Immediate surgical exploration is required, regardless of the stage of gestation. Appendicectomy should be performed even if the appendix does not look infected.

Delaying diagnosis and treatment can result in rupture of the appendix, which may lead to generalised peritonitis. This has a high maternal mortality in pregnancy, as well as a significant risk of miscarriage or preterm labour.

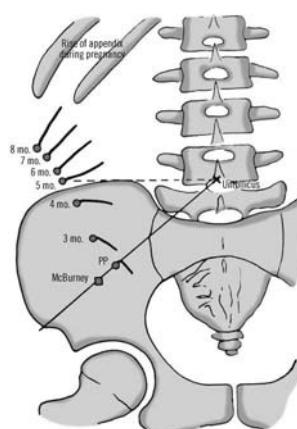


FIGURE 2.8.E.1 The changes in position of the appendix as pregnancy advances. Adapted from McGraw-Hill Companies, Inc. Reproduced with the permission of Chris Paschalidis.

2.8.F Cystitis and acute pyelonephritis

BOX 2.8.F Minimum requirements

- Microscopy and bacterial culture.
- Dipstick tests for leucocytes and nitrites.
- Antibiotics (e.g. ampicillin, gentamicin).
- Ultrasonography.

Acute cystitis

Cystitis is a common complication of pregnancy, and is characterised by dysuria, frequency, urgency and, if severe, by haematuria. Severe cystitis can progress to pyelonephritis if not treated. The presence of loin pain and tenderness, along with fever, suggests a diagnosis of pyelonephritis.

Asymptomatic cystitis is more common in pregnancy, carries a risk of progression to pyelonephritis, and is associated with an increased risk of premature delivery.

Diagnosis

- Use a dipstick leucocyte esterase test to detect white blood cells, and a nitrate reductase test to detect nitrites.
- Microscopy of a urine specimen (see Section 8.5) may show white blood cells in clumps, bacteria and sometimes red blood cells. Urine examination requires a clean-catch midstream specimen of urine to minimise the possibility of contamination. The results of bacterial culture, although not necessary before starting treatment, are helpful if there is treatment failure, and also for monitoring bacterial sensitivity in the population.

Treatment with antibiotics for uncomplicated cystitis

- Amoxicillin 500 mg by mouth three times a day for 5 days or cephalaxin (or alternative available cephalosporin) 500 mg three times a day for 5 days.
- Trimethoprim/sulfamethoxazole 1 tablet 160/800 mg

by mouth twice a day for 3 days. **This drug is best avoided in pregnancy** unless there is no alternative. It must be completely avoided in the first trimester. This antibiotic is a folate antagonist and therefore promotes congenital abnormalities, and in the third trimester it may cause haemolysis in the neonate.

- If treatment fails, check urine culture and sensitivity (if available), and treat with an antibiotic appropriate for the organism.

Acute pyelonephritis

Acute pyelonephritis is an acute infection of the upper urinary tract, mainly of the renal pelvis, which may also involve the renal parenchyma. It can precipitate premature labour.

- If shock is present or suspected, initiate immediate ABC treatment.
- Check urine culture and sensitivity (if available), and treat with an antibiotic appropriate for the organism.
- If urine culture is unavailable, treat with antibiotics until the woman has been fever-free for 48 hours:
 - ampicillin 2 grams IV every 6 hours
 - plus gentamicin 80 mg IM/IV every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours.
- Once the woman has been fever-free for 48 hours, give amoxicillin/ampicillin 500 mg by mouth three times a day to complete 14 days of treatment.
- If there is no clinical response within 72 hours, review the results and antibiotic coverage.

Alternative and/or second line treatment is with IV cephalosporins, e.g. cefuroxime 750 mg to 1.5 g 8-hourly.

- Perform a renal ultrasound scan. If any significant malformation of the kidneys or renal tract is noted, refer the patient for specialist advice.

2.8.G Tuberculosis in pregnancy

BOX 2.8.G Minimum standards

- Mantoux test/purified protein derivative.
- Sputum for acid-fast bacilli for stain and culture.
- Chest X-ray.
- Anti-tuberculosis therapy.

Introduction

Tuberculosis (TB) is generally becoming less common during pregnancy and in the fetus, even in high endemic countries, but remains a leading infectious cause of death during pregnancy and delivery, especially among women living with HIV. It is estimated that more than half a million women of child-bearing age die from TB (including HIV-related TB) each year, but the current epidemiology of TB in pregnancy is a reflection of the general incidence of disease. The infection has been associated with an increased risk of spontaneous abortion, perinatal mortality,

small-for-gestational age and low birth weight in some studies. Poor outcome is attributable to delays in diagnosis or treatment, increasing the frequency of severe forms of extra-pulmonary disease.

Clinical findings

Signs and symptoms of TB are usually the same in both pregnant and non-pregnant woman. They include prolonged fever (especially at night), cough, weight loss, fatigue and breathing difficulty. Extra-pulmonary disease will present with organ-specific signs and symptoms such as lymphadenopathy, abdominal pain or mass, back pain, vaginal bleeding, pelvic inflammatory disease symptoms or infertility.

Diagnosis

Any woman who presents to an antenatal clinic with chronic respiratory symptoms, or has had close contact with a TB index case, or unexplained illness, should be screened

for TB. This includes a tuberculin skin test, sputum for acid-fast bacilli (AFB) stain and culture for mycobacterium TB. A chest X-ray may have harmful effects on the fetus in the first trimester of pregnancy, but may be done with an abdominal lead shield. If clinically indicated a Chest X-ray is recommended as the risk to the fetus is very small and the mother's health a priority.

Additional newer tests, namely interferon gamma release assay (IGRA) or polymerase chain reaction (PCR) identification (if available), may complement diagnosis.

Extra-pulmonary TB is much more difficult to diagnose during pregnancy. After delivery, the placenta should be sent for histopathology, AFB stain and AFB culture to contribute to a diagnosis. The neonate should be evaluated thoroughly and treated accordingly.

Antituberculous treatment during pregnancy

During pregnancy, tuberculosis represents a greater hazard to the pregnant woman and her fetus than does its treatment. Therefore treatment should be commenced as soon as possible after a diagnosis has been made. Treatment for new patients with pulmonary TB is the same in pregnancy as it is for all other adults (see WHO guidelines 4th edition 2010 for full details: www.who.int/tb/publications/2010/9789241547833/en/).

In summary, new patients with pulmonary TB should be treated with a regime containing isoniazid (H) and rifampicin (R) for 6 months (see Table 2.8.G.1 for doses). There is an initial 2-month intensive phase of HRZE and then a 4-month continuation phase of just HR.

The optimal dosing frequency is daily throughout the 6-month course. However, provided directly observed treatment is practiced and the patient is not living with HIV infection or in a high risk setting for HIV the last 4 months of treatment can be given three times a week.

Isoniazid, ethambutol and rifampin are relatively safe for

the fetus. In some countries, the routine use of pyrazinamide is discouraged because of inadequate teratogenicity data, but the WHO continues to recommend it as first-line therapy. The benefits of ethambutol and rifampin for therapy of tuberculosis disease in the mother outweigh the risk to the infant.

The use of these first-line antituberculous drugs in pregnancy is considered safe for the mother and the baby by the British Thoracic Society, International Union Against Tuberculosis and Lung Disease, and the World Health Organization.

The effects of other second-line drugs on the fetus are unknown, and their use during pregnancy must be undertaken only after a careful risk and benefit analysis.

Fixed-dose combinations (FDCs) are recommended in both children and adults, but drugs can be given separately as well. Tablets are the preferred formulation, even in children, as they prevent the emergence of resistance and improve compliance.

The WHO-recommended two-, three- and four-drug FDC schemes are simplified for clinical use according to body weight, and ensure that the doses remain within the therapeutic margins, and that underlying liver and renal impairment is considered (see Tables 2.8.G.1 and 2).

Drugs that are contraindicated during pregnancy

These include the following:

- streptomycin (which interferes with development of the ear and may cause congenital deafness)
- kanamycin, amikacin and capreomycin
- fluoroquinolones (ciprofloxacin, levofloxacin, ofloxacin and sparfloxacin)
- other second-line drugs (cycloserine, ethionamide and clofazimine).

TB treatment during pregnancy is the same for pregnant women as it is for non-pregnant women.

TABLE 2.8.G.1 Commonly used drugs for the treatment of TB in pregnancy

| Drug | Daily dose (mg/kg/when given daily) | Daily dose when given three times weekly | Potential adverse reactions |
|--|--|--|---|
| Isoniazid (H) tablet, 100 mg, 300 mg | 5 mg/kg (4–6 mg/kg) Maximum 300 mg | 10 mg/kg (8–12 mg/kg) Maximum 900 mg | Mild hepatic enzyme elevation, hepatitis, peripheral neuritis, hypersensitivity |
| Rifampin (R) tablet, 150 mg, 300 mg, 450 mg | 10 mg/kg (8–12 mg/kg) Maximum 600 mg | 10 mg/kg (8–12 mg/kg) Maximum 600 mg | Orange discolouration of urine and other body fluids, vomiting, hepatitis |
| Pyrazinamide (Z) tablet, 500 mg | 25 mg/kg (20–30 mg/kg) | 35 mg/kg (30–40 mg/kg) | Hepatotoxicity, hyperuricaemia |
| Ethambutol (E) tablet, 100 mg, 400 mg | 15 mg/kg (15–20 mg/kg) | 30 mg/kg (25–35 mg/kg) | Optic neuritis, decreased visual acuity, gastrointestinal disturbance, hypersensitivity |
| Four-drug FDC tablet, R 150 mg + H 75 mg + Z 400 mg + E 275 mg | Dosage recommendations are more straightforward, and adjustment of dosage is done according to patient weight category | | |
| Three-drug FDC tablet, R 150 mg + H 75 mg + Z 400 mg | | | |
| Two-drug FDC tablet, R 300 mg + H 150 mg R 150 mg + H 75 mg | | | |
| Two-drug FDC tablet, H 150 mg + E 400 mg | | | |

H = isoniazid, R = rifampicin, Z = pyrazinamide, E = ethambutol, S = streptomycin, FDC = fixed drug combination.

- A **three- to four-drug regimen** of isoniazid, rifampin and pyrazinamide with or without ethambutol is recommended for uncomplicated pulmonary TB (see Table 2.8.G.1).
- If pyrazinamide treatment is included in the initial drug regimen, after an **initial 2 months of three to four drugs**, therapy is continued with **two drugs** (isoniazid and rifampin) to complete **at least 6 months of therapy**.
- If pyrazinamide is not used, the two-drug period should be extended to at least 9 months.
- Prompt initiation of therapy is mandatory to protect the mother and the fetus.

Streptomycin should not be used in pregnancy, as it crosses the placenta and can cause auditory nerve impairment and nephrotoxicity in the fetus.

Vitamin K should be administered at birth to the infant of a mother taking rifampicin because of the risk of postnatal haemorrhage.

Pyridoxine (vitamin B₆) 10 mg daily is recommended for pregnant or breastfeeding women who are taking isoniazid-containing regimens.

Extra-pulmonary TB in pregnant women requires the same regimens as uncomplicated pulmonary TB. Some forms (e.g. meningitis, bone, joint) require a longer duration (9–12 months) of TB drugs.

If a woman has suspected resistant TB, attempts must be made to confirm drug resistance by appropriate cultures and therapy based on susceptibility results. Regimens are complicated and depend on susceptibilities, previous drug therapy, local susceptibility data, availability of second-line drugs and tolerability. **An expert in infectious disease must be consulted in such cases.** Pregnant women with resistant TB have a less favourable prognosis. They may sometimes require treatment with second-line drugs, including cycloserine, ofloxacin, amikacin, kanamycin, capreomycin and ethionamide. The safety of these drugs is not well established in pregnancy.

Breastfeeding and TB

The low concentrations of anti-TB drugs in breast milk do not produce toxicity in the nursing newborn. Therefore breastfeeding should not be discouraged for an HIV-seronegative woman who is planning to take or is taking anti-TB drugs. Anti-TB treatment is the best way to prevent transmission of tubercle bacilli to the baby. Mother and baby should stay together and the baby should continue to breastfeed. After active TB in the baby is ruled out, the baby should be given 6 months of isoniazid preventive therapy, followed by BCG vaccination (for advice on breastfeeding and HIV, see Section 6.2.D). Breastfed infants do not require pyridoxine supplementation unless they are receiving isoniazid.

Treatment of latent TB infection

In most pregnant women, treatment of latent TB infection (LTBI) – that is, treatment of asymptomatic pregnant women with a positive tuberculin test or IGRA result and normal chest X-ray – should be delayed until 2 or 3 months after delivery, even though no harmful effects of isoniazid (INH, the standard treatment regimen for LTBI) on the fetus have been documented.

However, in the following situations where there is a high risk of progressing to active disease, treatment for LTBI with isoniazid (INH), 300 mg daily should begin during pregnancy.

Treatment of LTBI should be started **during the first trimester** of pregnancy for:

- pregnant women who have HIV infection or behavioural risk factors for HIV infection, but who refuse HIV testing
- pregnant women who have been in recent close contact with an individual with smear-positive pulmonary TB.

Treatment of LTBI should be started **after the first trimester** of pregnancy for pregnant women who have had a documented tuberculin skin test conversion in the past 2 years.

Treatment of LTBI, if indicated, should be started 2 to 3 months after delivery for all other pregnant women, including those with radiographic evidence of old healed TB. The recommended duration of LTBI therapy is 9 months. If a woman who is taking isoniazid and/or rifampin for treatment of LTBI becomes pregnant, treatment should be interrupted and started again 2 or 3 months after delivery, unless one or more of the above risk factors are present.

Perinatal TB

Women who have only pulmonary TB are not likely to infect the fetus, but can infect their infant after delivery. Although protection of the infant from exposure and infection is of paramount importance, continuous close contact between infant and mother should be encouraged. Congenital TB is rare, but *in-utero* infections can occur after maternal bacteraemia. If a newborn infant has suspected congenital TB, a full evaluation should be done and treatment initiated based on individual circumstances and specific recommendations. Management of the newborn infant is based on categorisation of the maternal (or household contact) infection as follows:

- If the mother has completed TB chemotherapy during pregnancy, or has inactive disease, her infant should be given BCG at birth.
- If the mother has active disease or still requires treatment, the infant should be given isoniazid 10 mg/kg once daily for 3 to 6 months.
- Once the mother and infant are on appropriate treatment, the infant may breastfeed unless the mother has multidrug-resistant TB. A tuberculin test and chest X-ray are then performed on the neonate. If these are negative, BCG is given. If they are positive, full investigations for TB are undertaken. If no evidence of disease is detected, isoniazid is continued for another 3 to 4 months. If TB is suspected, full treatment is given at standard doses.

Monitoring

All pregnant women with TB must be carefully followed up monthly. At each visit, the patient needs to be checked for compliance, response to therapy, adverse effects and adjustment for any clinical event.

Directly observed treatment

Directly observed treatment: short-course (DOTS) remains an important WHO strategy for reducing the TB burden worldwide. In DOTS, healthcare workers observe patients as they take their medicine. DOTS is practised even for children, and parents can be asked to supervise treatment in the communities where DOTS is used. This is especially true for HIV-infected children, patients with multi-drug-resistant (MDR) TB or those with complicated TB, and has been shown to be successful.

The WHO has developed a new six-point **Stop TB Strategy**, which builds on the successes of DOTS. One of these is to ‘pursue high-quality DOTS expansion and enhancement’ through the following steps.

- 1 Secure political commitment, with adequate and sustained financing.

- 2 Ensure early case detection and diagnosis through quality-assured bacteriology.
- 3 Provide standardised treatment with supervision and patient support.
- 4 Ensure effective drug supply and management.
- 5 Monitor and evaluate performance and impact.

2.8.H Syphilis in pregnancy and the newborn infant

Introduction

Syphilis is a dangerous bacterial infection caused by *Treponema pallidum* which, when it occurs in pregnancy, can cause early fetal death, stillbirth, preterm birth, neonatal death or congenital infection. Mother-to-child transmission is a major problem, especially in resource-limited countries.

In a recent analysis, it was estimated that in 2008 worldwide there were between 1.2 and 1.6 million pregnant women with active syphilis, of whom 39% were living in Africa. In the absence of screening and treatment this would have resulted globally in 707 000 adverse pregnancy outcomes, including 286 000 stillbirths or early fetal deaths, 122 000 neonatal deaths, 82 000 preterm or low-birth-weight babies and 218 000 infected newborn infants. Additional mortality after the first month of life was estimated to be 10% by 1 year of age.

The cost of diagnosis and treatment per individual is US\$2.

All countries must ensure that all pregnant women have access to antenatal care that includes diagnostic screening and treatment for syphilis.

Clinical features

Infection is either congenital (through *in-utero* transfer) or acquired (through sexual transmission or blood transfusion). The average time between acquired infection and the appearance of symptoms and signs is 21 days, but this period can range from 10 to 90 days.

Acquired syphilis has early and late phases. The early phase has primary, secondary, early latent (hidden and < 1 year), late latent (hidden > 1 year) and tertiary stages.

The early stages are more infectious and respond best to penicillin treatment.

The symptoms and signs can resemble those of many other diseases.

Primary stage

The chancre is firm, round, painless and usually single, but may be multiple at the location where syphilis entered the body. Chancres may not be visible in the vagina or anus. The chancre lasts for 3 to 6 weeks, and heals whether or not it is treated. If untreated, the infection progresses to the secondary stage.

Secondary stage

A non-itchy skin rash and/or mucous membrane lesions (sores in the mouth, vagina or anus) occur. This stage typically starts with the development of a rash on one or more areas of the body. The characteristic rash is rough red or reddish brown spots on the palms of the hands and the

soles of the feet. However, rashes with a different appearance may occur on other parts of the body, sometimes resembling rashes caused by other diseases. Sometimes the rashes are barely visible. Large raised grey or white lesions, known as condylomata lata, may develop in warm moist areas such as the mouth, underarm or groin region. In addition, there may be fever, swollen lymph glands, sore throat, patchy hair loss, headaches, weight loss, muscle aches and fatigue. The symptoms will resolve with or without treatment, but if not treated the infection will progress to the latent and possibly late stages of disease.

Latent (hidden) and late stages

Without treatment, syphilis infection can persist without showing any signs or symptoms. **Early latent syphilis** is latent syphilis where infection occurred within the past 12 months. **Late latent syphilis** is latent syphilis where infection occurred more than 1 year ago.

Late stages (tertiary syphilis) develop in around 15% of people who have not been treated, and can appear 10–20 years after infection was first acquired. In the late stages of syphilis, the disease may damage the internal organs, including the brain, nerves, eyes, heart, blood vessels, liver, bones and joints. Symptoms of the late stages of syphilis include difficulty coordinating muscle movements, paralysis, numbness, gradual blindness and dementia.

When it invades the nervous system, at any stage of infection, syphilis causes headache, altered behaviour, and movement disorders that occur in Parkinson’s and Huntington’s disease.

HIV infection modifies the symptoms and signs described above, including hypopigmented skin rashes. There is also a greater likelihood of neurological involvement.

Where disease is prevalent, most cases are asymptomatic. At least 50% of women with acute syphilis have adverse pregnancy outcomes. The more recent the maternal infection, the more likely it is that the fetus and infant will be infected.

Congenital syphilis is divided into early (becoming apparent in the first 2 years of life) and late (becoming apparent after the first 2 years of life) types. At birth the following can be present: low birth weight, hepatosplenomegaly, pallor, jaundice and purpura, blisters or peeling of palms and soles. There can be difficulties in feeding and rhinorrhea. If not treated immediately, the newborn baby may remain asymptomatic but more commonly develops serious problems within a few weeks affecting many body systems. Untreated babies may become developmentally delayed, have seizures or die.

Late congenital syphilis can present with the following: blunted upper incisor teeth known as Hutchinson’s teeth,

inflammation of the cornea known as interstitial keratitis, deafness from auditory nerve disease, frontal bone bossing, a saddle nose (collapse of the bony part of nose), defects of the hard palate, swollen knees, saber like shins, short maxillae and protruding mandible. A frequently-found group of symptoms is Hutchinson's triad, which consists of Hutchinson's teeth (notched incisors), keratitis and deafness and occurs in 63% of cases.

Treatment (with penicillin) before the development of these late symptoms is essential.

Congenital syphilis may occur if the expectant mother has syphilis, but the risk is minimal if she has been given penicillin during pregnancy. Congenital syphilis does not cause congenital malformations as infection of the fetus in early pregnancy is lethal.

Treatment with penicillin is extremely effective (98% success rate) in preventing mother-to-child transmission.

Diagnosis

There are two types of blood tests available, namely non-treponemal tests and treponemal tests.

Non-treponemal tests (e.g. VDRL and RPR) are simple, inexpensive, and are often used for screening. Ideally, women with a reactive non-treponemal test should receive a treponemal test to confirm a syphilis diagnosis.

Their sensitivity increases from primary to secondary syphilis, and their specificity is high in the absence of another chronic condition.

The on-site RPR card test is quick and simple to use, allowing immediate treatment to be given. A simple strip of paper impregnated with treponemal antigen is used to test a finger-prick sample of blood.

Treponemal tests such as the *Treponema pallidum* haemagglutination assay (TPHA) and Rapid Syphilis Test have higher sensitivity and specificity and measure antibodies that are specific for syphilis. Treponemal antibodies appear earlier than non-treponemal antibodies and usually remain detectable for life, even after successful treatment, and therefore do not correlate with disease activity.

All pregnant women should be screened for syphilis at their first antenatal visit with an on-site RPR or other rapid test and to prevent congenital infection, preferably before 16 weeks' gestation and again in the third trimester.

All women who were not screened or tested during pregnancy should be screened at or immediately after delivery.

All infants born to mothers who have positive non-treponemal and treponemal test results should be evaluated for congenital syphilis.

Advise women who test positive that their partner(s) must also be investigated and treated if positive.

Test all women with a history of adverse pregnancy outcome (e.g. abortion, stillbirth, syphilitic infant) for syphilis.

Screen all women with syphilis for other sexually transmitted and HIV infections.

Treatment of pregnant women with syphilis

Early syphilis (primary, secondary or latent syphilis of not more than 2 years' duration)

Give benzathine benzylpenicillin, 2.4 million IU intramuscularly (check that it is not injected into a vein), in a single

session. Because of the high volume, this is usually given as two injections at separate sites.

Alternatively, give procaine benzylpenicillin 1.2 million IU intramuscularly (check that it is not injected into a vein) daily for 10 consecutive days.

If the patient is allergic to penicillin, give ceftriaxone 500 mg IM/IV daily for 10 days. Erythromycin does not cross the placenta to treat the fetus.

Late latent syphilis (infection of more than 2 years' duration)

Give benzathine benzylpenicillin, 2.4 million IU intramuscularly (check that it is not injected into a vein), once weekly for 3 consecutive weeks.

Alternatively, give procaine benzylpenicillin, 1.2 million IU intramuscularly (check that it is not injected into a vein), once daily for 20 consecutive days.

If the patient is allergic to penicillin, give ceftriaxone 500 mg IM/IV daily for 14 days or (although this is less effective) erythromycin, 500 mg orally, four times a day for 30 days.

Treatment of congenital syphilis

All asymptomatic newborn infants born to seropositive mothers should be treated with a single IM dose of benzathine benzylpenicillin, 50 000 IU/kg, whether or not their mothers were treated during pregnancy. Routine CSF examination is not required.

Newborn infants with any signs of congenital syphilis should receive:

- aqueous benzylpenicillin, 100 000–150 000 IU/kg/day administered as 50 000 IU/kg/dose IV every 12 hours, during the first 7 days of life, and every 8 hours thereafter for a total of 10 days
- or
- procaine benzylpenicillin, 50 000 IU/kg by IM injection, as a single daily dose for 10 days (ensure that it is not injected into a vein).

Early congenital syphilis generally responds well to penicillin. Recovery may be slow in seriously ill children with extensive skin, mucous membrane, bone or visceral involvement.

For older infants up to 2 years of age with confirmed congenital syphilis the treatment is the same as above.

If the patient is allergic to penicillin (this is unusual), give ceftriaxone 80 mg/kg IM/IV once daily for 10 days or give erythromycin, 7.5–12.5 mg/kg orally, four times a day for 14 days but erythromycin is less effective.

For infants older than 2 years, give aqueous benzylpenicillin, 200 000–300 000 IU/kg/day by IM/IV administered as 50 000 IU/kg/dose every 4–6 hours for 10–14 days.

An alternative regimen for penicillin-allergic patients after the first month of life is to give erythromycin, 7.5–12.5 mg/kg orally, four times a day for 30 days.

Jarisch-Herxheimer reaction

After starting penicillin treatment in some patients, the death of the bacteria results in the release of mediators that produce the adverse symptoms and signs such as myalgias, fever, headache and tachycardia, sometimes with exacerbation of whatever current syphilitic lesions are manifested (e.g. rash, chancre).

This reaction develops within several hours after

beginning antibiotic treatment, and usually clears within 24 hours after its onset. It is very rare in newborn infants.

Management consists of symptomatic treatment (e.g. antipyretics, analgesics) and observation. In pregnancy, treatment may induce early labour or cause fetal distress. Patients should be informed of the possibility of this reaction

before undergoing antibiotic therapy. However, this risk should not preclude or delay therapy for syphilis. Women are advised to seek obstetric care after treatment if they notice any fever, uterine contractions, or a decrease in fetal movement.

2.8.1 Varicella zoster (chickenpox) in pregnancy

Introduction

Pregnant women and newborn infants are at risk of severe disease from varicella, involving serious effects on organs such as the lungs.

Varicella is transmitted from respiratory aerosols and skin lesions in chickenpox itself, and from the skin lesions but not aerosols in shingles (which is not infectious until the skin lesions appear).

In chickenpox, patients are infectious for 48 hours prior to emergence of the rash and until all of the skin lesions are crusted over.

The incubation period is 10–21 days.

Non-immune patients are those without a history of chickenpox or shingles or a completed vaccination profile. Immune status can be checked with blood varicella IgG measurement (if available).

Clinical features in pregnancy

Congenital varicella syndrome (CVS)

In the first or early second trimester infection may result in stillbirth, or the neonate may be born with a group of physical abnormalities known as congenital varicella syndrome (CVS). This is rare, occurring in 1–2.8% of women infected with chickenpox in the first 20 weeks of gestation (the period of maximum risk is between 12 and 20 weeks' gestation). There may be dermatomal scarring, limb hypoplasia, ocular abnormalities, low birth weight and early death. Survivors may have long-term developmental problems. An infant with CVS has a 30% risk of mortality in the first few months of life, and a 15% risk of developing herpes zoster between 2 months and 3 years of life.

Varicella pneumonia

Pregnant women with chickenpox may be more likely than non-pregnant women to develop severe pneumonitis. The risk is greatest in the third trimester, especially if lung disease is already present, or if the patient is a smoker or is immunocompromised (e.g. due to HIV infection).

Symptoms start as a non-productive cough, which can rapidly progress to respiratory failure within 36–48 hours. The cough becomes increasingly productive, with tachypnoea, dyspnoea, cyanosis and chest pain.

Perinatal infection

If a neonate is exposed (mother has a rash) around the time of birth (from 5 days before to 2 days after delivery), there is a 17–30% risk of dangerous perinatal infection. This is characterised by skin lesions, disseminated intravascular

coagulation, pneumonitis and hepatitis, and it has a mortality of up to 30%.

Management

Maternal contact with varicella during pregnancy

If the patient is immune (see above for definition), no treatment or isolation is required.

If she is non-immune and an IgG test is not available and affordable, then if she has had a significant contact with chicken pox or shingles then give varicella zoster immunoglobulin (VZIG) (see below for details) within 4 days of contact if possible (maximum of 10 days after contact). Avoid contact with other pregnant women. The patient should be counselled regarding the signs of infection so that she can be treated early if it occurs.

Significant exposure to chicken pox occurs after very limited contact with an infected person (any face to face contact and as little as 15 minutes in the same room as an infectious patient). The risk of contracting chicken pox from exposure to shingles is very low if the infection is not in an exposed area.

Chickenpox during pregnancy

If this is **mild**, give oral aciclovir (see below for dose regimen) for 7 days, starting within 24 hours of the appearance of vesicles, and avoid contact with other pregnant women. In mild cases, aciclovir leads to little improvement. It is most important in women at risk of severe disease (immuno-compromised, HIV infected, history of respiratory disease or smoking).

If it is **severe**, give IV aciclovir for 7 days. High-dependency care should be provided if available, as appropriate.

Prevention of neonatal chickenpox if the mother is infected from 7 days before to 7 days after birth

Give VZIG to the neonate as soon as possible after delivery. Isolate the mother and infant.

In addition, give IV aciclovir to the neonate if the onset of maternal symptoms was between 4 days before, and 2 days after the birth.

Infant in contact with chickenpox other than from mother, or from mother who develops chickenpox more than 7 days after the birth

If the mother is immune and the infant is full term at birth, no prophylaxis is needed. Mild illness may occur.

If the mother is not immune and the infant is less than 4 weeks of age, and full term at birth, give varicella zoster immunoglobulin (VZIG) (if available).

If the infant is preterm, and regardless of maternal immunity, give VZIG.

Regardless of whether VZIG is given, monitor the baby for signs of infection to enable early treatment should infection occur.

Shingles is very rare in infants and, if present, suspect HIV infection.

Doses of VZIG and aciclovir

In pregnancy

Aciclovir is of no benefit if commenced more than 24 hours after the appearance of chickenpox vesicles.

- Oral route: 800 mg five times daily for 7 days (mildly ill cases only).
- IV route: 10mg/kg/dose every 8 hours for 7 days.

Side effects include nausea, vomiting, diarrhoea, headache and nephrotoxicity. Reduce the dose or dosage interval in patients with impaired renal function.

Varicella zoster immunoglobulin (VZIG): 1 gram IM. Anaphylaxis is rare, but ensure that adrenaline is available.

In the neonate

Aciclovir 10–20 mg/kg IV every 8 hours for at least 7 days.

Side effects are as described above.

Varicella zoster immunoglobulin (VZIG): 250 mg by deep IM injection.

2.9

Mental health problems associated with pregnancy and the postnatal period

BOX 2.9.1 Minimum standards

- Screening tools for depression, such as the Edinburgh Postnatal Depression Scale (EPDS).
- Selective serotonin reuptake inhibitor (SSRI) antidepressant drugs.
- Ideally, an inpatient hospital facility for mothers and babies when the mother has puerperal psychosis.
- Antipsychotic drugs.

Introduction

Childbirth poses a risk to a woman's mental health. This applies to all women and girls who become pregnant in all countries, irrespective of their social and cultural background. However, the background will influence how a mother presents and how quickly she receives appropriate care.

Much of the research about pregnancy-related mental illness and its effects on the new baby has been done in high-income countries where it has been possible to develop specialised services. However, there is evidence that mental health problems in mothers are as common in low- and middle-income countries. A number of risk factors that have been suggested as underlying maternal depression are listed in Box 2.9.2.

Perinatal psychiatric services have developed in many high-income countries, and involve liaison between psychiatric and obstetric services. The specialty covers women with pre-existing mental health problems who want to have a family, as well as mental illness that is first diagnosed antenatally and postnatally. Maintaining the mental health of a pregnant woman benefits the family, and in some cases can prevent problems from developing postnatally. The onset of depression and anxiety in pregnancy or postnatally can be especially worrying for a woman and her family because it is contrary to their expectations that this will be a happy time. The woman may not want to admit how she is feeling,

BOX 2.9.2 Risk factors for development of maternal depression in low- and middle-income countries

- Poverty and high levels of economic stress
- Low levels of social support
- Domestic violence
- Chronic maternal illness
- Maternal anaemia
- Lack of awareness among primary healthcare workers of depression as an illness
- Social stigma associated with a family member being diagnosed with a mental illness
- Families with four or more children, especially when the children are under 7 years of age
- Having a preterm infant or an infant with a low birth weight
- Having a child with a developmental disability
- Having an unplanned or unwanted infant
- Having a female child in a culture where there is a strong preference for male children
- Lack of participation in family financial decisions, control of resources and reproductive health

Adapted from Wachs, Black and Engle (2009).

being ashamed both of her inability to feel joy about her newborn baby and of her perceived inability to cope, and fearing that she will be judged harshly for these feelings. This is especially important in countries and cultures where women and girls are not valued and their main role is perceived to be the production of healthy babies.

Mild antenatal and postnatal depression can be managed with minimal resources and does not require medication. Recognition of the condition and practical help from family and friends can be enough to prevent depression affecting the care of the baby. Reassurance from

healthcare professionals can help the mother and her family to realise that she is not on her own in her feelings. To a depressed new mother it can feel as if every other mother is better than her, and to know that this is not the case can be extremely helpful. If antidepressants are available they may, in selected cases, speed up recovery (see below).

However, there are serious psychiatric conditions associated with childbirth that can necessitate prompt psychiatric treatment and admission of the mother to a psychiatric hospital, preferably with her baby. The most serious of these conditions, puerperal psychosis, has been described as the only true psychiatric emergency. Usually rare, this condition is more common in women who have had a manic episode and have been diagnosed with bipolar affective disorder. A history of a previous episode of puerperal psychosis considerably increases the risk of having another episode following subsequent pregnancies. Knowing that a woman is at risk provides an opportunity for prevention – either of the illness itself, or of the repercussions of the illness if it has not been possible to prevent it.

Antepartum psychiatric disorders

There is evidence that psychiatric symptoms occur as frequently antenatally as postnatally, with an estimated prevalence of 10–15%. The symptoms are often of mild depression and anxiety. Careful enquiry may reveal that the symptoms were present before conception. The development of a serious psychiatric condition in the antenatal period is no more common than at other times, but if a diagnosis is made during pregnancy, the decision to start medication has to balance the severity of the mother's illness against the adverse effects of medication on the fetus.

Women with mild symptoms usually present early in pregnancy, and may improve as the pregnancy progresses. Hyperemesis can make the first trimester miserable and lead women to express thoughts of rejecting the pregnancy. Sometimes this is mistaken for evidence of depression. The third trimester can be a time of anxiety about labour and the impending birth, especially for first-time mothers or those who have had previous complicated deliveries. The factors that make women and girls more vulnerable are listed in Box 2.9.3.

Supportive counselling is often sufficient to improve the mental health of most women, but if antidepressants are indicated, there needs to be a discussion about the risks and benefits before they are prescribed. The selective serotonin reuptake inhibitors (SSRIs) fluoxetine and sertraline seem to have the best safety profile, but new information is emerging as more women take antidepressants in pregnancy and clinicians continually evaluate the safety profile of this class of drugs. There is increasing evidence that the SSRI antidepressants, especially paroxetine, are associated with an increased risk of cardiac abnormalities in the baby if taken during embryogenesis. However, the risk is still relatively low (4%), and has to be balanced against the risks to the pregnancy if the depression is left untreated. If SSRIs are not available, tricyclic antidepressants can be effective, but prescribers must be wary of patients with suicidal ideation, as the tricyclic antidepressants are more dangerous than SSRIs when taken in overdose.

A woman with an established diagnosis of bipolar disorder may be taking a mood stabiliser such as **lithium**, **sodium valproate** or **carbamazepine**, and **these are**

associated with increased fetal malformations, so consideration needs to be given to stopping them prior to conception. In women in whom relapse has occurred when stopping lithium, the balance between risks and benefits is probably in favour of continuing the drug. This is less likely to be the case for sodium valproate or carbamazepine.

BOX 2.9.3 Factors that increase the risk of antenatal depression and/or anxiety

- Previous obstetric loss
- Previous fertility problems
- Anxiety about the viability of the pregnancy
- Social and interpersonal adversity
- Feelings of ambivalence about the pregnancy
- Previous depression and/or anxiety associated with pregnancy

Postpartum psychiatric disorders

Psychiatric disorders that present postnatally are traditionally classified into three types as shown in Box 2.9.4. Other conditions can also present at this time, and it has been suggested that the term **postnatal common mental disorders** is more useful for distinguishing the milder depressive, anxiety and obsessional disorders from the more severe depressive disorders and puerperal psychosis.

BOX 2.9.4 Postpartum-onset psychiatric disorders

Maternity blues

Postnatal depression

- Mild
- Moderate
- Severe

Puerperal psychosis

Anxiety and obsessive-compulsive disorders

Maternity blues

This is generally a mild and self-limiting condition that affects over 50% of women, usually between day 3 and day 10 postnatally, but most commonly on day 5. A hormonal cause has been postulated for this transient condition, which is marked by variability of mood, feelings of confusion, irritability, insomnia and a feeling of not being able to cope. It is generally self-limiting, although if it is longer-lasting or more severe than usual, it can herald problems later in the postnatal period. Reassurance is usually sufficient to help the woman through this period, which usually last about 48 hours.

Postnatal depression

It is estimated that around 10% of women develop symptoms of depression postnatally. The majority of these symptoms will be relatively mild and overlap with the process of adjusting to having a baby, particularly (although not exclusively) following the birth of a first child. In most cases a diagnosis will not be made until about 6 weeks after the onset of the depression.

Symptoms are not dissimilar to those that occur in non-puerperal depression, but sleep and appetite are

often disrupted because of the baby's presence, so different questions may need to be asked in order to elicit a diagnosis. The mother may not recognise that she is depressed and so does not share how she is feeling. The commonly experienced anhedonia (inability to feel pleasure) is particularly difficult at this time, when the mother (and those around her) feels that she should be happy. This can lead her to conclude that she is a poor mother. Meanwhile others, particularly in western cultures, may state that there is a problem with bonding, which can exacerbate her guilt and low mood. Obsessional symptoms and irritability are also often reported.

The Edinburgh Postnatal Depression Scale (EPDS) is a screening tool (see Appendix) which has been translated into a number of languages and used across diverse cultural settings. It requires no psychiatric training to administer, and so can be used by healthcare workers to identify mothers who may be depressed.

Two recent studies in Ethiopia showed the EPDS to be less effective in rural areas than in urban ones. For rural Ethiopia the self-reporting questionnaire (SRQ) was considered to be superior. In urban areas the Kessler Psychological Distress Scale (which is used to assess psychological distress in various situations) and the EPDS were reported to be equally effective screening tools, but it was suggested that the Kessler Psychological Distress Scale may be more effective in detecting postnatal mental health disorders in this setting.

When the depression is mild, relatively simple interventions can be very effective, including listening to the mother's concerns, reassuring her that her feelings do not mean she is a bad mother, and giving practical help with the baby, allowing her to rest as much as possible. Antidepressants are not usually indicated in mild depression.

In cases of moderate depression with persistent low mood, reduced sleep and appetite, poor concentration, feelings of not being able to cope, and lack of improvement when practical help and support are given, antidepressants are likely to be needed. If available, sertraline or paroxetine are the SSRIs with the lowest relative infant dose (i.e. the amount passing to the infant through breast milk), so are the safest ones for breastfeeding mothers.

- **Sertraline:** starting dose is 50 mg, with a maximum dose of 200 mg daily.
- **Paroxetine:** starting dose is 20 mg, with a maximum dose of 60 mg daily.

The most commonly reported side effect for both of these drugs is nausea, which wears off after 2 to 3 weeks – the same time that it takes for the therapeutic effects to begin to appear – so the mother needs to be warned about this.

Imipramine and amitriptyline also appear to be safe in breastfeeding mothers.

- **Imipramine:** starting dose is 25 mg three times daily, increasing to a maximum total daily dose of 200 mg.
- **Amitriptyline:** starting dose is 25 to 100 mg total daily dose, given in three doses during the day or (usually more acceptably, because of its sedative effects) once at night. The maintenance dose is a total daily dose of 75 to 150 mg/day. Rarely a total daily dose of up to 300 mg may be used.

Side effects include sedation, postural hypotension, dry mouth, blurred vision, constipation, urinary retention

and increased body temperature. In overdose imipramine and amitriptyline are cardiotoxic, and this has to be considered when prescribing for a mother who may be experiencing suicidal thoughts. However, if these are the only drugs available, this risk needs to be weighed against the ongoing suicide risk if the mother is not given antidepressants.

Severe postnatal depression affects about 3% of women and can merge with puerperal psychosis. It tends to occur early postnatally, and it is likely to be obvious that the mother is unwell. Sleep is evasive, even when the baby sleeps well through the night. Appetite will be markedly reduced, with marked weight loss. Most mothers, even when very depressed, will use all their energies on the baby and neglect themselves. Depressive delusions can develop, with the mother believing that the baby would be better off without her, and this leads to a significant suicide risk. The risk of the mother taking the baby with her in a suicide attempt, although rare, has to be considered, though again this should be managed by closely monitoring the mother while keeping her baby with her. Separating the mother from the baby can increase the woman's sense of desperation and feelings of failure as a mother.

Admission of the mother and baby to a suitable hospital setting (if available) is the ideal way to manage a woman with severe delusional postnatal depression. **Electroconvulsive treatment ECT), but only if given under general anaesthesia and safely**, is indicated, often fairly early after the onset of symptoms, as this can treat the mother quickly and reduce the amount of time she is unwell. Antidepressants should be given (see above for doses; the SSRI group is likely to be the best and safest option if available), and also antipsychotics if these are needed.

Once improved, the mother is likely to benefit from the supportive measures described for milder types of postnatal depression. It is not only possible but desirable to continue breastfeeding, whether or not the mother is being treated with antidepressants. If antipsychotics are also required, breastfeeding can continue. Adequate sleep for the mother can be achieved by her expressing breast milk and other family members giving this to the baby from a cup and spoon whenever the baby wakes during the night.

Puerperal psychosis

This is the most severe postpartum mood disorder, and symptoms can appear rapidly. The usual incidence is 1 in 500 deliveries. It is a great shock to the mother and her family when it develops with no prior warning. However, a previous diagnosis of bipolar disorder or puerperal psychosis increases the risk to as much as 1 in 2. This presents the clinician with an opportunity to identify women at risk antenatally, consider the options for prevention, and develop a plan of management for the puerperium should the mother become unwell.

Characteristically, the woman may have been mentally healthy during her pregnancy, which may have given her and her family hope that all would be well in the puerperium. Typically there is a sudden onset of symptoms, most commonly in the first 2 weeks following childbirth. Sometimes the symptoms appear to come on overnight. The symptoms vary, but tend to progress rapidly over the first few days, and characteristically include the following:

- perplexity and confusion
- overactivity

- insomnia
- marked behavioural changes.

These common presenting features are often accompanied by a fear that something will happen to the mother or the baby, or sometimes a belief that the baby is not her own. The woman is usually easily distracted, with grossly impaired concentration, and is unable to finish one task before trying to start another, in a markedly disorganised way. This significantly interferes with her ability to look after her baby. Pointing this out often causes her even more distress. This can reinforce delusional beliefs that the baby is not her own, or that others are going to take her baby away, especially if she is separated from the baby because of her illness. A strong affective component is often present, usually hypomania or labile emotions, although this can develop into a more typically depressive picture.

During the acute phase there is a risk of harm to the mother or child, mainly due to the mother's chaotic behaviour which may unintentionally lead to neglect of the infant, rather than to any deliberately harmful actions on her part. Rarely, a mother may describe delusional beliefs involving the baby that could lead to direct harm, but this is very unusual. Although these risks to the child obviously have to be borne in mind, it is important to note that most mothers do not want to harm their babies. This risk should be managed wherever possible by keeping the mother and baby together and supervising them very closely. Even when the mother is very unwell and unable to manage much of the baby's care herself, both mother and baby benefit from being in close proximity. The mother can then be encouraged to take over more of the baby's care as her mental state improves, re-establishing the mother-child bond.

Women or girls with puerperal psychosis will frequently need medication, and the type of drug will depend on the predominant symptoms. In settings where the choice of medication is limited, the older antipsychotics can be just as effective as more modern drugs, and, with monitoring, breastfeeding can be continued, although it should be remembered that the disorganized behaviour of the mother can make breastfeeding difficult. It is therefore very important to supervise this.

Chlorpromazine is an inexpensive and generally widely available 'typical' antipsychotic drug which is very effective but tends to have been superseded in well-resourced countries by the 'atypical' antipsychotics with their more acceptable side-effect profile. Nevertheless, chlorpromazine is efficacious and the dose can be titrated up quite rapidly from 50 mg four times daily to as high as 1000 mg daily. Side effects include sedation (which can be beneficial in the acute stages of illness), dry mouth, nausea and parkinsonism (mask-like face, slowing and stiffness of gait, and tremor), although the inherent anticholinergic properties of chlorpromazine mean that this is not so common as with some of the other typical antipsychotic drugs (e.g. haloperidol).

Haloperidol is given at a dose of 0.5–3 mg two to three times daily, with a maximum daily dose of 30 mg orally. It is also often used in emergency situations as an IM injection of 5 mg or 10 mg, with a maximum daily dose of 18 mg IM.

The atypical antipsychotic drugs include **risperidone**, for which the starting dose is 1 mg twice daily, with a maximum daily dose of 6 mg, and **olanzapine**, for which the starting dose is 10 mg, with a maximum daily dose

of 20 mg. Although these drugs have a low incidence of parkinsonism, they are associated with weight gain and an increased risk of type 2 diabetes.

If a woman on an atypical antipsychotic wishes to conceive, she may want to switch to a typical drug, as there is longer-term evidence for their safety. However, this introduces a risk of relapse, and she may not want to take that risk. Also if a woman has conceived while on an atypical antipsychotic, the balance is probably in favour of continuing it, although, if possible, the dose could be reduced.

In mothers who present with puerperal psychosis, the prognosis is generally good if treatment is available, but they may remain vulnerable for several months even when the psychotic symptoms remit. As the psychotic symptoms improve and insight develops, the mother may experience a period of depressed mood as she adjusts to what has happened. However, recovery is usually complete by 6 months, although there is a risk of relapse at other times, particularly in a subsequent pregnancy.

In a woman with a pre-existing diagnosis of bipolar disorder, the management of labour is important for reducing the risk of a puerperal psychosis. Where possible, sleep deprivation should be minimised in order to reduce the risk of the illness developing. The importance of letting the mother sleep when she can following childbirth should be emphasised to the family, and the father should be asked to undertake as much care as possible during the night.

The effectiveness of using prophylactic antipsychotic drugs has yet to be established. The trigger for puerperal psychosis appears to be biological, but so far the condition has proved difficult to prevent, even when treatment is continued through pregnancy. It is therefore essential to have a plan in place for what to do if the mother becomes unwell, and this can also reduce stress for the family.

Anxiety disorders and obsessive-compulsive disorders

Women and girls with a history of anxiety disorders and obsessive-compulsive disorders may relapse postnatally.

Anxiety can range from mild concerns about the health of the baby to extreme anxiety that the baby may be seriously unwell, with constant vigilance and fear of a sudden infant death. The mother may seek and receive much reassurance from family and healthcare workers, yet remain concerned.

Mothers may experience obsessional thoughts or images of their babies being harmed, and sometimes the thought is that they will be the person to harm the baby. This can cause great distress, as the mother may fear that she will act on these thoughts, and so will avoid caring for her baby and allow her family to do so instead, which will reinforce her belief that she is a bad mother. Careful diagnostic exploration to identify obsessional rather than psychotic symptoms is essential in such cases.

Non-delusional, non-psychotic obsessions have the following characteristics:

- They come into the mind fully formed.
- They are recognised as the mother's own thoughts and not placed there by someone else.
- They are not voices telling her to harm her child.
- They are repetitive and intrusive.
- They are difficult to push away.

This analysis should be followed by an explanation of the

nature of these thoughts. The mother will need encouragement to continue to care for her baby despite these abnormal thoughts, and to dispel the belief that she is a bad mother. These intrusive thoughts can lead to immense guilt and feelings of incompetence. Therefore allowing the mother to express her concerns and be reassured can be very therapeutic. Antidepressants may be indicated, even in the absence of other biological symptoms of depression.

Benzodiazepines such as diazepam must not be used regularly in pregnancy. When taken later in pregnancy they can cause withdrawal symptoms, hypotonia and agitation in the newborn.

Effect of maternal mental health disorders on the infant

For the majority of women experiencing symptoms of depression and anxiety during pregnancy or in the early postnatal period, their ability to care for their baby is not significantly compromised. However, there are many studies describing the adverse effects of maternal depression on early childhood development, and chronic depression does have deleterious effects on the whole family. This evidence needs to be taken seriously from a public health point of view to highlight the problem and aid development of services. However, it is also important to remember that for an individual mother the thought that she may be regarded as causing harm to her baby will reinforce the guilt that she is already feeling, and delay recovery. Several of the factors listed in Box 2.9.2, while predisposing to maternal depression, are also going to disadvantage the child, so addressing these where possible will benefit both mother and child.

Appendix

Edinburgh Postnatal Depression Scale (EPDS)

Name: _____

Address: _____

Your date of birth: _____

Baby's date of birth: _____ Phone number: _____

Instructions

As you have recently had a baby, we would like to know how you are feeling now. Please choose the answer that comes closest to how you have felt IN THE PAST WEEK, not just how you feel today.

Here is an example, already completed.

I have felt happy:

- Yes, all of the time
- Yes, most of the time (*This would mean: 'I have felt happy most of the time' during the past week*)
- No, not very often
- No, not at all

In the past 7 days:

Question 1

In the past week I have been able to laugh and see the funny side of things:

- As much as I always could
- Not quite so much now
- Definitely not so much now
- Not at all

Question 2

In the past week I have looked forward with enjoyment to things:

- As much as I ever did
- Rather less than I used to
- Definitely less than I used to
- Hardly at all

Question 3*

In the past week I have blamed myself unnecessarily when things went wrong:

- Yes, most of the time
- Yes, some of the time
- Not very often
- No, never

Question 4

In the past week I have been anxious or worried for no good reason:

- No, not at all
- Hardly ever
- Yes, sometimes
- Yes, very often

Question 5*

In the last week I have felt scared or panicky for no very good reason:

- Yes, quite a lot
- Yes, sometimes
- No, not much
- No, not at all

Question 6*

In the past week things have been getting on top of me:

- Yes, most of the time I haven't been able to cope at all
- Yes, sometimes I haven't been coping as well as usual
- No, most of the time I have coped quite well
- No, I have been coping as well as ever

Question 7*

In the past week I have been so unhappy that I have difficulty sleeping:

- Yes, most of the time
- Yes, sometimes
- Not very often
- No, not at all

Question 8*

In the past week I have felt sad or miserable:

- Yes, most of the time
- Yes, quite often
- Not very often
- No, not at all

Question 9*

In the past week I have been so unhappy that I have been crying:

- Yes, most of the time
- Yes, quite often
- Only occasionally
- No, never

Question 10*

In the past week the thought of harming myself has occurred to me:

- Yes, quite often
- Sometimes
- Hardly ever
- Never

Administered/reviewed by: _____ Date: _____

Source: Cox JL, Holden JM and Sagovsky R (1987) Detection of postnatal depression: development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry*, 150, 782–6.

Instructions for using the Edinburgh Postnatal Depression Scale

- 1 The mother is asked to check the response that comes closest to how she has been feeling in the previous 7 days.
- 2 All of the items must be completed.
- 3 Care should be taken to avoid the possibility of the mother discussing her answers with others. Answers must come from the mother or pregnant woman.
- 4 The mother should complete the scale herself, unless she has limited English or has difficulty with reading.

Mothers who score above 13 are likely to be suffering from a depressive illness of varying severity. The EPDS score should not override clinical judgement. A careful clinical assessment should be undertaken to confirm the diagnosis.

The scale indicates how the mother has felt during the previous week. In doubtful cases it may be useful to repeat the tool after 2 weeks. The scale will not detect mothers with anxiety neuroses, phobias or personality disorders.

Scoring

Questions 1, 2 and 4 (without an asterisk) are scored 0, 1, 2 or 3, with the top box scored as 0 and the bottom box scored as 3.

Questions 3, 5, 6, 7, 8, 9 and 10 (marked with an asterisk) are reverse scored, with the top box scored as 3 and the bottom box scored as 0.

The maximum possible score is 30.

Possible depression is indicated by a score of ≥ 10 .

Always look at item 10 (suicidal thoughts).

2.10 Female genital cutting

Introduction

What is female genital cutting?

Female genital cutting (FGC), also known as female circumcision or female genital mutilation, refers to all procedures involving partial or total removal of the external female genitalia, or other injury to the female organs for non-therapeutic reasons. It ranges from very simple to radical, and may be carried out between birth and puberty, or can be performed just before marriage or childbirth.

FGC varies across cultures, ethnic groups and tribal affiliations; there is also some variation in the types of cutting undertaken within cultures, ethnicity and tribes. The World Health Organization has estimated that 130 million women worldwide have undergone FGC. There are an estimated 2 million infants, girls and women at risk each year.

The European Parliamentary Committee on Women's Rights and Gender Equality states that around 500 000 women and girls living in Europe have been subjected to FGC.

A practice of performing a symbolic form of infibulation to accompany the usual ceremonies has been recently adopted in Somalia. The procedure consists of applying to the clitoris a small needle (sterile insulin needle) to obtain a drop of blood. The practice is called 'Sunna' and is not yet widespread in the country. It is performed only by enlightened women in that society, but hopefully it will attract others to adopt this approach while awaiting a time when all forms of this practice end.

Who performs FGC?

FGC is commonly performed by traditional medicine practitioners, including traditional birth attendants, local women or men, or female family members. Such individuals do not have formal medical training, and usually perform cutting without anaesthesia or asepsis with crude instruments such as kitchen knives or razor blades. It is not uncommon

for those who perform FGC to cut or damage more of the genital area than they intended to. Increasingly, doctors are also undertaking these procedures.

The health problems associated with FGC are life-threatening haemorrhage, sometimes death during or shortly after the procedure (from haemorrhage or infection), death during pregnancy, the need for assistance during childbirth due to interference with normal delivery, and the spread of HIV/AIDS and hepatitis due to the frequent use of unclean and unsterile instruments. There are also links to mental illness in the victims and to intimate partner violence.

Prevalence of FGC

FGC is practised in about 28 countries in Africa, Asia and the Middle East. A recent interview by Integrated Regional Information Networks (IRIN) in 2012 confirmed that FGC is still being practised in Pakistan. It is estimated that at least 50–60% of Bohra women undergo FGC; this is usually a symbolic snipping of the clitoris.

TABLE 2.10.1 Estimated prevalence of FGC by country

| Country | Estimated prevalence of FGC in girls and women aged 15–49 years (%) | Year |
|--------------------------|---|------|
| Benin | 16.8 | 2001 |
| Cameroon | 1.4 | 2004 |
| Chad | 44.9 | 2004 |
| Central African Republic | 25.7 | 2005 |
| Djibouti | 93.1 | 2006 |
| Egypt | 95.8 | 2005 |
| Ethiopia | 74.7 | 2005 |
| Eritrea | 95.0 | 1995 |

| Country | Estimated prevalence of FGC in girls and women aged 15–49 years (%) | Year |
|---|---|------|
| Guinea Bissau | 44.5 | 2005 |
| Ghana | 3.8 | 2005 |
| Guinea | 95.6 | 2005 |
| Gambia | 78.3 | 2005 |
| Ivory Coast | 41.7 | 2005 |
| Liberia | 45.0 | |
| Mali | 91.6 | 2001 |
| Mauritania | 71.3 | 2001 |
| Nigeria | 19.0 | 2003 |
| Niger | 2.2 | 2006 |
| Sierra Leone | 90.0 | 2003 |
| Senegal | 28.2 | 2005 |
| Somalia | 97.9 | 2005 |
| Sudan, northern (approximately 80% of total population in survey) | 90.0 | 2000 |
| Kenya | 32.2 | 2003 |
| Togo | 5.8 | 2005 |
| United Republic of Tanzania | 14.6 | 2004 |
| Uganda | 0.6 | 2006 |
| Yemen | 22.6 | 1997 |
| Burkina-Faso | 72.5 | 2005 |

Data taken from OHCHR, UNAIDS, UNDP, UNECA, UNESCO, UNFPA, UNHCR, UNICEF, UNIFEM and WHO (2008) *Eliminating Female Genital Cutting: an interagency statement*. www.un.org/womenwatch/daw/csw/csw52/statements_missions/Interagency_Statement_on_Eliminating_FGM.pdf

Types of female genital cutting

The WHO has classified FGC into four types.

- **type 1:** excision of the prepuce, with or without excision of the clitoris, entirely or in part
- **type 2:** excision of the clitoris with partial or total excision of the labia minora
- **type 3:** excision of part or all of the external genitalia and stitching/narrowing of the vaginal opening (also known as infibulation). This type is most common in countries in the Horn of Africa, namely Sudan, Eritrea, Djibouti, Ethiopia and Somalia
- **type 4:** unclassified – includes pricking or incising of the clitoris or labia, cauterisation by burning of the clitoris, or introduction of corrosive substances or herbs into the vagina; sometimes the clitoris is buried rather than excised.

Around 90% of FGC is of types 1, 2 and 4, and 10% is of type 3 (infibulation). The type often varies depending on ethnicity.

The age at which FGC is undertaken varies between countries. In Ethiopia, Eritrea and Yemen most girls will have been mutilated in infancy. In Egypt, 90% are mutilated between 5 and 15 years of age.

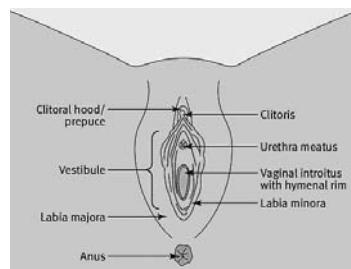


FIGURE 2.10.1 Normal female external genitalia.

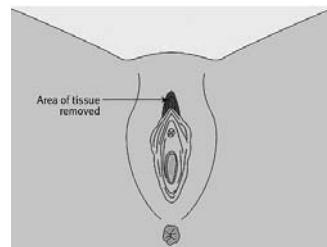


FIGURE 2.10.2 Area of tissue removed in type 1 female genital cutting.

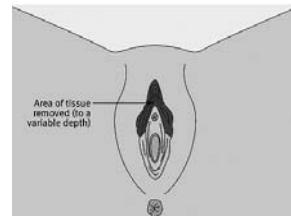


FIGURE 2.10.3 Area of tissue removed in type 2 female genital cutting.

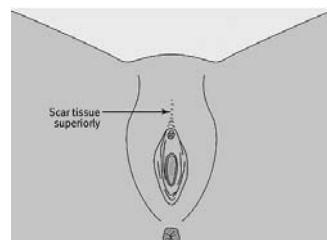


FIGURE 2.10.4 Appearance of genitalia after type 2 female genital cutting.

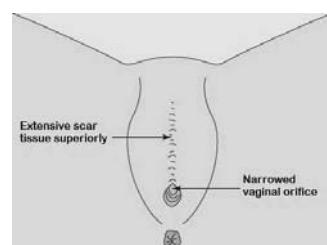


FIGURE 2.10.5 Appearance of genitalia after type 3 female genital cutting.

Implications and complications of FGC

FGC is dangerous to girls' and women's health and psychological well-being. It can cause urological, gynaecological and obstetric problems. Around 10% of girls and women are estimated to die from the short-term complications of FGC, such as haemorrhage, shock and infection. Another 25% die in the long term as a result of recurrent urinary and vaginal infections and complications during childbirth, such as severe bleeding and obstructed labour.

Short-term complications

These include the following:

- haemorrhage and anaemia
- severe pain (it is almost always the case that no local anaesthetic is given)
- shock (due to haemorrhage and/or pain)
- death from shock (due to haemorrhage and/or pain)
- difficulty passing urine or faeces
- urinary tract infection
- urethral meatus injuries, prolonged micturition, and dysuria
- injury to adjacent tissues
- damage to other organs
- fractures or dislocation due to restraint during the procedure
- infection due to tetanus, and bloodborne viruses such as HIV, and hepatitis B and C
- vulval abscess.

Long-term complications

These include the following:

- chronic pain
- chronic pelvic infection
- haematocolpos (obstruction to menstrual flow, leading to dangerous swelling of the vagina)
- keloid scarring
- decreased quality of sexual life, including pain on intercourse
- complications in pregnancy and childbirth, including obstructed labour (see below)
- psychological damage, including fear and anxiety during labour and delivery, as well as post-traumatic stress disorder and depression
- psychosexual effects; fear of and anxiety about sexual intercourse, difficulties with penetration, marital breakdown and divorce.

Complications during childbirth

Women who have undergone FGC are more likely to experience difficulties during childbirth, and their babies are more likely to die. A WHO study conducted in 2006 in six African countries showed an increased risk of possible obstetric complications in women who had been subjected to FGC compared with women who had not undergone this procedure. The same study showed an increased incidence of maternal death, Caesarean section, postpartum haemorrhage and neonatal resuscitation, as well as prolonged hospital stays, in women who had undergone FGC.

Management during pregnancy, labour and the postnatal period

Antenatal period

All women and girls who have been subjected to FGC

should be identified at antenatal booking or the gynaecological clinic by asking questions such as 'Have you been closed?' or 'Did you have the cut or operation as a child?' Most women will then assume that you know about FGC, and further questions can be asked, such as 'Do you have any problems with passing urine or menstruation?' or 'How long does it take to pass urine?' Once the issue is raised, the woman may then feel comfortable discussing it further with the midwife or doctor.

Reversal of FGC (de-infibulation)

Reversal (de-infibulation) is best undertaken at 17–18 weeks' gestation (mid-trimester) by a specialist midwife or surgeon, to enable easy access to the vaginal orifice and urethra during labour. Performing reversal in the second trimester ensures complete healing prior to labour. Reversal is not recommended in the first trimester, as the procedure may be wrongly blamed for fetal loss.

Antenatal reversal is essential to assist in vaginal examinations using a speculum, and in urinary catheterisation. It may also prevent recurrent urinary tract infection. Local anaesthesia is encouraged for reversal, but general anaesthesia may be necessary if the woman suffers from flashbacks to childhood trauma.

Post-reversal care during the antenatal period should include adequate pain relief and promotion of personal hygiene. Some re-education may be necessary, as some women will have forgotten, or may never have known, what normal micturition or menstruation is like.

Labour

The aim is a normal delivery, with Caesarean section only for the usual obstetric indications. The woman should receive standard care in labour.

If the woman has not been seen antenatally, or if she has chosen not to have reversal undertaken, an individual assessment should be made on admission in labour, regarding the need for reversal and/or episiotomy to facilitate delivery.

If she has sustained FGC type 3 (infibulation), a midline incision should be made to expose the introitus and urethra, after infiltration with 1% lignocaine. Infibulated women should have a midline incision and medio-lateral episiotomy **only if necessary**.

Adequate **pain relief** is very important, especially as flashbacks may occur.

Bladder care is very important during labour, to avoid damage to the bladder and the urethra (catheterisation is not usually necessary; encourage frequent voiding).

Care following delivery

If suturing is needed, it should occur promptly. **Re-infibulation of FGC type 3 must not be carried out at this time.**

If a midline incision has been made to open a type 2 or 3 FGC to enable delivery, then each side of the incision is oversewn separately on either side. In this way the FGC is 'reversed' and haemostasis achieved.

Postnatal period

Immediate care following delivery should include the following:

- adequate pain relief.
- perineal care
- re-education. Some women will have forgotten or will

never have known what normal micturition or menstruation is like.

Following discharge from the healthcare facility, continued support for the woman should be provided. If reversal is performed in labour, there should be a post-reversal check 4 to 6 weeks later.

If the woman has delivered a baby girl, support and information should be given, encouraging her not to inflict or allow others to inflict the same procedure on her daughter.

All decisions or plans for the child(ren) should be based on good-quality assessments. They should be sensitive to issues of race, culture, gender, religion and sexuality, and should avoid stigmatising the child or the practising community as far as possible.

Accessible, acceptable and sensitive involvement with the health, education, police, children's social care and voluntary-sector services may be needed.

All agencies should work in partnership with members of local communities, to empower individuals and groups to develop support networks and education programmes.

Safeguarding children who are at risk of FGC

- The safety and welfare of the child is paramount.
- All agencies must act in the best interests of the rights of the child as stated in the UN Convention on the Rights of the Child (1989).
- In some countries, FGC is illegal.

Laws and FGC

The following countries in Africa have issued laws against FGC, although this does not mean that the prevalence of FGC has been significantly reduced:

- Benin (2003)
- Burkina Faso (1996)
- Central Africa Republic (1966)
- Chad (2003)
- Cote d'Ivoire (1998)
- Djibouti (1994)
- Egypt (Ministerial Decree) (1996)
- Ethiopia (2004)
- Ghana (1994)
- Guinea (1965)
- Kenya (2001)
- Niger (2003)
- Senegal (1999)
- Tanzania (1998)
- Togo (1998)
- Nigeria (multiple states) (1999–2002).

It is acknowledged that some families see FGC as an act of love rather than of cruelty. However, FGC causes significant harm in both the short and long term, and constitutes physical and emotional abuse of children.

Appropriate care for women and girls who have been subjected to FGC

- Provide access to information, support and services.
- Provide care pathways and guidelines for professionals.
- Ensure that information is accurate and up to date.
- Empower women and girls and encourage them to speak out and seek help.
- Engage and mobilise all concerned, and develop an understanding of cultural diversity.
- Be open and supporting, sensitive and non-judgemental.
- Encourage alternative rites to FGC. This is a strategy that retains all of the rites of passage or initiation that the girls would traditionally undergo, except for the genital cutting. The girls are still encouraged to learn essential domestic duties that would be useful when they get married.

Conclusion

FGC is a violation of human rights. It is essential to empower women and girls, to encourage women to have a voice, and to raise awareness of the dangers of FGC. Engagement with all concerned local communities is crucial, including community and religious leaders.

As has been expressed so beautifully by Uche Umeh, 'When culture kills, when culture silences, when culture is complicit then culture must be changed.'

It is essential to work with all professionals. We all have a duty and a responsibility to safeguard girls who are at risk of FGC, as the welfare of children is paramount.

2.11

Domestic/intimate partner violence and pregnancy

Introduction

Everyone has a fundamental right to be, and remain, safe from harm. **Domestic violence**, also described as **intimate partner violence**, is defined as 'any incident of threatening behaviour, violence or abuse (psychological, physical, sexual, financial or emotional) between adults who are, or have been, intimate partner or family members, regardless

of gender or sexuality'. Family members are defined as mother, father, son, daughter, brother, sister and grandparents, whether directly related, in-laws or step-family.

The main characteristic of domestic violence is that the behaviour is intentional and is calculated to exercise power and control within a relationship.

Domestic violence is reported in up to one in five

pregnancies, often beginning or getting worse at this time. The risk of moderate to severe violence appears to be greatest in the postpartum period.

Injuries to the abdomen, genitals and breasts are most frequent in pregnancy, but can be multiple, affecting any part of the woman's body.

Women and girls who suffer domestic violence are at increased risk of miscarriage, premature labour, placental abruption, low-birth-weight infants, fetal injury and intrauterine fetal death. As a result of violence, women are five times more likely to attempt suicide.

The impact of domestic violence can be devastating, and creates long-term consequences for women and girls, such as anxiety and mistrust. The impact on children must also be considered, as domestic violence and child abuse are often linked to the same perpetrator.

Recognising domestic violence in pregnancy

Studies show that around 30% of women will suffer from domestic violence in their lifetime. The first incident of violence commonly occurs during pregnancy. For some of these women, the pregnancy might be unwanted, due to abuse, rape, or as a result of not having access to or not being able to negotiate contraceptive use.

Domestic violence in pregnancy may be suspected on the basis of the type of injury, as well as the mental health and emotional status of the woman.

Women who are being abused may book late, and be poor attendees at antenatal clinics. They may attend repeatedly with trivial symptoms, and appear reluctant to be discharged home. The partner may be constantly present, not allowing private discussion. The woman may seem reluctant to speak in front of her partner, or to appear to contradict him.

Abusive partners often seek to minimise the evidence of their violence (e.g. by targeting areas that are normally clothed). As with child abuse, the stated mechanism of injury often does not fit with the apparent injury. There may be unintended injuries of different ages, or the late presentation of injuries.

Multiple injuries and bruising (especially to the face, arms, breasts and abdomen), loss of consciousness, and drunkenness are significant but non-specific markers of domestic violence.

A history of behavioural problems, or abuse of children in the family, may be suggestive of domestic violence.

Diagnosing domestic violence

Routinely ask mothers whether they have been subjected to violence. Questions such as the following may allow the woman to disclose that she is being subjected to violence:

- I have noticed you have a number of bruises. Did someone hit you?
- You seemed frightened by your partner. Has he ever hurt you?
- You mention that your partner loses his temper with the children. Does he ever do that with you?
- How does your partner act when he is drinking alcohol or on drugs?

Other strategies such as the use of questionnaires in the women's toilets/rest room may help those women whose partner is constantly by their side (see Appendix).

Community midwives and traditional birth attendants visiting women at home may have the privacy to discuss such sensitive issues.

The provision of interpreters is essential. **Family members should not act as interpreters in this situation, as free dialogue will probably not occur.**

A system for caring for and protecting mothers subject to violence should be advocated for by all healthcare professionals undertaking maternal and child healthcare. Multi-agency working is crucial, and should include liaison with police, social services and the judicial system.

All professionals must take any available steps to seek a safe haven and to protect and support women who are experiencing domestic violence. The impact of domestic violence on the unborn child should be acknowledged, as well as the potential impact on existing children. It is very important to perform a risk assessment on women. Access to information and support must be easily and readily available to pregnant women.

It is equally crucial to empower and counsel women to make their own choices. Underlying issues such as finance and housing should be addressed, and the woman should be directed to the appropriate agency or support group, or to a legal adviser.

Appendix

How do I know if I am experiencing abuse?

If you answer yes to one or more of the following questions, you may be in an abusive relationship.

- Has your partner tried to keep you from seeing your friends or family?
- Has your partner prevented you from continuing or starting a college course, or from going to work?
- Does your partner constantly check up on you or follow you?
- Does your partner accuse you unjustly of flirting or of having affairs?
- Does your partner constantly belittle or humiliate you, or regularly criticise or insult you in front of other people?
- Are you ever scared of your partner?
- Have you ever changed your behaviour because you're afraid of what your partner might do or say to you?
- Has your partner ever deliberately destroyed any of your possessions?
- Has your partner ever hurt or threatened you or your children?
- Has your partner ever kept you short of money so that you were unable to buy food and other necessary items for yourself and your children?
- Has your partner ever forced you to do something that you really didn't want to do, including sexually?

Further reading

Wellbeing Foundation Africa. *Eliminating Domestic Violence.* www.wbfafrica.org/resources/cat_view/1-resources/6-eliminating-domestic-violence.html

2.12 Post-operative care

Basic nursing issues

The patient should be discharged to the ward or recovery area with clear orders for the following:

- **Monitor ABC.**
- If the patient is unconscious (P or U on the AVPU scale) they should not be left alone until they are responding to voice. Put them in the recovery position and undertake airway opening as required.
- Check vital signs (temperature, pulse, respiratory rate, blood pressure and capillary refill time) every 15 minutes for the first hour, hourly for the next 4 hours, and then 2-hourly. Observations should be more frequent if there is a change in observation from a normal to abnormal value.
- Monitor SaO₂ (normal value is > 93%) after a general anaesthetic. Give **oxygen** as required until SaO₂ is > 93% in air or the patient's colour is normal. Remember that cyanosis may not be present if the patient is severely anaemic.
- Observe the mother closely until the effect of the anaesthetic has worn off.
- Control pain: if it is severe, the patient will need IV morphine.
- Record the rate and type of IV fluid (if the patient has ketosis, ensure that there is an adequate amount of glucose in the drip).
- Record urine output, surgical and nasogastric drainage, and vomiting.
- Record input versus output, and calculate the difference every 12 hours.
- Document other medications.
- Perform laboratory investigations.

The patient's progress should be monitored, and documentation should include at least the following:

- a comment on medical and nursing observations
- a specific comment on the wound or operation site
- any complications
- any changes made in treatment.

Prevention of complications

- Provide adequate pain control.
- Encourage early mobilisation:
 - deep breathing and coughing
 - active daily exercise
 - joint range of motion
 - muscular strengthening
 - availability of walking aids such as canes, crutches and walkers, as well as instructions for their use.
- Ensure adequate nutrition.
- Consider thromboprophylaxis in those at high risk of thrombo-embolic disease (DVT/PE) (see Section 2.5.H: 'Pulmonary embolism').
- Prevent skin breakdown and pressure sores:
 - turn the patient frequently
 - keep urine and faeces off the skin.

Pain management (see Section 1.15)

Manage pain wherever the patient is seen (emergency department, operating theatre or on the ward), and anticipate their needs for pain management after surgery and discharge. Do not delay the treatment of pain unnecessarily.

In the first 12–24 hours after a major surgical procedure, such as Caesarean section, powerful opiate analgesia (usually morphine IV) will be needed (see Section 1.15 for details). Thereafter, the pain should be less severe, and regular codeine, non-steroidal anti-inflammatory drugs (NSAIDs), aspirin or paracetamol should be sufficient.

Wound care

Dressings protect the wound and absorb exudates. Usually the dressing applied in theatre can remain in place for 48 hours unless there is excessive or purulent exudate, when a new dressing should be applied as a sterile procedure after cleansing with sterile 0.9% saline. Swabbing a wound can be harmful as it damages the newly granulating tissue. It is also painful.

After 48 hours, provided that the wound is intact, it can be cleaned under a shower.

Removal of sutures should usually occur after 7 days. Use one hand to hold the knot with forceps, place the stitch cutter or scissors under the knot next to the skin, and cut the stitch where it emerges from the skin. Remove the suture by pulling on the knot, which prevents a potentially contaminated stitch being pulled through the wound. Observe the wound every 4–6 hours, without touching it, for evidence of dehiscence.

Monitoring

All patients should be assessed at a frequency that is determined by the severity of their condition. Even those who are not seriously ill must be regularly assessed.

Vital signs (temperature, pulse, respiratory rate, blood pressure, urine output and fluid inputs) should be recorded on a standard form or graph at least 4-hourly for 24 hours after the immediate post-operative recovery phase.

Do not forget anti-tetanus coverage when appropriate.

Progress notes need not be lengthy, but must comment on the patient's condition and note any changes in the management plan. They should always be signed by the person writing the note.

Notes can be organised in the 'SOAP' format as follows:

- **Subjective:** how the patient feels.
- **Objective:** findings on physical examination, vital signs and laboratory results.
- **Assessment:** what the healthcare worker thinks.
- **Plan:** management plan (this may also include directives which can be written in a specific location as 'orders').

Specific post-operative issues

Post salpingectomy for ruptured ectopic pregnancy

- Counsel patient regarding operative findings and likely

- future fertility (if the other tube is normal in appearance then fertility is around 70%).
- Counsel patient regarding risk of recurrence (1 in 10 or more) and the need for early ultrasound in any subsequent pregnancy. If evidence of pelvic inflammatory disease intraoperatively, treat patient and partner unless clear history of recent treatment.
 - Offer child spacing/family planning advice. The intrauterine contraceptive device (IUCD) is associated with ectopic pregnancy if the patient becomes pregnant while using it. If another contraceptive is available and acceptable/suitable then this should be used in preference.

Post Caesarean section

Monitoring

- 1 Regularly (at least 2- to 4-hourly initially) monitor vital signs, including temperature, heart rate, respiratory rate, blood pressure, urine output, AVPU and SaO_2 .
- 2 Regularly palpate the uterine fundus to ensure that the uterus remains contracted.
- 3 Regularly check for excessive vaginal blood loss.

Fluids and nutrition

- 1 If uncomplicated, give liquids and solids after 4–8 hours.
- 2 Bowel function should be normal after 12 hours.
- 3 Remove the IV cannula when the patient is stable and eating and drinking.
- 4 If there is infection, obstructed labour or uterine rupture, wait until bowel sounds appear before giving oral fluids.

Urine output

- 1 Keep a fluid balance chart and ensure that adequate urine output is occurring.
- 2 Remove the urinary catheter after 8 hours if the urine is clear; if not wait, until it is.
- 3 Wait 48 hours before removing the urinary catheter if there is a history of severe pre-eclampsia, uterine rupture, prolonged or obstructed labour, massive perineal oedema, or puerperal sepsis with pelvic peritonitis.
- 4 If the bladder was damaged, leave the catheter in for 7 days and until the urine is clear. If the patient is not receiving antibiotics, give nitrofurantoin 100mg or cefalexin 500mg or amoxicillin 500mg orally once daily until the catheter is removed.

Anaemia

- 1 If the mother is significantly anaemic (haemoglobin level < 6–7 g/dL), transfusion may aid recovery from the operation. If possible, consider giving 500mL of fresh cross-matched blood from a relative or other donor. The need for blood transfusion is dependent on the starting Hb and how well the patient is tolerating the anaemia.

Wound care

- 1 Check the dressing without disturbing it every 6 hours for the first 48 hours. Look for bleeding or infection.
- 2 Change the dressing after 48 hours.
- 3 If blood is leaking, replace the dressing with a new one if it is more than half soaked.

Postpartum vaginal haemorrhage

- 1 Massage the uterus to expel blood and blood clots. The presence of blood clots will inhibit effective uterine contractions;

- 2 Give oxytocin 10 units IM and then infuse 40 units in 500 mL of IV fluids (Ringer-lactate or Hartmann's solution) over 4 hours. If bleeding is heavy, give misoprostol orally, 3 × 200 microgram tablets, or rectally, 4 × 200 microgram tablets (see Section 2.5.D.iv for further management of postpartum haemorrhage).

Infection

- 1 If there are signs of infection or the mother currently has fever, give ampicillin 2 grams IV every 6 hours, plus gentamicin 80mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours, plus metronidazole 500mg IV every 8 hours. If fever is still present 72 hours after initiating antibiotics, re-evaluate and revise the diagnosis.
- 2 Infection of the uterus is a major cause of maternal death. Delayed or inadequate treatment of endometritis may result in pelvic abscess, peritonitis, septic shock, deep vein thrombosis, pulmonary embolism, chronic pelvic infection with recurrent pelvic pain and dyspareunia, tubal blockage and infertility.
- 3 If retained placental fragments are suspected as a cause of infection, perform a digital exploration of the uterus to remove clots and large pieces. Use ovum forceps or a large curette if required.
- 4 If there is no improvement with conservative measures and there are signs of general peritonitis (fever, rebound tenderness and abdominal pain), perform a laparotomy to drain the pus.
- 5 If the uterus is necrotic and septic, perform a hysterectomy (subtotal is preferable, if the cervix is not necrotic).

General measures

- 1 Ensure that the mother cannot fall out of bed when recovering from a general anaesthetic or if she is very unwell with a reduced conscious level.
- 2 Ensure pain control.
- 3 Encourage early mobility and deep breathing exercises.
- 4 The patient should wear knee-length well-fitting anti-embolism stockings until she is fully ambulant.

At the time of discharge from hospital

- 1 Discuss the implications of Caesarean section for future pregnancy management.
- 2 Discuss the timing of future activities such as sexual intercourse and heavy lifting.
- 3 Provide details of warning signs as to when the mother should contact a trained healthcare worker for advice.

Wound abscess

- If there is **pus or fluid**, open and drain the wound. Remove infected skin or subcutaneous sutures and debride the wound. Do not remove fascial sutures unless deep infection is evident or suspected.
- If there is an **abscess without cellulitis**, antibiotics are not required.
- Place a damp sterile normal saline dressing in the wound and change the dressing every 24 hours.
- Advise the patient on good hygiene and the need to wear clean pads or cloths that are changed frequently.
- **If the infection is superficial and does not involve deep tissues, monitor for development of an abscess and give antibiotics for 5 days or until fever free for 48 hours:**

- Flucloxacillin/cloxacillin 250–500 mg by mouth four times a day for 5 days.
- If the infection is deep, involves muscles and is causing necrosis (necrotising fasciitis), give antibiotics until the necrotic tissue has been removed and the patient has been fever-free for 48 hours:
 - Flucloxacillin/cloxacillin 500 mg–1 gram IV 6 hourly plus penicillin G 2 million units IV every 6 hours, plus metronidazole 500 mg IV every 8 hours.

Necrotising fasciitis requires urgent wide surgical debridement. Perform secondary closure 2 to 4 weeks later, depending on the resolution of infection.

It is important to inform the mother on discharge that she is at risk of uterine rupture during her next pregnancy. Offer child spacing/family planning advice.

Other complications

Peritonitis

Signs and symptoms

These include severe generalised abdominal pain, nausea and vomiting, fever, absent bowel sounds, rigid abdominal wall and shock.

Treatment

- 1 Call a surgeon and an anaesthetist.
- 2 Provide nasogastric suction.
- 3 Treat shock if present, but always place a wide-bore IV line and infuse fluids.
- 4 Give antibiotics until the patient has been fever-free for 48 hours:
 - ampicillin 2 grams IV every 6 hours, plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours, plus metronidazole 500 mg IV every 8 hours.
- 5 If necessary, perform laparotomy for peritoneal washout.

Pelvic abscess

Give antibiotics before draining the abscess, and continue until the patient has been fever-free for 48 hours:

- ampicillin 2 grams IV every 6 hours, plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/

IM once every 24 hours, plus metronidazole 500 mg IV every 8 hours.

If the abscess is fluctuant in the pouch of Douglas (cul-de-sac), perform culdocentesis. If the spiking fever continues, perform a laparotomy.

Care of the patient after spinal anaesthesia

Observations

Standard post-anaesthetic observations

Sensation should return within 4 hours. If after 4 hours the patient remains numb and/or cannot move her legs, contact the anaesthetist urgently.

Analgesia

Severe pain may return suddenly when the effects of the spinal block have worn off. Give analgesia when the patient first experiences pain.

Fasting

Fasting is not needed unless it is a surgical requirement (e.g. after abdominal operations).

Posture

The patient does not have to lie flat. Allow them to sit up as soon as they are able to do so.

Mobilising

If not contraindicated by the surgery, the patient can get out of bed 2 hours after the return of normal sensation, but only with assistance. Before getting the patient out of bed, sit her up slowly. If she feels faint, dizzy or sick then lie her down, take her blood pressure and inform the anaesthetist.

Potential complications

- **Postural hypotension:** lie the patient on the bed, give or increase IV fluids and inform the anaesthetist.
- **Urinary retention:** encourage the patient to pass urine when sensation returns. If the patient has not passed urine and she has a palpable bladder, she may need a catheter.

2.13 Obstetric procedures

The importance of basic and comprehensive Emergency Obstetric and Neonatal Care in resource-limited settings

The availability of Emergency Obstetric and Neonatal Care (EmONC) indicates how well any healthcare system can respond to the obstetric and newborn complications that are the main causes of maternal and newborn deaths. The Averting Maternal Death and Disability Program (AMDD)

and the United Nations have defined nine essential EmONC services that directly treat these complications. These are termed signal functions.

The functional status of an EmONC facility depends on the 24-hour availability of these life-saving signal functions and whether they have been performed recently. To qualify as a basic EmONC (or BEmONC) facility, health centres and hospitals must have performed the following seven signal functions within the past 3 months:

- 1 administered IM or IV antibiotics
- 2 administered IM or IV anticonvulsants
- 3 administered IM or IV uterotonic drugs
- 4 performed manual removal of the placenta
- 5 performed removal of retained products of conception (manual vacuum aspiration)
- 6 performed assisted vaginal delivery (with vacuum extractor or forceps)
- 7 performed neonatal resuscitation with a bag and mask.

To qualify as a comprehensive EmONC (or CEmONC) facility, health centres and hospitals must have performed all seven basic services listed above plus the following two additional signal functions within the past 3 months:

- 1 blood transfusion
- 2 Caesarean section.

In order for these EmONC systems to work adequately, there must be effective coordination of the supplies of essential emergency drugs, medical and surgical supplies and equipment to every facility providing this care. Essential drugs must include oxytocin, magnesium sulphate, misoprostol, antibiotics and antihypertensive drugs. Essential supplies include sutures and urinary catheters. Essential equipment includes manual vacuum aspirators, vacuum delivery kits and self-inflating bag-and-mask ventilators for newborn resuscitation.

Urethral catheterisation

Method

Use an appropriate size of catheter, which is one that is smaller in diameter than the external urethral meatus (to minimise the risk of subsequent urethral stricture formation). Usually this will be size 10–14 French gauge.

Using sterile precautions (gloves, etc.), wash the area with gauze swabs soaked with antiseptic (although sterile water or 0.9% saline can be just as effective), and clean from anterior to posterior with downward movements (to avoid faecal contamination). Sterile lubricant should be used to aid passage of the catheter. Use a syringe of sterile water or 0.9% saline to inflate the balloon if it is a Foley catheter, with the woman lying on her back or in the left lateral tilt position if she is more than 20 weeks' pregnant. The catheter is inserted far enough (urethra length is around 4 cm) for urine to be seen in the tube. Attach a catheter bag (if

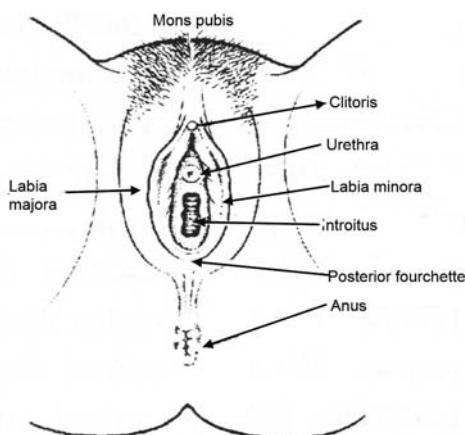


FIGURE 2.13.1 Normal female external genitalia showing urethra.

available). Secure the catheter to the thigh with tape to prevent traction damage to the bladder.

The balloon must be deflated before the catheter is removed.

Ventouse (vacuum) delivery

Introduction

The ventouse creates a vacuum in a cup attached to the fetal head to assist delivery. This technique is also called vacuum-assisted vaginal delivery or vacuum extraction (VE).

The advantages of the ventouse over forceps are that less training is needed, there is less risk of excessive traction, there are clear-cut rules on its use (e.g. the number of contractions during which traction is allowed), if the baby needs to rotate in order to be delivered this can occur spontaneously, and it can cause less injury to the mother.

The disadvantages are that it cannot be used for pre-term delivery, face presentation, breech or after-coming head of breech, and if the mother is unable to provide expulsive efforts the ventouse is generally not effective. The equipment is more complex than forceps and more difficult to sterilise and maintain, and there can be more trauma to the baby (e.g. cephalhaematoma).

A number of different types of cups are available.

The original (Malmström) metal cup (see Figure 2.13.2) has the chain within a pipe leading to the cup. It may be difficult to sterilise the tube adequately.

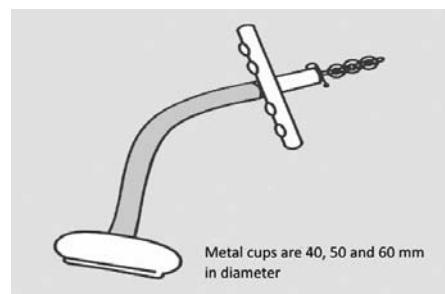


FIGURE 2.13.2 The Malmström cup.

The Bird metal cup (see Figure 2.13.3) has two configurations:

- 1 The 5 cm **anterior metal cup** is used for occipito-anterior positions. The smaller 4 cm cup is reserved for the small fetus (e.g. a second twin, and particularly if the cervix is no longer fully dilated).
- 2 The **posterior metal cup** is used for occipito-posterior positions, particularly those with significant deflexion. This is often also the cup of choice for the deep transverse arrest, as the abnormal angle of the baby's head to the vertical, which is often marked, makes correct placement with the anterior cup highly unlikely.

The plastic cup (50 or 60 mm internal diameter) comes in two main forms:

- a silastic/silicon soft cup (see Figure 2.13.4) is the safest of all for the fetus, but has a slightly higher failure rate, especially with occipito-posterior positions
- the easy-to-use Kiwi OmniCup (see Figure 2.13.5), which is reusable but relatively expensive (www.youtube.com/watch?v=TgAcCi9rJhw).

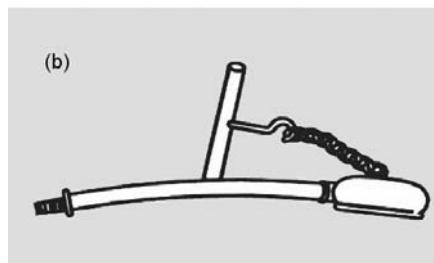
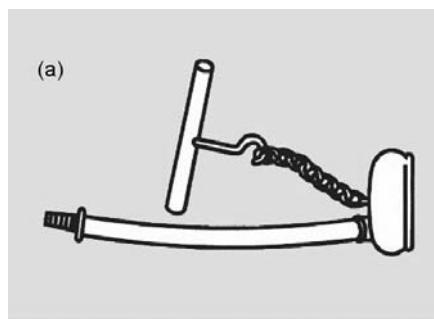


FIGURE 2.13.3 The two types of Bird metal cup. (a) Anterior cup.
(b) Posterior cup.

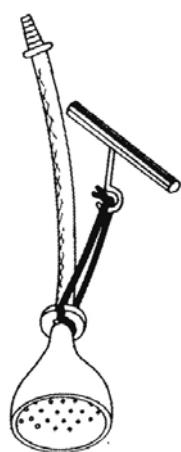


FIGURE 2.13.4 A soft plastic cup.

The application of negative pressure to the cup, including a vacuum gauge to show how much pressure is being applied, is shown in Figure 2.13.6.

Indications for an assisted delivery using the vacuum extractor

- Delay in the second stage of labour.
- Fetal distress in the second stage.
- Maternal conditions that require a short second stage (e.g. eclampsia, heart disease).
- Maternal exhaustion.

Contraindications

- Face presentation.
- Gestation less than 34 weeks.
- Breech presentation.
- Signs of obstructed labour.



FIGURE 2.13.5 The Kiwi OmniCup.

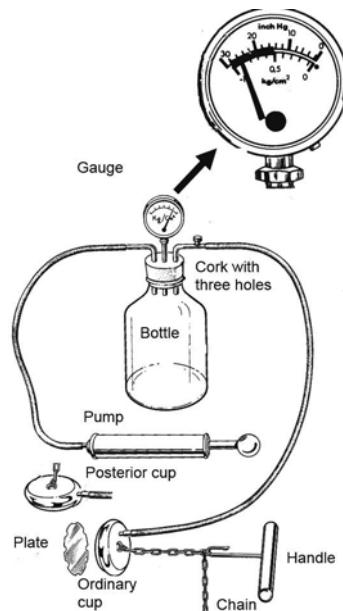


FIGURE 2.13.6 A simple vacuum extractor attached to a Bird anterior metal cup. This is Bird's modification of Malmström's extractor.

Prerequisites

- Full dilatation of the cervix and engagement of the head (head at least at 0 station and no more than 1/5 above the symphysis pubis).
- The position of the fetal head in relation to the pelvis must be known.
- A fetus greater than 36 weeks' gestation, or with great care if between 34 and 36 weeks.
- Cooperation of the mother is helpful so that she can enhance contractions and traction by bearing down.
- Uterine contractions must be present.
- Ensure that a healthcare worker who is able to undertake neonatal resuscitation is present in case this is required.
- Ensure that the equipment is working, in particular that the vacuum reaches the correct value by testing the cup on the palm of the hand of the operator (covered by a sterile glove).

Basic rules

- If the patient is mobile, ask them to empty their bladder. If not, catheterise them. If the patient is catheterised, ensure that any within-catheter balloon is deflated.
- No additional anaesthetic is required (perineal infiltration with lidocaine will suffice if an episiotomy is planned).
- Lithotomy is the commonest position used, but delivery may be possible in a dorsal, lateral or squatting position. The mother should be in a 45-degree sitting position to aid expulsion.
- The delivery should be clearly achievable after three pulls, with evidence of descent with each pull.
- The head, not just the scalp, should descend with each pull.
- The cup should be reapplied no more than twice provided that it has been in the right position and the direction of pull is correct (and after one detachment an experienced operator, if available, should be summoned).
- If failure with the ventouse occurs despite good traction, do not try the forceps but proceed to Caesarean section (provided that it is safe, and available within a reasonable time).

Methods

First check your equipment. Attach the cup to the suction, and ensure the suction is working by testing it. This can be done by briefly holding the cup against your hand while suction is applied.

- 1 Examine the mother carefully using a sterile procedure and gloves and ideally an obstetric cream such as Hibitane. Estimate the size of the baby by abdominal examination, and ensure that the head is fully engaged (no more than 1/5 of the head should be palpable). The membranes should have ruptured.
- 2 Determine the position of the vertex and the amount of caput by vaginal examination. Identify the posterior fontanelle.
- 3 Describe the attitude of the presenting part as 'flexed' or 'deflexed'. In a flexed attitude only the posterior fontanelle can be felt, whereas any situation in which the anterior fontanelle can be felt or the posterior fontanelle cannot be found should be described as deflexed.
- 4 With two fingers press on the perineum posteriorly to widen the vaginal opening (see Figure 2.13.7).

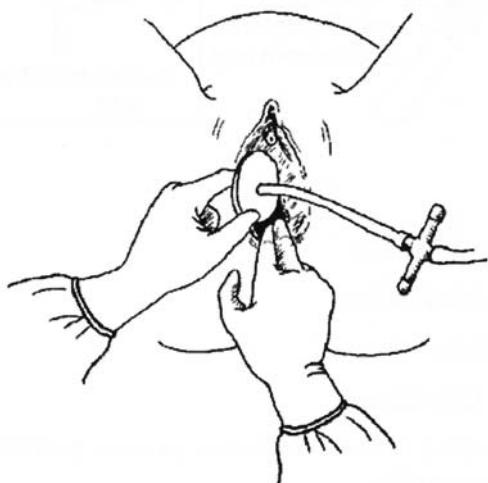


FIGURE 2.13.7 Inserting a Malmström cup.

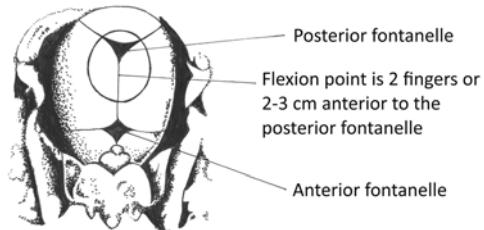


FIGURE 2.13.8 Placing the cup.

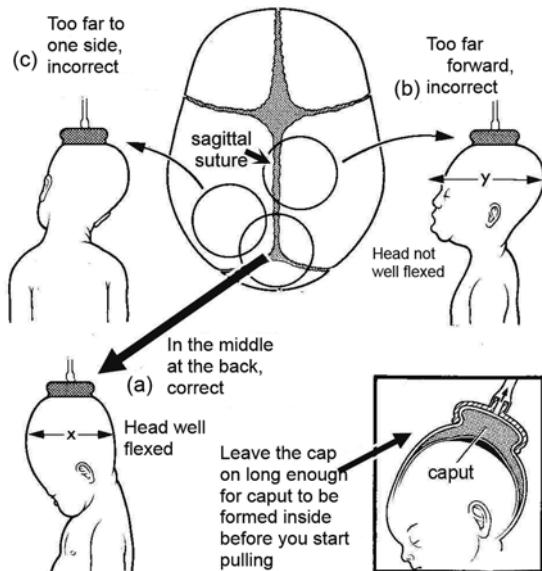


FIGURE 2.13.9 Correct and incorrect positions for the cup.

- 5 Insert the cup, avoiding the urethra. Apply the largest cup that will fit, with the centre of the cup over the flexion point, 2–3 cm anterior to the posterior fontanelle (see Figures 2.13.8 and 2.13.9). This placement will promote flexion, descent and autorotation with traction. Suction is applied to draw the fetal scalp into the cup.
- 6 Ensure that no maternal tissue is caught under the edge of the cup.
- 7 Place the middle of the cup 1–2 cm anterior to the baby's posterior fontanelle/posterior to the anterior fontanelle. This will flex the head during its passage through the pelvis.
 - If you put it more towards the front it will tend to extend the head, so that it will be less easy to pull out. The distance 'Y' when the head is deflexed (bent backwards) is much longer than the distance 'X' when it is flexed (bent forward).
 - If you put the cup to one side, the head will bend to one side.
- 8 Connect the cup to the pump (see Figure 2.13.6), and check for leaks prior to commencing the delivery.
- First increase the pressure to 0.2 kg/cm^2 , and then, after checking again that there is no maternal tissue caught under the cup, increase the pressure to 0.8 kg/cm^2 , but never any higher than this.
- Common problems include suction bottles not tightly screwed in or tubing loosely attached to the metal cup.
- The metal cup should have a meshed bottom plate, which functions to maintain a clear space between

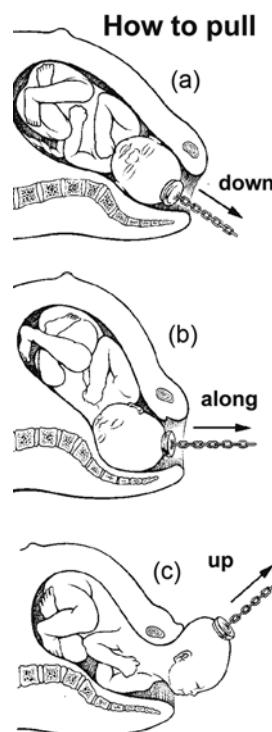


FIGURE 2.13.10 Delivery with the Bird anterior metal cup.

- the scalp and the cup so that an effective vacuum can be applied.
- 9 Only perform an episiotomy when the head stretches the perineum (to avoid blood loss), and only if the perineum is interfering with the delivery.
 - 10 Check the application. Ensure that there is no maternal soft tissue (cervix or vagina) within the rim.
 - 11 During a contraction, encourage the patient to push, and aid her expulsive efforts by applying traction to the cup/fetal head (method described below).

Delivery with the anterior metal or plastic cup

The metal or plastic cup is lightly lubricated with sterile delivery cream (e.g. chlorhexidine cream) and then inserted sideways into the vagina. To orientate the cup correctly, direct the chain towards the occiput, which will result in the vacuum pipe lying centrally. Take the pressure up to 0.2 kg/cm^2 . Check that no maternal tissue is caught under the cup and then increase the pressure directly to 0.8 kg/cm^2 , but never any higher than this. Begin traction with the next contraction after this pressure has been achieved.

Traction should be along the pelvic axis for the duration of the contraction (initially down, then progressively forwards, and finally upwards as the head delivers) and always perpendicular to the cup (see Figure 2.13.10).

Always pull in the direction of the birth canal.

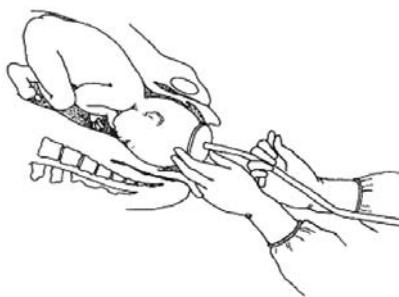


FIGURE 2.13.11 How to ensure that the vacuum cup is securely on the infant's head as you pull.



FIGURE 2.13.12 Guiding the cup with the fingers to detect any slippage while pulling.



FIGURE 2.13.13 Cup slipping off with sideways traction.

- 1 Pull downwards towards the floor until the head is below the ischial spines.
- 2 Pull outwards until the head is stretching the perineum.
- 3 Finally pull upwards until the baby is delivered.

During traction keep one finger or thumb on the edge of the cup and another finger on the scalp so that the earliest sign of detachment or slippage is detected (see Figures 2.13.11 and 2.13.12).

With each contraction apply traction in a line perpendicular to the plane of the cup rim to help to prevent the cup slipping off (see Figure 2.13.13). Place a finger on the scalp next to the cup during traction to assess potential slippage and descent of the vertex (see Figure 2.13.12).

Slight side-to-side movements may help to edge the head down the pelvic wall, but side-to-side movements must be small to keep the traction line perpendicular and prevent the cup from detaching.

As the head crowns, the angle of traction changes through an arc of over 90 degrees.

If the perineum is stretching as normal, it is simply supported with the hand that was on the cup. An episiotomy must only be undertaken if perineal resistance is preventing delivery.

Occasionally, an edge of the cup might lift off at the introitus (this is more likely to happen if there is caput present). If this occurs, one has to be careful not to catch maternal tissue under the cup as it reattaches. Therefore this should be rechecked before final delivery of the head.

Once the head has delivered, release the vacuum and take off the cup and complete the delivery normally.

Delivery with the posterior metal cup

For a deflexed head in an occipito-posterior position, the 'OP' cup or if this is not available a plastic cup, ideally a Kiwi OmniCup, should be used. It is applied as far back on the head as possible, again ideally in the midline over the occiput. To allow good placement of the cup, it sometimes helps to try to flex the head, with two fingers of the left hand pressing on the sinciput, while the right hand inserts the cup behind the head. Once correctly placed, the vacuum can be started and taken directly to the required level. (Because the cup lies parallel to the vagina it is unlikely to catch any maternal tissue.) The first pull will be in the direction required to flex the head. With flexion of the head, the presenting diameter immediately becomes less. Thereafter, traction will be along the pelvic axis. The delivery may be completed simply by a standard spontaneous rotation of the baby with maternal effort and gentle assistance. **It is essential not to try to twist the cup to rotate the baby. This will cause trauma, especially spiral tears of the scalp, with the rotational deliveries.**

Overall, occipito-posterior deliveries are the most likely to cause problems. The most difficult ones are those where the head is markedly deflexed or where there is excessive caput. Another difficulty sometimes encountered is that the suction pipe tends to kink once the head flexes, making the cup more likely to detach. If the cup detaches at this point (after flexion and rotation), put it back on again or perform a lift-out forceps.

Between contractions, check the **fetal heart rate** and **secure application of the cup**.

Note the following:

- Never use the cup to actively rotate the baby's head. Rotation of the baby's head will occur naturally with traction, if it is going to rotate.
- Do not continue to pull between contractions and expulsive efforts.
- With progress, and in the absence of fetal distress, continue the 'guiding' pulls to achieve delivery. Descent must be seen with each pull, and delivery should be clearly achievable following three pulls.

Causes and management of failure to deliver with the ventouse

Vacuum extraction has failed if:

- the head does not advance with each pull
- the fetus is not delivered or delivery is not imminent after three pulls
- the cup slips off the head twice at the proper direction of pull with a maximum negative pressure.

Every application should be considered a trial of vacuum extraction. Do not persist if there is no descent with every pull.

Generally delivery is achieved with three pulls. As a minimum, it should be clear after three pulls that the delivery is **definitely** going to be achieved imminently by the vaginal route.

Failures occur for the following reasons.

- 1 Inadequate initial assessment of the case:
 - The head being too high: a classic mistake is to assume that because caput can be felt below the ischial spines, the head must be engaged.
 - Misdiagnosis of the position and attitude of the head: attention to simple detail will minimise this.
- 2 Anterior or lateral placements will increase the failure rate.
 - If the cup placement is found to be incorrect, it may be appropriate to begin again with correct placement (i.e. midline over the flexion point).
- 3 Failures due to traction in the wrong direction.
 - Gentle sustained traction in the correct direction is what is needed, and sideways movements will be ineffective and increase scalp trauma and cup detachments.
- 4 Excessive caput.
 - Rarely, even with metal cups, adequate traction is not possible because of excessive caput.
 - In these cases, consideration must be given to delivery by Caesarean section unless the head is well down, in which case forceps can be used.
- 5 Poor maternal effort.
 - Maternal effort can contribute substantially to success.
 - Adequate encouragement and instruction should be given to the mother.
 - This may be a reason for preferring forceps to ventouse if the patient is under general anaesthetic.
- 6 The incidence of cephalo-pelvic disproportion (CPD) (true failure) is low. However, in settings where the majority of women deliver at home or in community clinics, it must be remembered that the patient is likely to have been fully dilated for some time before arrival in the hospital, if she has been referred for failure to progress in the second stage. CPD is likely to be relatively more common in this group.

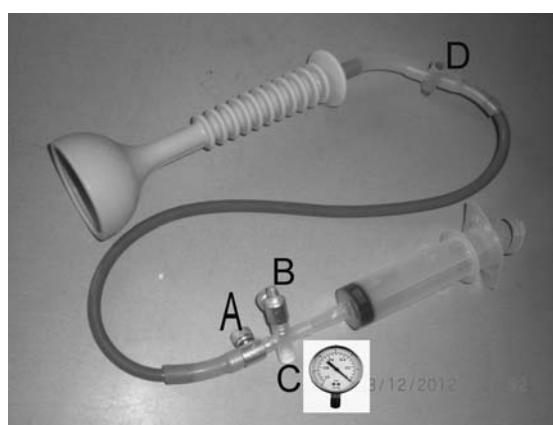


FIGURE 2.13.14 The EgAr device.

One of the main problems with using a ventouse in resource-limited settings is difficulty with the availability of reliable suction. Although this is integral to the Kiwi, these are expensive and usually disposable. A new technique to provide negative pressure for a plastic or metal cup (the EgAr device) has been developed in Gambia by a senior midwife and is described here.

The main components are two valves from out-of-use aneroid blood pressure machines, a 100-mL bladder syringe, a four-way open tap from a urine bag, a urine bag control valve, and a vacuum gauge (see Figure 2.13.14).

The blood pressure system valves are attached to the outflow control unit of a urine bag, which is then attached to the syringe. The valves are arranged in such a way that when the plunger of the syringe is pulled, air is withdrawn into the syringe through the first valve (i.e. valve A). When the plunger is pushed back, the air in the syringe is expelled through the second valve (i.e. valve B). Since the valves (when closed) allow air to flow in only one direction, the syringe can function both to create vacuum pressure by pulling the plunger, and also as an air pump when the plunger is pushed back.

A standard conventional vacuum delivery cup (either the metal or silicon type) is attached to the syringe through one of the blood pressure valves, using the tube from the blood pressure machine. Both valves are closed to ensure that air flows into the syringe only through the first valve (A) when the plunger is pulled, and is expelled only through the second valve (B) when the plunger is pushed back. The vacuum cup is attached to the fetal head and a few pulls (three or four) on the plunger create a negative pressure measured on the vacuum gauge attached to the fourth outlet of the four-way tap (D) sufficient to deliver the baby without the need for continuous pumping. Vacuum pressure is released when the baby is born through the valve (C) from the urine bag near to where the cup is attached.

If vacuum extraction fails, use vacuum extraction in combination with symphysiotomy (see below) or perform Caesarean section.

Vacuum extraction and symphysiotomy

Vacuum extraction may be used in combination with symphysiotomy in the following circumstances:

- the head is at least at -2 station or no more than 2/5 palpable above the symphysis pubis
- Caesarean section is not feasible or immediately available
- the provider is experienced and proficient in performing symphysiotomy
- vacuum extraction alone has failed or is expected to fail
- there is no major degree of disproportion.

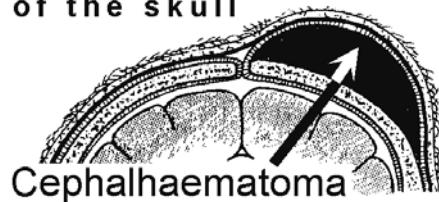
Complications of vacuum extraction

Complications usually result from not observing the conditions of application, or from continuing efforts beyond the time limits stated above.

Fetal complications

- Localised scalp oedema (artificial caput or chignon) under the vacuum cup is harmless and disappears within a few hours.
- Cephalhaematoma (see Figure 2.13.15) requires observation, and will usually clear in 3 to 4 weeks.
- Scalp abrasions (common and harmless) and lacerations

Under the periosteum of the skull



Under the galea

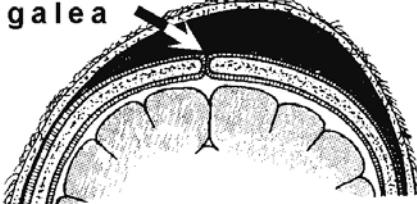


FIGURE 2.13.15 Fetal scalp bleeding complications of ventouse (vacuum extraction).

may occur. Clean and examine lacerations to determine whether sutures are necessary. Necrosis is extremely rare.

- Sub-galeal haemorrhage is more serious.

There have been reports of transmission of herpes viral infections from the mother to the fetal scalp following the use of a metal cup. It is theoretically possible that hepatitis or HIV infection may also be transmitted in this way. There is a lower risk of scalp injury using the flexible/plastic cups. Therefore for straightforward ventouse deliveries use the flexible cup when possible, bearing in mind that where rotation is needed as part of the delivery the metal cup is more successful. The metal cup can also deliver a stronger traction force.

Maternal complications

Tears of the genital tract may occur. Examine the woman carefully and repair any tears to the cervix or vagina, or undertake episiotomy repair.

Special indications for delivery with the ventouse

With the exception of second twin deliveries (where the cervix is in effect recently parous), vacuum extraction before full dilatation is generally only possible in multiparous women in which the cervix is soft and easily stretchable. This is definitely not always the case even with multiparous women, and great caution must be taken before proceeding to any vaginal delivery before full dilatation. Complications of such deliveries include cervical tears which can extend upward to involve the uterus, and therefore may require laparotomy for repair or even hysterectomy as for a ruptured uterus.

If the operator is uncertain about the degree of engagement, degree of cervical dilatation or the position of the head, a more experienced practitioner should assist (if available).

Forceps delivery after failure to deliver with the ventouse

There is no place for an attempt at forceps delivery if there

has been no descent with the ventouse despite adequate traction. However, if traction has been inadequate (due to caput, leaking equipment or no maternal assistance), it may be justified to change to forceps. The most experienced operator should make this decision.

The ventouse is the instrument of first choice for operative vaginal delivery provided conditions for its use are safe and suitable.

Forceps delivery

Introduction

Forceps are particularly helpful in the delivery of the after-coming head of a breech, delivery of a mento-anterior face presentation, and delivery before 34 weeks (although this is controversial).

Conditions for possible use of forceps

These include the following:

- vertex presentation
- face presentation with chin anterior
- entrapped after-coming head in breech delivery; some operators will routinely control the delivery of the head here by using forceps, provided that the cervix is fully dilated.

At the very minimum, the sagittal suture should be in the midline and straight, guaranteeing an occiput-anterior or occiput-posterior position.

Outlet forceps

In resource-limited settings, forceps at the outlet can be helpful for delay in the second stage when the baby's head is near the outlet, but for all other situations the ventouse is preferred if suitable. The conditions for the use of outlet forceps are as follows:

- the fetal scalp is visible without separating the labia
- the fetal skull has reached the pelvic floor
- the sagittal suture is in the antero-posterior diameter or right or left occiput-anterior or occiput-posterior position (rotation does not exceed 45 degrees)
- the fetal head is at or on the perineum.

The blade on the mother's left always goes in first, and the right blade fits on top of it.

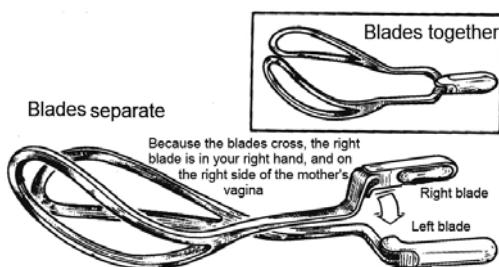


FIGURE 2.13.16 Outlet forceps.

Procedure

- Ensure that the head is engaged in the pelvis. Abdominal palpation must be undertaken, particularly in the case of face presentation.
- Urinary catheterisation is required.

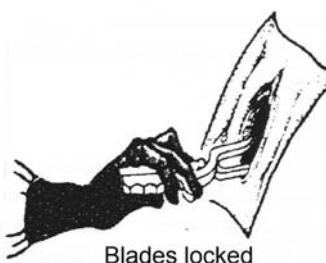
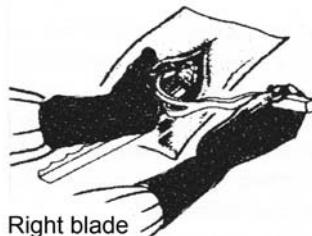
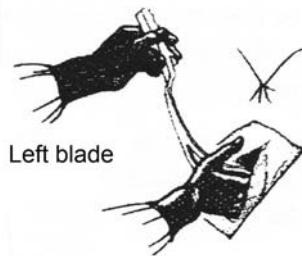


FIGURE 2.13.17 Applying outlet forceps.

- Pudendal block and perineal infiltration with 1% lignocaine is required.
- An episiotomy is usually required.
- Identify the position of the head. Occipito-transverse or occipito-posterior positions are indications for ventouse, and if the head is deflexed, for using the OP ventouse cup or Kiwi OmniCup.
- Ensure that the pair of forceps match. Assemble them and check. It may be useful to check the maximum diameter between the blades, which must be at least 9cm.
- Lubricate the blades of the forceps with disinfectant cream (e.g. Hibitane).
- Wearing sterile gloves, insert two fingers of the right hand into the vagina on the side of the fetal head. Slide the left blade gently between the head and fingers to rest on the side of the head (see Figure 2.13.18).

A biparietal bimolar application is the only safe option.

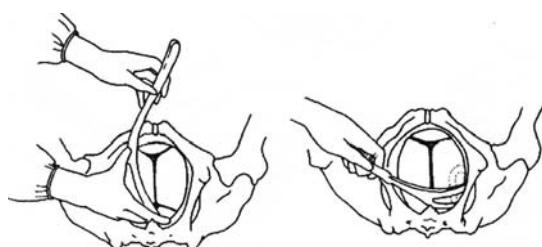


FIGURE 2.13.18 Applying the left blade of the forceps.

Repeat the same manoeuvre on the other side, using the left hand and the right blade of the forceps (see Figure 2.13.19).

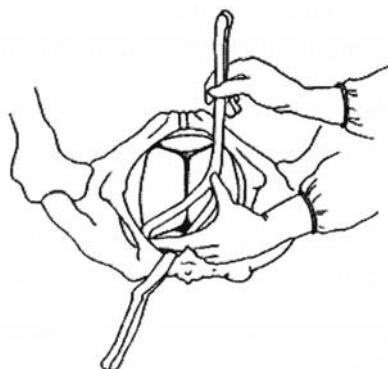


FIGURE 2.13.19 Applying the right blade of the forceps.

- Depress the handles and lock the forceps.
- Difficulty in locking usually indicates that the application is incorrect. In this case, remove the blades and recheck the position of the head. Reapply only if the head is in the appropriate position for the use of forceps.
- After locking check that the sagittal suture lies vertically in the midline between the shanks of the forceps. Also ensure that no more than two fingers can be placed laterally into the fenestrations of the blades. Note: these checks do not ensure correct placement but do help detect some instances of mal-placement.
- After locking, apply steady traction inferiorly and posteriorly with each contraction (see Figures 2.13.20 and 2.13.21). There should be both traction and pressure on top of the joined forceps.

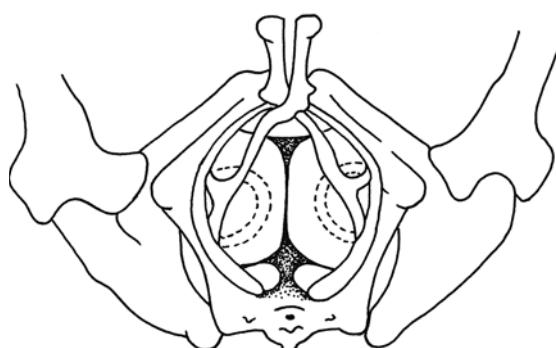


FIGURE 2.13.20 Locking the handles.

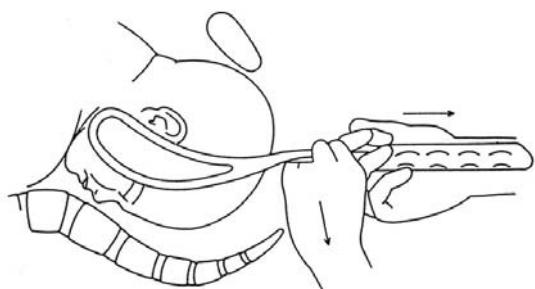


FIGURE 2.13.21 The correct way of applying traction with downward pressure.

Between contractions check the fetal heart rate and correct application of forceps.

- When the head crowns, make an adequate **episiotomy**.
- Lift the head slowly out of the vagina between contractions.
- The head should descend with each pull. Only two or three pulls should be necessary.
- Ensure that the head rather than the blades of the forceps are descending with each pull by feeling the fingers on the fetal head moving down. It is very harmful to the fetus if the blades slide down the side of the fetal head.

Failure of forceps

- The fetal head does not advance with each pull.
- The fetus is not delivered after three pulls.

Every application should be considered a trial of forceps. Do not persist if there is no descent with every pull.

If forceps delivery fails, consider a symphysiotomy or perform a Caesarean section.

- After repairing any episiotomy, ensure that swab and instrument counts are correct.
- Do a rectal examination to check the integrity of the rectal sphincter and the mucosa for tears.

Complications of forceps use

Fetal complications

- Injury to facial nerves requires observation. This injury is usually self-limiting.
- Lacerations of the face and scalp may occur. Clean and examine any lacerations to determine whether sutures are necessary.
- Fractures of the face and skull require close monitoring.

Maternal complications

Tears of the genital tract may occur. Examine the woman carefully and repair any cervical or vaginal tears and undertake episiotomy repair.

Caesarean section

The WHO suggests that systems should be in place to ensure that Caesarean section is performed in a minimum of 5% of all expected births.

Indications

- Obstructed labour.
- Obstetric haemorrhage (especially if ongoing or the mother or fetus is unstable).
- Severe maternal illness where urgent delivery is indicated and is not achievable rapidly by vaginal delivery (e.g. eclampsia where delivery is advised within 12 hours).
- Fetal distress.
- Malpresentation.
- Major placenta praevia.

Pre-operative considerations

- Check for fetal life by listening to the fetal heart rate.
- Examine for fetal presentation and to ensure vaginal delivery is not achievable.
- Avoid performing a Caesarean section if there is no maternal indication and the fetus is dead.
- Obtain informed consent from the mother.

Take a blood sample for haemoglobin or haematocrit, blood grouping and cross-matching if indicated. More than 2 × 500mL units may be needed if antepartum bleeding or massive haemorrhage is anticipated.

- Transfer the patient to the operating theatre in the left lateral position with a wedge under the right buttock.
- Give antacid immediately prior to general anaesthetic (30mL of 0.3% sodium citrate (preferable non-particulate) or 300mg of magnesium trisilicate). This neutralises the stomach acid and minimises damage to the lungs if aspiration occurs.
- Start an IV infusion with a crystalloid such as Ringer-lactate or Hartmann's solution.
- Spinal or general anaesthesia with rapid sequence induction, or ketamine, or local infiltration may be used, depending on local circumstances.

(For choice of anaesthesia, see Section 1.24.)

In theatre, the operating table must be kept in the left lateral tilt position or a pillow placed under the woman's right lower back to reduce aorto-caval compression until after delivery.

Urinary catheterisation

The woman must be catheterised and her bladder emptied before starting the procedure, both to avoid injury to the bladder and to monitor urine output.

Remove the catheter after 8 hours if the urine is clear; if not, wait until it is.

Wait 48 hours before removing the catheter if there is:

- uterine rupture
- prolonged or obstructed labour
- gross perineal oedema
- puerperal sepsis with pelvic peritonitis.

If the bladder was damaged, leave the catheter in for 7 days. The urine should be clear of blood and remain so after 48 hours. If the woman is not receiving antibiotics, give nitrofurantoin 100mg (or cefalexin 500mg or amoxicillin 500mg) orally once daily until the catheter has been removed.

Skin preparation

The presence of a large amount of pubic hair around the site of skin incision can interfere with healing. A suitable proportion of this should be shaved off **immediately before the skin is disinfected and the incision is made. There must not be a gap between shaving and operation.**

Tincture of chlorhexidine, iodophor and tincture of iodine are the recommended antiseptic products for preparing the patient's operative site. Apply three times to the incision site using disinfected ring forceps and a cotton or gauze swab. Do not contaminate the glove by touching unprepared skin. Begin at the proposed incision site and work outwards in a circular motion away from the incision site. At the edge of the sterile field discard the swab.

The use of alcohol or hexachlorophene as a single agent is not recommended unless the patient's skin is sensitive to the recommended antiseptic products. Impregnated adhesive film as skin preparation is not recommended.

All patients should be given a prophylactic antibiotic, ampicillin 2 grams IV, before the skin incision, and ideally thromboprophylaxis post-operatively (compression stockings, mobilisation, and 5000 units of heparin

subcutaneously 12-hourly until the patient is discharged from hospital).

Prevention of exposure of staff to HIV and hepatitis

In many operations, micro-holes develop in gloves (not due to needlestick injuries). These micro-holes will of course be more prevalent if gloves are reused, as in some resource-limited settings. If there is a significant risk of HIV or hepatitis, double gloves or special thick gloves should be used. A clear plastic facial shield reduces exposure to blood.

Opening the abdomen

Abdominal and uterine scars are two separate issues. Classical section is a vertical uterine scar, usually but not always associated with a vertical abdominal scar. A vertical abdominal scar may be present with either a classical or lower segment uterine scar.

Skin incision

The choice of skin incision depends on the following:

- the gestational age of the fetus
- the indication for section
- the presence of previous scars
- the operator's surgical experience.

A low transverse incision is preferred to the vertical incision, as there is less likelihood of wound dehiscence and hernia. There are two possibilities, namely the Pfannenstiel incision and the Joel-Cohen incision.

The Joel-Cohen incision

The Joel-Cohen technique includes straight transverse incision through the skin only, 3cm below the level of the anterior superior iliac spines (higher than the Pfannenstiel incision; see below). The subcutaneous tissues are opened only in the middle 3cm. The fascia is incised transversely in the midline and then extended laterally with a blunt finger. Finger dissection is used to separate the rectus muscles vertically and laterally and open the peritoneum. All of the layers of the abdominal wall are stretched manually to the extent of the skin incision. The bladder is reflected inferiorly. The myometrium is incised transversely in the midline, but not to breach the amniotic sac, then opened and extended laterally with finger dissection. Interrupted sutures are used for the closure of the myometrium.

The Pfannenstiel incision

This consists of a curved skin incision, two finger-breadths above the symphysis pubis, transverse incision of the sheath, blunt separation of the rectus muscles, and incision of the parietal peritoneum in the midline.

The low vertical incision

The incision is made from the base of the umbilicus to the pubic hair line. This is preferred if better exposure is needed or local anaesthesia is used. It allows easier access to the upper abdomen, is indicated if the lower uterine segment is difficult to access due to adhesions from previous Caesarean sections, if the lie of the fetus is transverse with the back down, and if there are fetal malformations, large fibroids over the lower segment, a vascular lower segment due to placenta praevia, or carcinoma of the cervix.

Compared with Pfannenstiel-based Caesarean

section, Joel-Cohen-based Caesarean section has been shown to be associated with a reduction in blood loss, operating time, time to oral intake, fever, duration of post-operative pain, analgesic injections, and time from skin incision to birth of the baby.

The surgeon must ensure that the access to the uterus is adequate to deliver the fetus without difficulty, and in the presence of scarring a Pfannenstiel incision may give better exposure.

Length of incision

A minimum length of 15 cm is indicated (which accommodates an open Allis forceps).

Excision of the previous scar is not essential for better healing and cosmetic results unless there is keloid scarring.

General measures

- Handle tissue gently.
- Prevent bleeding.
- Eradicate dead space.
- Minimise the amount of desensitised tissue and foreign material in the wound.

Practical points

- Extend incision of the fascia, peritoneum and myometrium digitally or with scissors rather than with a scalpel.
- Transfer sharp instruments into a basin/tray.
- Retract tissue with instruments, reposition suture needles with forceps and remove the needle before the final tying of sutures.

Make the skin incision to the level of the fascia.

If the Caesarean section is performed under local anaesthesia, make a vertical incision that is about 4 cm longer than when general/spinal anaesthesia is used. A Pfannenstiel incision takes longer, retraction is poorer and it requires more local anaesthetic.

Make a 2–3 cm vertical incision in the fascia.

- Hold the fascial edge with forceps and lengthen the incision from side to side using scissors.
- Use fingers or scissors to separate the rectus muscles (abdominal wall muscles).
- Use scissors to make an opening in the peritoneum near the umbilicus. Use scissors to lengthen the incision up and down in order to see the entire uterus. Use scissors to separate the layers and open the lower part of the peritoneum, taking care to avoid bladder injury.
- Place a bladder retractor over the pubic bone.
- Use forceps to pick up the loose peritoneum covering the anterior surface of the lower uterine segment, and incise with scissors.
- Extend the incision by placing the scissors between the uterus and the loose serosa. Cut transversely about 3 cm on each side.
- Use two fingers to push the bladder downwards off the lower uterine segment. Replace the bladder retractor over the pubic bone and bladder.

Opening the uterus

- Use a scalpel to make a 3 cm transverse incision in the lower segment of the uterus. It should be about 1 cm below the level where the vesico-uterine peritoneal fold was incised to bring the bladder down.

- Widen the incision by placing a finger at each edge and gently pulling upwards and laterally at the same time.
- If the **lower uterine segment is thick and narrow**, extend the incision in a crescent shape, using scissors instead of fingers to avoid extension into the uterine vessels.
- **It is important to make the uterine incision large enough to deliver the head and body of the baby without tearing the incision.**

Uterine incision

A **high vertical uterine incision** is indicated if any of the following are present:

- an inaccessible lower segment due to dense adhesions from previous Caesarean section
- transverse lie (with the baby's back down) for which a lower uterine segment incision cannot be safely performed
- fetal malformations (e.g. conjoined twins)
- large fibroids over the lower segment
- a highly vascular lower segment due to placenta praevia
- carcinoma of the cervix.

A **lower transverse incision** is commonly used because:

- less dissection of the bladder is needed
- entry into the uterus is easier
- there is less blood loss
- there is a lower incidence of uterine rupture with subsequent pregnancies.

Lower vertical incision (De Lee's incision) can be useful if the lower uterine segment is poorly formed and thickened, in which case a transverse incision would be unwise.

If a lower transverse incision has been attempted and found to be inadequate, it can be extended upwards in a J-shaped incision to avoid blood vessels and enable adequate access.

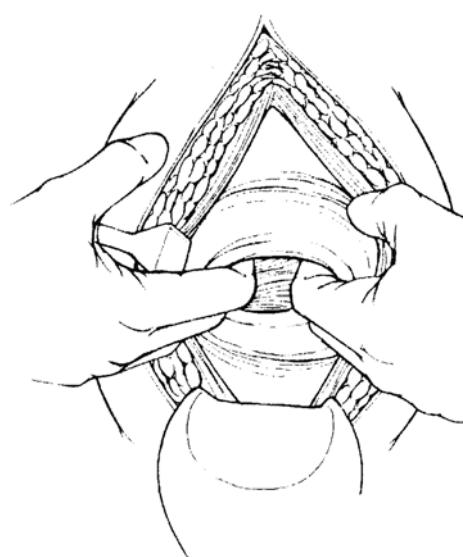


FIGURE 2.13.22 Enlarging the uterine incision.

Delivery of the baby and placenta

- To deliver the baby, place one hand inside the uterine cavity between the uterus and the baby's head.
- With the fingers, grasp and flex the head.

- Gently lift the baby's head through the incision (see Figure 2.13.23), taking care not to extend the incision down towards the cervix.

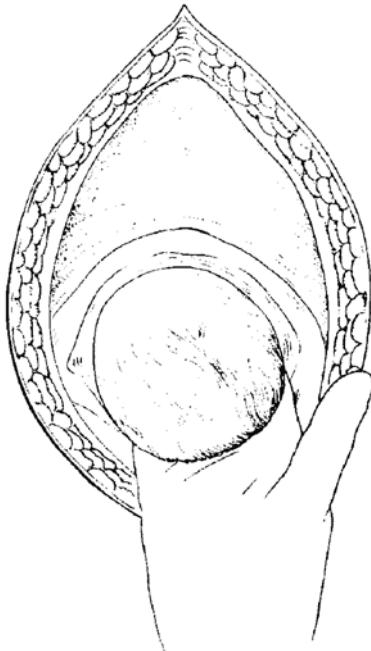


FIGURE 2.13.23 Delivering the baby's head.

- With the other hand, gently press on the abdomen over the top of the uterus to help to deliver the head.
- If the **baby's head is deep down in the pelvis or vagina**, ask an assistant (wearing sterile gloves) to reach into the vagina (which must be sterilised as described above) and push the baby's head up into the uterus. Then lift and deliver the head (see Figure 2.13.24).



FIGURE 2.13.24 Delivering the deeply engaged head abdominally with assistance via the vagina.

Method of delivery of fetus

The head delivers into the wound in a transverse direction, so gentle rotation with lateral flexion of the neck is required. In the following circumstances this can be difficult or impossible:

- Caesarean section in the second stage of labour following failed forceps/ventouse, when the head is very low

- occipito-posterior position
- impacted breech
- transverse lie
- prematurity and oligohydramnios where the lower segment is poorly formed and thick.

Manoeuvres that may help include the following:

- an assistant can disengage and push the presenting part upwards from the vagina
- modified lithotomy position with a combined abdomino-vaginal approach
- application of forceps when the head is free
- grasping a foot and delivering by the breech in the presence of transverse lie
- uterine relaxation.

Other practical points

- If there is posterior placenta praevia, open the uterus and reach in below the placenta, separating it upwards until the membranes are reached, and then deliver the baby. If the placenta is anterior, as soon as you cut into it there will be haemorrhage from the fetus. **It is vital that the cord is clamped as quickly as possible.**
- In all cases of fetal distress, quick delivery is required.**
- Suction the baby's mouth and nose when delivered, especially if there is meconium-stained liquor.
- Deliver the shoulders and body.
- Give oxytocin 5 units IV to aid delivery of the placenta, and then infuse 40 units in 500 mL of IV fluids (Ringer-lactate or Hartmann's solution) over 4 hours if there is a risk of haemorrhage.
- Clamp and cut the umbilical cord.
- Hand the baby to an assistant for initial care.
- Give a single dose of a prophylactic antibiotic after the cord has been clamped and cut, but only if not given prior to incision: ampicillin 2 grams IV or cefotaxime 1 gram IV.
- Keep gentle traction on the cord and massage the uterus through the abdomen.
- Deliver the placenta and membranes.

Delivery of the placenta

Spontaneous delivery after oxytocin has been given on delivery of the baby, and with controlled cord traction, is preferred to manual removal. Manual delivery of the placenta may be necessary, and routine checking of the cavity is essential to ensure that no retained placental fragments or membranes are present, as this cannot always be ensured by inspection of the placenta.

Closing the uterine incision

General principles

- Meticulous handling with re-approximation of tissues. Avoid strangulating tissue with tight knots.
- Haemostasis: isolate and ligate major bleeding vessels.
- Grasp minimal tissue while cauterising.

Exteriorisation of the uterus

This may be necessary in order to visualise the lower segment for suturing, and it may thereby reduce blood loss. It may cause vagal stimulation leading to bradycardia, and may be uncomfortable if performed under spinal or epidural anaesthesia. It is important to inform the anaesthetist of the need to exteriorise.

Suturing of the uterus

Sutures of polyglycolic acid suture are preferred to catgut. Use of thick suture causes more foreign body and tissue reaction, but if too thin it will cut through the myometrium. Usually the uterus is closed in two layers.

- Grasp the corners of the uterine incision with clamps.
- Grasp the bottom edge of the incision with clamps. Make sure that it is separate from the bladder.
- Look carefully for any extensions of the uterine incision.
- Repair the incision and any extensions with a continuous locking stitch using a robust absorbable suture such as No. 1 or 0 chromic catgut, polyglycolic acid or Vicryl (see Figure 2.13.25).
- A routine second layer of sutures is usually undertaken for the uterine incision, as it may help to reduce the risk of haemorrhage and subsequent uterine rupture through the scar.
- If there is any **persisting bleeding from the incision site**, close with figure-of-eight sutures.

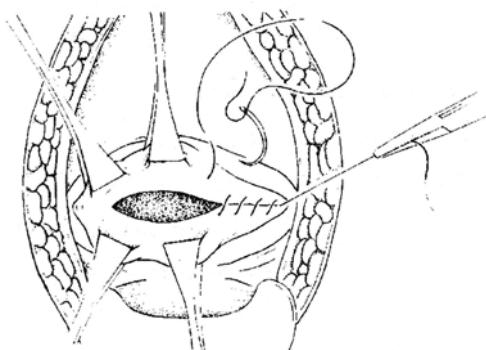


FIGURE 2.13.25 Closing the uterine incision.

Peritoneal closure of parietal and visceral peritoneum is safe. Healing and strength of the wounds are not affected. The duration of surgery is reduced and there is less tendency to form intra-abdominal adhesions.

Rectus sheath

Standard single-layer closure with a synthetic delayed absorbable suture is recommended. Place each suture 1 cm from the wound edge to allow healing. In vertical incisions, mass closure using synthetic permanent suture is appropriate, but the stitch should not be locking, as this increases post-operative pain and wound hernias.

Subcutaneous tissue and skin closure

Closure of Camper's fascia with continuous suture reduces the rate of wound disruption. The routine use of closed suction drainage in non-obese patients is not recommended.

Subcuticular or interrupted skin suturing may be undertaken. The type of suture material used for subcuticular suturing does not affect the outcome. Interrupted mattress sutures are recommended in obese patients and in cases where delayed healing is anticipated. Placement of clips has similar results.

If a Couvelaire uterus (swollen and discoloured by blood) is seen at Caesarean section, as a result of major placental abruption, close it in the normal manner and monitor closely for 48 hours after delivery.

- **Closing the abdomen.** Look carefully at the uterine incision before closing the abdomen. Make sure that there

is no bleeding and the uterus is firm. Use a sponge to remove any clots inside the abdomen.

- Examine carefully for any injuries to the bladder, and repair these.
- If there are **signs of infection**, pack the subcutaneous tissue with gauze and insert loose 0 catgut (or polyglycolic) sutures. Delay closure of the skin until the infection has cleared.
- If there are **no signs of infection**, close the skin with vertical mattress sutures of 3-0 nylon (or silk) and apply a sterile dressing.
- Gently push on the abdomen over the uterus to remove clots from the uterus and vagina. Swab out the vagina to remove any clots. Any bleeding subsequently noted will therefore be recognised as fresh loss.
- Ensure that there are no instruments or swabs left in the abdomen. One way of achieving this is to have a black or white board in the operating theatre on which is documented every swab or instrument used during the operation, and to ensure that these are available when the abdomen is closed.

Types of needle and suture material

In resource-limited settings it is often only possible to find two types of suture material for a Caesarean section, for example:

- 1 chromic catgut which can be used on a round-bodied needle for the uterus
- 2 polyglycolic acid which can be used on a round-bodied needle for the uterus and on a cutting/round-bodied needle for the rectus sheath and the skin.

Complications of Caesarean section

In cases of previous Caesarean section, other abdomino-pelvic operations or pelvic sepsis, bowel may be adherent to the undersurface of the peritoneum. Extra care must then be taken when opening the peritoneum, dividing it transversely under direct vision when possible.

In such cases, the peritoneum should be opened with a knife or scissors rather than with the fingers.

Bladder may be adherent to the lower segment, and care must be taken to push the bladder well down in order to avoid trauma to the bladder or ureters. Emptying the bladder pre-operatively reduces the likelihood of bladder damage.

Fibroids may obstruct access to the lower segment. A decision has to be made as to whether to make the uterine incision above, below or around the fibroids, or to cut through them. Alternatively, a classical (midline) uterine incision may be necessary, with its attendant greater risk of scar rupture in future pregnancies.

In cases of placenta praevia, the placenta is encountered on making the lower segment incision. This may lead to excessive bleeding.

The placenta may be morbidly adherent to a previous Caesarean section scar (placenta accreta). It is important not to traumatisate the uterine wall by delivering the placenta piecemeal. It may be necessary to leave the adherent fragment *in situ*, and monitor carefully for bleeding and signs of infection. Postpartum hysterectomy may be required in this situation.

Caesarean section at full dilatation may be complicated by difficulty in dis-impacting the fetal head. An assistant should push firmly but gently from the vagina using sterile

gloves and obstetric chlorhexidine cream on their fingers. Once the head is dis-impacted, fundal pressure is required.

Excessive bleeding at Caesarean section is most commonly due to uterine atony, lateral extension of the lower segment incision, or a combination of these two factors (see Section 2.5.D.iv on postpartum haemorrhage).

Where a trial of forceps has taken place prior to Caesarean section, care must be taken to identify and suture any vaginal tears, which may bleed heavily.

Uncontrolled bleeding

Primary haemorrhage

The cause of the haemorrhage, whether due to atony or trauma, should be determined. Help should be sought from senior colleagues (if available). The anaesthetist must be informed about the haemorrhage, and blood should already be cross-matched (at least 4 to 6 units). In cases of vertical extension into the vagina, suturing should be attempted from the lowest part of the tear before suturing the transverse incision. Massage the uterus to expel blood and blood clots. The presence of blood clots will inhibit effective uterine contractions.

Broad ligament haematomas

The leaves of the broad ligament need to be opened and the ureters should be identified before suturing the bleeding point.

Atonic uterus

If the uterus is atonic, massage it, continue to infuse oxytocin, and give:

- ergometrine 200–500 micrograms IM (must not be used if the patient has hypertension), if the mother is fully conscious
- and/or misoprostol 400–600 micrograms sublingually or orally or 800 micrograms rectally if the mother is drowsy or unconscious.

These drugs can be given together or sequentially.

Transfuse as necessary.

Have an assistant apply firm pressure with a fist over the aorta to reduce the bleeding until the source of bleeding can be found and stopped.

If bleeding is not controlled, see Section 2.5.D.iv for details of the many methods of treatment that can be adopted. They include a hysterectomy.

Breech delivery at Caesarean section

The fetal back should always be upwards during breech delivery. Gentle rotation of the fetal trunk may be required, being careful to grasp the bony pelvis and legs, thereby avoiding traumatising the fetal abdomen.

The baby is delivered as if performing a breech extraction vaginally. In summary, place the fingers of each hand into the groin of the baby and lift out the buttocks and legs.

Deliver the arms by the Løvset's manoeuvre; legs and the body up to the shoulders, then deliver the arms.

Flex the head and deliver using the Mauriceau-Smellie-Veit manoeuvre.

Complete the delivery as for a vaginal delivery.

Transverse lie delivery at Caesarean section

Assess the position of the fetus, including the position of the head, before opening the uterus. If the membranes are

intact and there is liquor around the fetus, try to convert the transverse lie to a longitudinal lie.

- If the back is up (near the top of the uterus), reach into the uterus and find the baby's ankles.
- Grasp the ankles and pull gently through the incision to deliver the legs and complete the delivery as for a breech baby.
- If the back is down, a high vertical uterine incision may be preferred, but this is too late if only discovered once inside the uterus.
- Following the incision, reach into the uterus and find the feet. Pull them through the incision and complete the delivery as for a breech baby.
- To repair the vertical incision, three layers of suture will be needed.

Placenta praevia

If a low anterior placenta is encountered, find an edge of the placenta and move the placenta laterally or incise through it and deliver the fetus.

- An ultrasound scan prior to the operation will help the operator to judge whether it will be possible to manually displace the placenta in order to access the amniotic cavity.
- After delivery of the baby, if the placenta cannot be detached manually, the diagnosis is placenta accreta, occasionally seen at the site of a previous Caesarean scar.
- There are two approaches to this problem. The placenta can be left *in situ* to degenerate spontaneously, or a hysterectomy may be performed. If the former approach is followed, a careful watch will need to be kept for any signs of infection in the postnatal period, and prophylactic antibiotics will be required.
- Women with placenta praevia are at high risk of postpartum haemorrhage.
 - If there is bleeding at the placental site, under-run the bleeding sites with chromic catgut (or polyglycolic/Vicryl) sutures before closing the wound.
 - It may also be helpful to compress the lower segment vessels by packing the uterus or inserting a condom-catheter.
 - Watch for bleeding in the immediate postpartum period and take appropriate action.

Post-operative care

- Bowel function should be normal after 12 hours.
- If progress is uncomplicated, give liquids immediately and solids when the patient is passing gas per rectum.
- If there is infection, obstructed labour or uterine rupture, wait until bowel sounds reappear before giving oral fluids.
- Keep a dressing on the wound for 24 hours to ensure re-epithelialisation.
- If blood is leaking, reinforce the dressing or replace it with a new one if it is more than half soaked.

If bleeding occurs:

- Massage the uterus to expel blood and blood clots. The presence of blood clots will inhibit effective uterine contractions:
 - Give oxytocin 5 units IV slowly or 10 units IM and then infuse 40 units in 500 mL of IV fluids (Ringer-lactate or Hartmann's solution) over 4 hours

- or ergometrine 500 micrograms IM or misoprostol 400 micrograms sublingually or orally **provided that the mother is fully conscious**
- or misoprostol 800 micrograms rectally **if the mother is drowsy or unconscious.**

These drugs can be given together or sequentially.

- If there are signs of infection or the mother has a fever, give a combination of antibiotics until she has been fever-free for 48 hours:
 - Ampicillin 2 grams IV every 6 hours
 - plus gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours
 - plus metronidazole 500 mg IV every 8 hours.
- Give appropriate analgesic drugs.

Discharge the mother home when her temperature has been normal for at least 24 hours, and she is mobilising and able to eat and drink normally.

Syphysisotomy

Background

Syphysisotomy is performed for the management of cephalo-pelvic disproportion in selected situations in resource-limited countries or ill-equipped obstetric units. It may be required for the delivery of the trapped after-coming head with a breech delivery, or for shoulder dystocia. Syphysisotomy results in a temporary increase in pelvic diameter (up to 2 cm) by surgically dividing the cartilage of the symphysis under local anaesthesia. Syphysisotomy in combination with vacuum extraction is a life-saving procedure in areas where Caesarean section is not immediately available.

Syphysisotomy leaves no uterine scar, so the risk of ruptured uterus in subsequent pregnancies is not increased.

Caesarean section can have high morbidity and mortality rates in resource-limited healthcare facilities. Mortalities of up to 5% and uterine scar rupture in 7% of subsequent pregnancies have been reported. Syphysisotomy has a very low maternal mortality, with 3 deaths reported in a series of 1752 syphysisotomies. These deaths were unrelated to the procedure.

However, syphysisotomy has risks of complications, which include urethral and bladder injury, infection, pain and long-term difficulty in walking. Therefore it should only be performed when there is no safe alternative.

Symptoms following syphysisotomy include pain in the symphysis pubis and groin, hip or thigh pain, backache and stress incontinence.

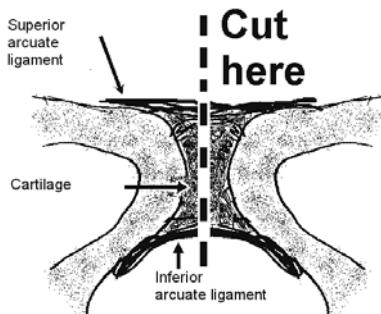


FIGURE 2.13.26 Site of the symphysisotomy incision.

The majority of mothers (73%) will have an uncomplicated vaginal delivery in a subsequent pregnancy.

Indications for symphysisotomy

- Trapped after-coming head in breech delivery, in the presence of full cervical dilatation.
- Shoulder dystocia, where all other methods have failed.
- A live fetus with vertex presentation and presumed cephalo-pelvic disproportion (i.e. prolonged second stage, no head descent after adequate augmentation, and failure or anticipated failure of vacuum extraction alone).
- At least one-third of the fetal head should have entered the pelvic brim.
- The cervix should be fully dilated, and the head should be at -2 station or no more than 3/5 above the symphysis pubis, with no overriding of the head above the symphysis.

Technique

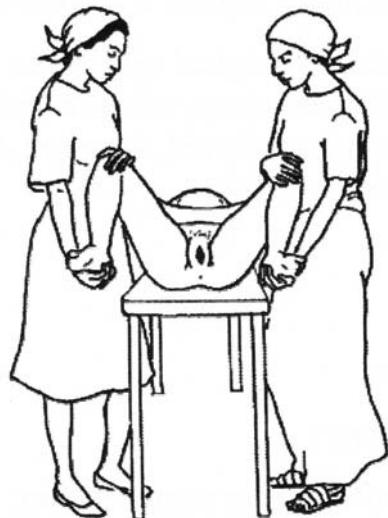


FIGURE 2.13.27 Legs abducted no more than 45 degrees from vertical.

Ask two assistants to support the woman's legs with her thighs and knees flexed. The thighs should be abducted no more than 45 degrees from the midline, **not** the lithotomy position.

Abduction of the thighs more than 45 degrees from the midline may cause tearing of the urethra and bladder.

- Infiltrate the anterior, superior and inferior aspects of the symphysis with 1% lignocaine solution.
 - Aspirate (pull back on the plunger) to make sure that no vessel has been penetrated. If blood is returned in the syringe with aspiration, remove the needle. Recheck the position carefully and try again. Never inject if blood is aspirated.
- Infiltrate the local anaesthetic and wait for it to take effect.
- Insert a firm sterile urinary catheter to identify the urethra.
- Apply antiseptic solution to the suprapubic skin.
- Wearing sterile gloves:
 - Place the index and middle fingers of the left hand into the vagina.



FIGURE 2.13.28 The position for holding the woman's legs for symphysiotomy.

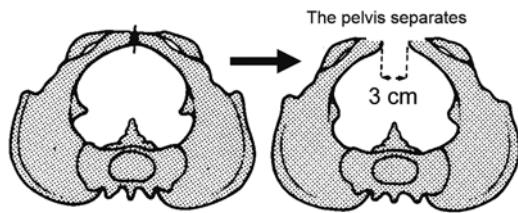


FIGURE 2.13.29 Sagittal view of symphysiotomy.



FIGURE 2.13.30 The symphysiotomy incision.

- Using the index finger, push and hold the catheter, and with it the urethra, away from the midline to the patient's right side.
 - The middle finger lies centrally under the symphysis to guide the incision.
 - With the other hand, use a firm-bladed scalpel to make a vertical incision over the symphysis.
 - Cut down through the cartilage joining the two pubic bones until the pressure of the scalpel blade is felt on the finger in the vagina.
 - The symphysis pubis is incised in the midline at the junction of the upper and middle thirds. The point of the scalpel will be felt impinging on the vagina by the underlying finger of the left hand.
 - The upper third of the uncut symphysis is used as a fulcrum against which the scalpel is levered to incise the lower two-thirds of the symphysis.
 - The scalpel is then removed and rotated through 180 degrees, and the remaining upper third of the symphysis is cut. - Once the symphysis has been divided, the pubic bones will separate.
- 1 The symphysis should open as wide as the operator's thumb. A large episiotomy is required to relieve tension on the anterior vaginal wall. Usually a vacuum extractor will be used to pull the fetus downward at this point.
 - 2 Delivery of the head and trunk of the baby occurs in a downward direction, taking care to avoid the temptation to lift the baby up until it is completely delivered.
 - 3 After delivery of the baby and placenta, the symphysis is compressed between the thumb above and the index

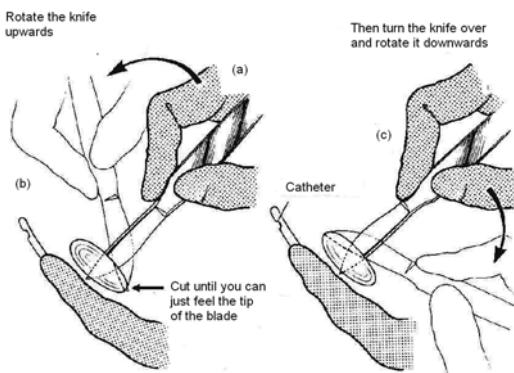


FIGURE 2.13.31 Cutting through the cartilage.

- and middle fingers below for several minutes in order to express blood clots and promote haemostasis.
- 4 There is no need to close the incision unless there is bleeding.
 - 5 Reinsert the urinary catheter.

Post-procedure care

- If there are signs of infection or the mother has a fever, give a combination of antibiotics until she has been fever-free for 48 hours:

- Ampicillin 2 grams IV every 6 hours
- plus gentamicin 80mg IV/IM every 8 hours or 5mg/kg body weight IV/IM once every 24 hours
- plus metronidazole 500mg IV every 8 hours.
- Give appropriate analgesia.
- Apply a binder or sheet or elastic strapping across the front of the pelvis from one iliac crest to the other to hold the pelvis together to aid pelvic healing and reduce pain. Nurse the woman on her side to allow gravity to aid pelvic healing.
- Leave the urinary catheter in for at least 5 days.
- Encourage oral fluids to ensure a good urinary output.
- Encourage bed rest for 7 days after discharge from hospital.
- Encourage the mother to begin walking with assistance when she is ready to do so.
- If **long-term walking difficulties and pain** occur (2% of cases), treat them with physiotherapy.

Induction of labour for intrauterine death in the second or third trimester

See Section 2.6.B.

Destructive operations

Background

Destructive procedures are undertaken when a vaginal delivery must occur because:

- skilled staff are not available to carry out what may be a difficult or dangerous Caesarean section
- in neglected obstructed labour there is a risk of overwhelming infection following Caesarean section
- of the implications of a uterine scar for future pregnancies
- the patient does not give consent to Caesarean section.

Reasons for fetal death in obstructed labour

- Strong and continuous contractions (sometimes made worse by inappropriate use of oxytocic drugs or other non-prescription uterotonic drugs) interfere with placental exchange.
- Excessive moulding of the head, in cephalic presentation, can lead to intracranial haemorrhage. In breech presentation the head may be trapped by an incompletely dilated cervix, or may not enter the pelvis because of disproportion.
- Prolapsed cord.
- Ascending infection, amnionitis and intrauterine infection due to prolonged ruptured membranes and labour, and/or unsterile vaginal examinations.
- Ruptured uterus.

Destructive operations

Before a destructive procedure is undertaken the fetus must be dead.

Ensure that the mother is adequately resuscitated.

Ruptured uterus must be excluded.

Ensure adequate analgesia or anaesthesia.

The procedure can be performed under general or regional anaesthesia, or sedation and analgesia with morphine, midazolam and/or ketamine.

General issues relating to destructive procedures

- The operator must be competent at destructive deliveries.
- Destructive operations are most safely done at full dilatation, but may be performed when the cervix is 7 cm or more dilated. If there is hydrocephaly, it is best to drain the CSF at diagnosis without waiting for full dilatation, as the hydrocephalic head may cause uterine rupture.
- The bladder must be catheterised.
- Post-delivery care includes continuous catheterisation of the bladder, IV antibiotics and IV fluids.

Craniotomy

Craniotomy is used for the delivery of a dead fetus with cephalic presentation when labour is obstructed. Usually the head is impacted in the pelvic brim. If the head is mobile, craniotomy may be difficult and Caesarean section may be safer (if circumstances are suitable).

The head may need to be dis-impacted from the pelvis to facilitate urinary catheterisation.

A 3 cm incision is made on the posterior aspect of the skull using Mayo scissors. The index finger of the left hand is inserted into the incision and the suture and fontanelle are identified. The scissors are then pushed though the fontanelle into the cavity of the skull. Thereafter the brain is evacuated and Kocher's forceps are clamped on to the edges of the parietal bones. A weight is attached to the Kocher's forceps with a length of bandage. The mother's legs are taken out of the lithotomy stirrups and placed on two stools for support. Delivery will take place within a period ranging from a few minutes to several hours. This method can be used when the cervix is at least 8 cm dilated.

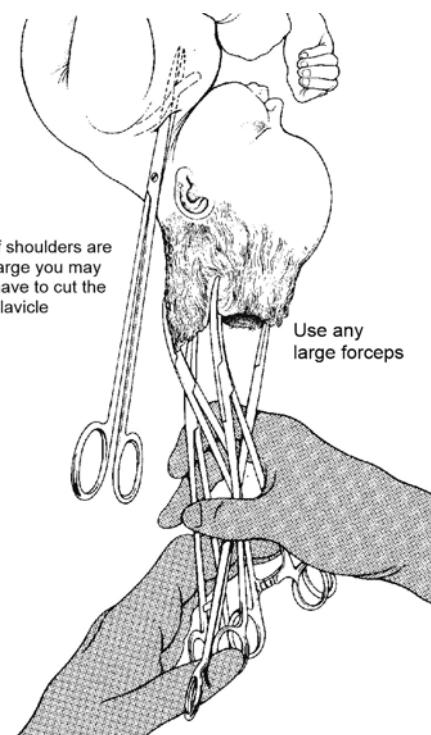


FIGURE 2.13.32 Craniotomy. This baby's skull has been opened and the brain removed. These are not vulsellum forceps, but you can use such forceps.



FIGURE 2.13.33 X-shaped fetal skull incision.

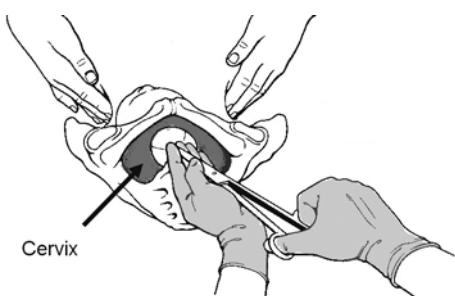


FIGURE 2.13.34 Perforating the skull: a life-saving operation. Your assistant is pushing the baby's head into the mother's pelvis. You have made an X-shaped incision in the skin of the baby's scalp. You have found a suture line, and are pressing a strong pair of scissors into it.

Breech presentation with an entrapped head and dead fetus

- Make an incision through the skin at the base of the neck.
- Insert a craniotome (or large pointed scissors or a heavy scalpel) through the incision and tunnel subcutaneously to reach the occiput.
- Perforate the occiput and open the gap as wide as possible.
- Apply traction on the trunk to collapse the skull as the head descends.

Craniocentesis (skull puncture) for hydrocephalus and obstructed labour and dead fetus

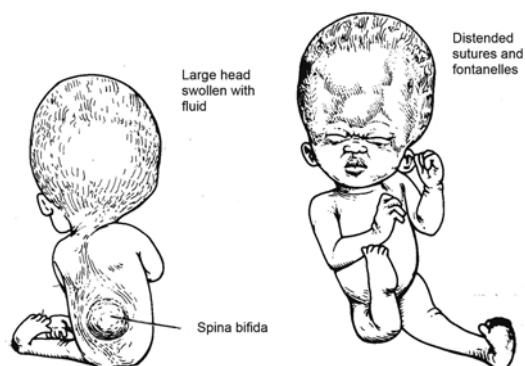


FIGURE 2.13.35 Hydrocephaly. A child with one abnormality often has several others as well.

Craniocentesis with a fully dilated cervix

- Pass a large-bore spinal needle through the dilated cervix and the sagittal suture line or fontanelles of the fetal skull (see Figure 2.13.36).
- Aspirate the cerebrospinal fluid until the fetal skull has collapsed. Then allow normal delivery to proceed.

Craniocentesis with a closed cervix

- Palpate for the location of the fetal head.
- Apply antiseptic solution to the suprapubic skin.
- Pass a large-bore spinal needle through the abdominal and uterine walls and through the hydrocephalic skull.

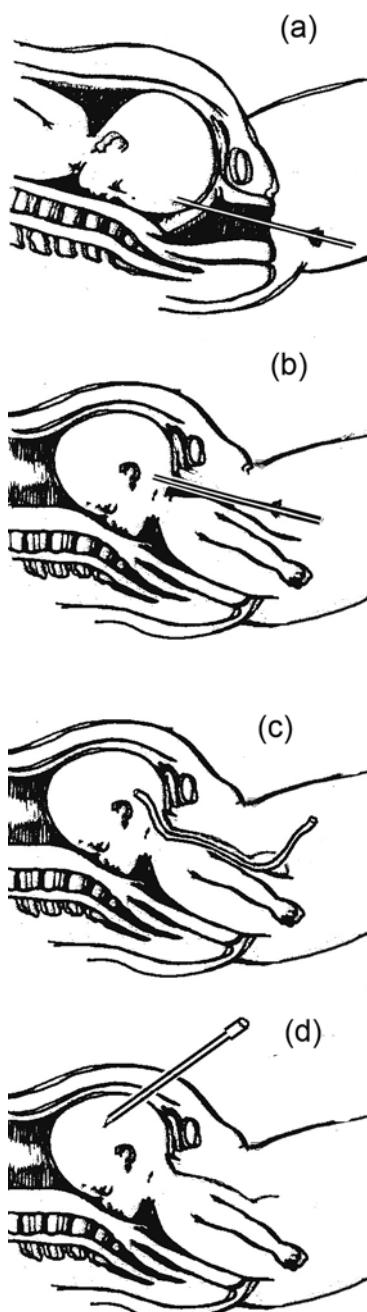


FIGURE 2.13.36 Draining a hydrocephalus. (a) Draining the vertex. (b) Draining the occiput. (c) Draining through a meningo-myelocele. (d) Draining through the mother's abdomen.

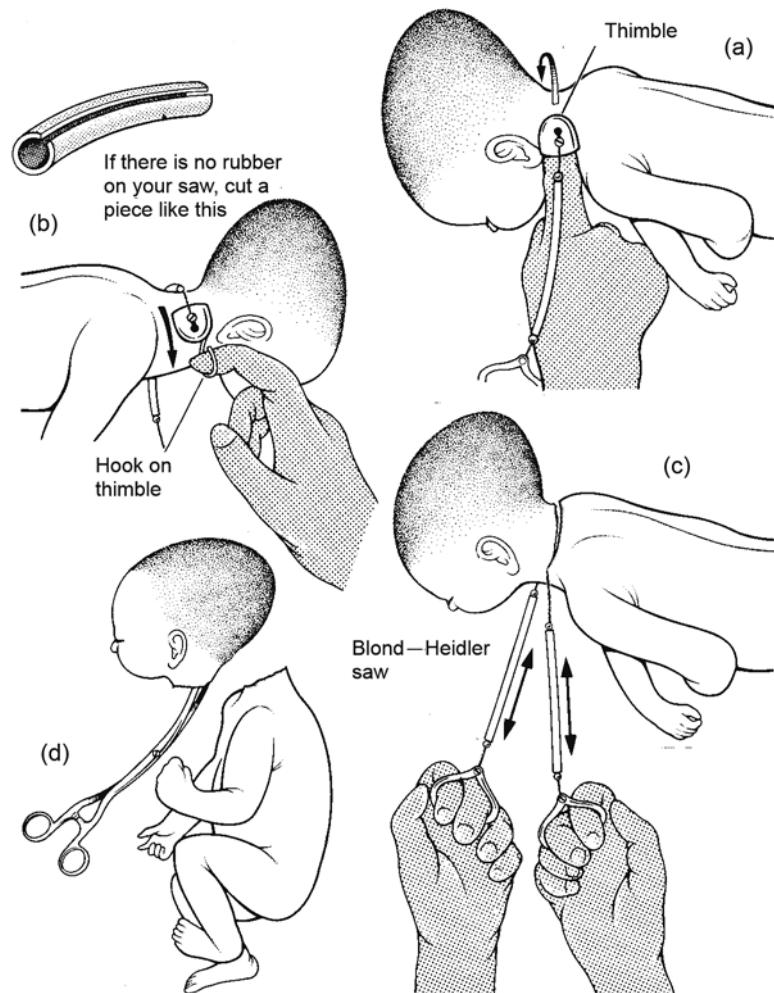


FIGURE 2.13.37 Decapitation of dead fetus. (a) Fix the saw to the thimble and push it over the neck. (b) Remove the thimble and fix the handles to each end of the saw. (c) Saw to and fro. (d) Grasp the stump of the neck.

- Aspirate the cerebrospinal fluid until the fetal skull has collapsed. Then allow vaginal delivery to proceed.

Craniocentesis in breech where the hydrocephalic head is stuck and the fetus is dead

- When the rest of the body has been delivered, insert a large-bore spinal needle through the dilated cervix and foramen magnum.
- Aspirate the cerebrospinal fluid and deliver the after-coming head as in breech delivery.

This can be managed similarly, by craniotomy with perforation of the head through the occiput. Where there is hydrocephalus and accompanying spina bifida, CSF can be withdrawn by exposing the spinal canal and passing a catheter into the canal and up into the cranium. Alternatively, the hydrocephalic head can be decompressed trans-abdominally using a spinal needle.

Decapitation

This procedure is summarised in Figure 2.13.37.

In cases of neglected obstructed labour with shoulder presentation and a dead fetus, decapitation is the treatment of choice. The lower uterine segment is very vulnerable. If

the fetus is small, the neck can easily be severed with stout scissors. However, for the larger fetus, where the neck is not easily accessible, the Blond-Heidler decapitation tool is probably the safest instrument. If possible, an arm of the fetus is brought down in order to facilitate access and exposure of the neck. The saw is threaded around the fetal neck, and by keeping the handles at the ends of the saw close together, injury to the vagina is prevented and the neck can be severed with a few firm strokes. Delivery of the trunk is straightforward, and the after-coming head is delivered by grasping the stump with a heavy vulsellum.

Cleidotomy

Cleidotomy is indicated where the impacted shoulders prevent delivery of the dead fetus. The most accessible clavicle is divided first using stout scissors.

Evisceration

This is sometimes necessary for an abdominal tumour or very large fetus following craniotomy. An incision is made in the abdomen or thorax. The viscera are then extracted digitally. Once the bulk of the fetus has been reduced the fetus can be extracted easily.

TABLE 2.13.1 Possible situations of fetal death and the relevant procedures

| Clinical situation | Procedure |
|---------------------------------------|--|
| <i>Cephalic presentation:</i> | |
| Head < 60% above the pelvic brim | Craniotomy |
| Head free or > 60% palpable | Caesarean section |
| Hydrocephalus | Perforation before full dilatation |
| Obstruction due to abdominal tumour | Embryotomy if the abdomen is accessible, otherwise Caesarean section |
| Impacted shoulders | Cleidotomy |
| <i>Breech presentation:</i> | |
| Obstruction due to after-coming head | Perforation of the head |
| Obstruction due to abdominal tumour | Embryotomy |
| Impacted shoulders | Cleidotomy |
| <i>Transverse or oblique lie:</i> | |
| Shoulder presentation or arm prolapse | Decapitation |
| Access to fetal neck difficult | Caesarean section |
| Ruptured uterus | Laparotomy – repair/hysterectomy |
| Gross disproportion | Caesarean section |

Complications of destructive operations

Instruments or sharp pieces of bone may cause a vesico-vaginal fistula. The vagina, cervix and perineum must therefore be carefully examined after the procedure.

Alternative to destructive operations

Syphphysiotomy with episiotomy may avert the need for destructive operations if the fetus is still alive.

Caesarean section may be preferred, if available, especially if the operator is inexperienced in performing destructive procedures. However, caesarean section will create a risk for scar rupture during a subsequent pregnancy and in low resource settings this could result in maternal and fetal death.

Post-procedure care

- After delivery, examine and repair any tears to the cervix or vagina, or undertake episiotomy repair.
- Leave a self-retaining catheter in place until bladder injury has been excluded.
- Ensure adequate fluid intake and urinary output.

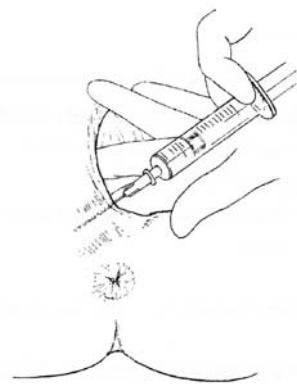
Episiotomy

Episiotomy should be considered in the case of:

- complicated vaginal delivery (e.g. breech, shoulder dystocia, forceps, vacuum delivery)
- scarring from female genital cutting
- fetal distress
- delay in the second stage
- previous third- or fourth-degree tears
- where significant perineal trauma is anticipated if it is not performed.

Procedure

- Apply antiseptic solution to the perineal area.
- Use local infiltration with 1% lignocaine. Make sure that there are no known allergies to lignocaine or related drugs.
- Infiltrate beneath the vaginal mucosa, beneath the skin of the perineum and deeply into the perineal muscle (see Figure 2.13.38) using 5–10mL of 1% lignocaine solution.
- **Aspirate (pull back on the plunger) to be sure that no vessel has been penetrated. If blood is returned in the syringe with aspiration, remove the needle. Recheck the position carefully and try again. Never inject if blood is aspirated.**
- After local anaesthetic infiltration, wait for 2 minutes and then pinch the incision site with forceps. **If the mother feels the pinch**, wait a further 2 minutes and then retest.

**FIGURE 2.13.38** Infiltration of the perineum with local anaesthetic.

Do not perform an episiotomy until the perineum is thinned out **and** 3–4 cm of the baby's head are visible during a contraction.

Performing an episiotomy will cause bleeding, so it must not be done too early.

- 1 Wearing disinfected gloves, place two fingers between the baby's head and the perineum.
- 2 Use scissors to cut the perineum about 3–4 cm in the medio-lateral direction (see Figure 2.13.39). It is essential that the episiotomy cut is not made where, if it runs into a tear, it involves the anal sphincter. That is, it must be at an angle away from the anus, as shown in Figure 2.13.39.
- 3 Control the baby's head and shoulders as they deliver, ensuring that the shoulders have rotated to the midline to prevent an extension of the episiotomy.
- 4 Carefully examine for extensions and tears, and repair them (see below).

Repair of episiotomy

It is important that absorbable sutures or Vicryl are used for closure. Polyglycolic sutures are preferred to chromic catgut because of their tensile strength, non-allergenic properties and lower risk of infection and episiotomy breakdown. However, chromic catgut is an acceptable alternative.

Apply antiseptic solution to the area around the episiotomy.

- If the episiotomy is extended (torn) through the anal sphincter or rectal mucosa, which should not happen if the original cut has been away from the vertical

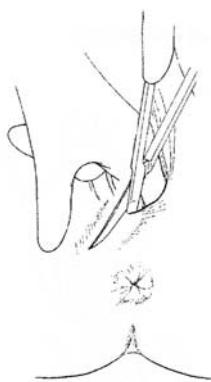


FIGURE 2.13.39 Using two fingers to protect the baby's head while making the incision.

(see above), manage as third- or fourth-degree tears, respectively.

- **Close the vaginal mucosa using continuous 2-0 suture.**
- Start the repair about 1 cm above the apex (top) of the episiotomy. Continue the suture to the level of the vaginal opening.
- At the opening of the vagina, bring together the cut edges of the vaginal opening.
- Bring the needle under the vaginal opening and out through the incision and tie.
- Close the perineal muscle using a continuous 2-0 suture.
- Close the skin using a subcuticular or interrupted 2-0 suture.

Complications of episotomy

- 1 **Haematoma.** If this occurs, open and drain it. If there are no signs of infection and bleeding has stopped, reclose the episiotomy.
- 2 **If there are signs of infection,** open and drain the wound. Remove infected sutures and debride the wound:
 - If the **infection is mild**, antibiotics are not required.
 - If the **infection is severe but does not involve deep tissues**, give a combination of antibiotics:
 - Ampicillin 500 mg orally four times a day for 5 days
 - *plus* metronidazole 400 mg orally three times a day for 5 days.
 - If the **infection is deep and involves muscles**, give a combination of antibiotics until the necrotic tissue has been removed and the mother has been fever-free for 48 hours:
 - penicillin G, 2 million units IV every 6 hours
 - *plus* gentamicin 80 mg IV/IM every 8 hours or 5 mg/kg body weight IV/IM once every 24 hours
 - *plus* metronidazole 500 mg IV every 8 hours.
 - When the **mother has been fever-free for 48 hours**, give:
 - ampicillin 500 mg orally four times a day for 5 days
 - *plus* metronidazole 400 mg orally three times a day for 5 days.

Necrotic tissue requires wide surgical debridement.

Perform secondary closure in 2 to 4 weeks (depending on resolution of the infection).

Repair of cervical tears

- If the mother is bleeding heavily it may be best to resuscitate and then pack the tear with sterile gauze. Bimanual compression may be required. Ensure that whoever repairs this is experienced. This might need referral to another hospital.
 - Repair only when the mother is stable and most of the bleeding has stopped, unless there is heavy ongoing blood loss despite compression in which case repair needs to be undertaken urgently while resuscitation continues
 - Apply antiseptic solution to the vagina and cervix.
- Anaesthesia is not required for most cervical tears.
 - For tears that are high and extensive, give morphine 10mg IV slowly over 5 minutes (provided that shock is not present), or use ketamine.
- Ask an assistant to massage the uterus and provide fundal pressure.
- Gently grasp the cervix with ring or sponge forceps.
 - Apply the forceps on both sides of the tear and gently use the forceps to pull each part of the cervix down in turn so that the entire cervix is examined.
 - There may be several tears.
- One way of finding a high tear is to insert a suture as high as possible and then use it to provide traction to work up to the apex to obtain haemostasis, and then to work downward towards the introitus.
- Close the cervical tears with a continuous polyglycolic/Vicryl suture starting at the apex (upper edge of tear), which is often the source of bleeding (see Figure 2.13.40).
- If a long section of the rim of the cervix is tattered and bleeding, under-run it with a continuous polyglycolic/Vicryl suture. Often if the bleeding is persistent but mild, compressing the ragged edges with a sterile pack is the most effective way of halting the bleeding, if no specific delineated tear is identified.
- If the apex is difficult to reach and ligate, it may be possible to grasp it with artery or ring forceps. Leave the forceps in place for 4 hours.
 - Do not persist in attempts to ligate the bleeding points, as this may increase the bleeding.
 - After 4 hours, open the forceps partially but do not remove.
 - After another 4 hours, remove the forceps completely.
- A laparotomy may be required to repair a cervical tear that has extended beyond the vaginal vault.

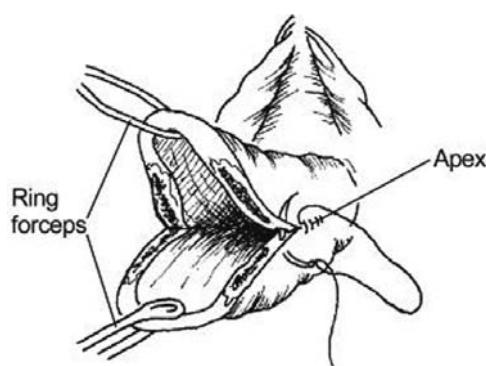


FIGURE 2.13.40 Repair of a cervical tear.

Manual removal of the placenta

- If the placenta does not separate within 1 hour of delivery, or immediately if there is heavy bleeding:
- start an IV infusion
 - ensure that the bladder is emptied either by the mother or by catheterisation
 - give a slow IV injection of ketamine (1–2 mg/kg or 50–100 mg) or morphine (10 mg), ideally in the presence of an anaesthetist
 - give a single dose of prophylactic antibiotics:
 - ampicillin 2 grams IV *plus* metronidazole 500 mg IV
 - or cefotaxime 1 gram IV *plus* metronidazole 500 mg IV.
 - Ensure full aseptic drapes.
 - Hold the umbilical cord with a clamp. Pull the cord gently until it is taut.
 - Wearing sterile gloves (ideally covering the forearms) insert a hand into the vagina and follow the cord up into the uterus until you reach the edge of the placenta (see Figure 2.13.41). If the cervix is closed, gentle pressure with one or two fingers will usually relax it and make it open.
 - Let go of the cord with the other hand and move the hand up over the abdomen in order to support the fundus of the uterus and to provide counter-traction during removal to prevent inversion of the uterus (see Figure 2.13.42).

If uterine inversion occurs, reposition the uterus immediately.

- Move the fingers of the hand laterally until the edge of the placenta is located.
- **If the cord has been detached previously,** insert a hand into the uterine cavity.
 - Explore the entire cavity until a line of cleavage is identified between the placenta and the uterine wall.

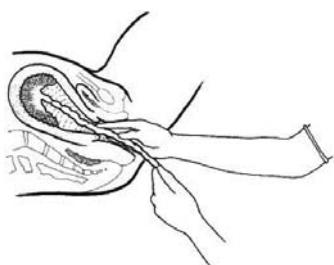


FIGURE 2.13.41 Entering the uterus along the cord.

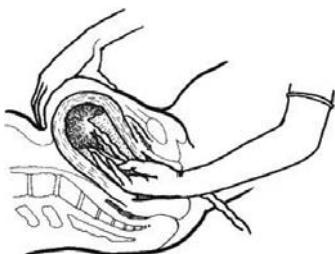


FIGURE 2.13.42 Supporting the fundus while detaching the placenta.

- Reach the placenta from the implantation site by keeping the fingers tightly together and using the edge of the

hand to gradually make a space between the placenta and the uterine wall.

- Proceed slowly all around the placental bed until the whole placenta is detached from the uterine wall.
- **If the placenta does not separate from the uterine surface** by gentle lateral movement of the fingertips at the line of cleavage, suspect placenta accreta.
 - Consider laparotomy and possible subtotal hysterectomy.
 - Alternatively, the placenta can be left *in situ* to spontaneously degenerate.
 - The main risk is that of infection and delayed haemorrhage, and follow-up needs to be maintained to assess the woman for signs of sepsis.
- Hold the placenta and slowly withdraw the hand from the uterus, bringing the placenta with it (see Figure 2.14.43).
- With the other hand, continue to provide counter-traction to the fundus by pushing it in the opposite direction to the hand that is being withdrawn.

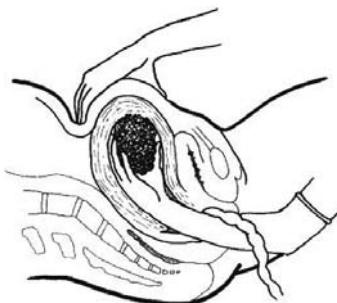


FIGURE 2.13.43 Withdrawing the hand plus the placenta from the uterus.

- Palpate the inside of the uterine cavity to ensure that all placental tissue has been removed.
- Give oxytocin 40 units in 500 mL of IV fluids (Ringer-lactate or Hartmann's solution) over 4 hours.
- Ask an assistant to massage the fundus of the uterus to encourage a tonic uterine contraction.
- If there is **continued heavy bleeding**, give 10 units of oxytocin IM. If this does not work, try ergometrine 200–500 micrograms (not if there is or has been hypertension) IM and, if that does not work, give misoprostol rectally as 4 × 200 microgram tablets or pessaries (800 micrograms total) or, **if the woman is conscious**, misoprostol orally 3 × 200 microgram tablets.
- Examine the uterine surface of the placenta to ensure that it is complete. If any **placental lobe or tissue is missing**, explore the uterine cavity under strict surgical asepsis to remove it.
- Examine the mother carefully and repair any tears to the cervix or vagina, or undertake episiotomy repair.

Problems

If the placenta is retained due to a constriction ring or if hours or days have passed since delivery, it may not be possible to get the entire hand into the uterus. Consider using a general anaesthetic to help to relax the cervix, and extract the placenta in fragments using two fingers or ovum forceps, but be very careful not to penetrate the soft uterine wall. If hours or days have passed and/or signs of sepsis are present, treat for puerperal sepsis with a full course of IV antibiotics (see Section 2.5.G).

Post-procedure care

Observe the mother closely until the effect of IV analgesia has worn off.

- Monitor the vital signs (pulse, blood pressure, respiration and temperature) every 15 minutes for the first hour and then every 30 minutes for the next 6 hours or until the patient is stable.
- Palpate the uterine fundus to ensure that the uterus remains contracted.
- Check for excessive lochia.
- Continue infusion of IV fluids.
- Transfuse as necessary, especially if the mother is severely anaemic before the procedure.
- Warn the mother of the increased risk of this occurring at the time of the next pregnancy, and therefore advise her to deliver in a well-equipped comprehensive EmOC facility.

Bilateral pudendal nerve block

Indications

This technique is indicated for some instrumental deliveries, for repair of larger tears, and for craniotomy or craniocentesis.

A pudendal nerve block targets the pudendal nerve as it enters the lesser sciatic foramen, about 1 cm inferior and medial to the attachment of the sacrospinous ligament to the ischial spine. The aim is to block the nerve proximal to its terminal branches. Here the nerve is medial to the internal pudendal vessels. The transvaginal approach is described here, as it is the most reliable.

Dilute 20mL of 1% lidocaine to 40mL with Ringer-lactate or Hartmann's solution, to make a solution of 0.5%. This is used starting with 15mL on each side. The remaining 10mL can be used to infiltrate the perineum during repairs if these are needed.

Adrenaline is not used with the lidocaine.

Ensure that IV access is in place.

The needle used should be around 15 cm in length and 20–22 gauge.

The procedure must be undertaken with surgical sterility after cleaning the vagina with chlorhexidine (Hibitane) obstetric cream, and always using sterile gloves.

Resuscitation equipment and medications should always be readily available in case an adverse reaction to the local anaesthetic occurs.

Procedure

Palpate the ischial spine through the vaginal wall.

A metal trumpet (see Figure 2.13.44) can facilitate the placement of the needle and limit the depth of submucosal penetration, but is not essential.

- 1 To perform a left-sided block, palpate the ischial spine with the index finger of the left hand, hold the syringe in the right hand, and guide the needle between the index finger and middle finger of the left hand toward the ischial spine (see Figure 2.13.45).
- 2 Place the end of the guide beneath the tip of the ischial spine.
- 3 Push the needle into the vaginal mucosa.
- 4 **Aspirate to ensure that the needle is not in one of the pudendal blood vessels, which could be very dangerous if lidocaine is injected.**
- 5 Inject 1mL of local anaesthetic.



FIGURE 2.13.44 Metal trumpet to guide needle to site of pudendal nerve.

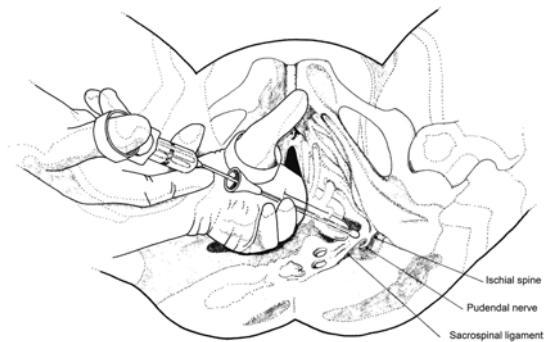


FIGURE 2.13.45 Inserting the needle using a trumpet guide. © 2012 Christy Krames.

- 6 Advance the needle through the vaginal mucosa until it touches the sacrospinous ligament 1 cm medial and posterior to the ischial spine.
- 7 **Aspirate to ensure that the needle is not in one of the pudendal blood vessels, which could be very dangerous if lidocaine is injected, and infiltrate with 3mL of local anaesthetic.**
- 8 Next, advance the needle further through the sacrospinous ligament for a distance of 1 cm until a loss of resistance is detected.
- 9 The tip now lies in the area of the pudendal nerve. At this point, the pudendal vessels lie just lateral to the pudendal nerve, so care must be taken to avoid intravascular administration. **Aspirate to confirm that the needle placement is not intravascular prior to injecting lidocaine.**
- 10 Inject another 3mL of local anaesthetic solution into this region.

- 11 Subsequently, withdraw the needle into the guide and move the tip of the guide to just above the ischial spine.
- 12 At this new location, reinject the needle through the mucosa and again inject 3 mL of local anaesthetic.

Aspirate to confirm that the needle placement is not intravascular prior to injecting lidocaine.

To block the right side of the pelvis, repeat these steps using the right hand to hold the needle and needle guide.

The block usually takes at least 5 minutes to become effective, and lasts for between 20 and 60 minutes. Check bilaterally for pain before starting the procedure.

A smaller repeat dose (up to 5 mL of 0.5% lidocaine) on each side can be used if an adequate block is not seen.

A pudendal block does not provide adequate anaesthesia for deliveries that require uterine manipulation, postpartum examination and repair of the upper vagina and cervix, and manual exploration of the uterine cavity.

Under these circumstances, the addition of intravenous narcotics or ketamine may be required.

Vaginal examination in obstetrics

Vaginal examination should be performed only if it is essential, and the risk of infection must be minimised by hygienic

hand washing and the use of a new set of examination gloves. At all times it is important to preserve the patient's dignity and privacy. In labour, a chlorhexidine obstetric cream can prevent ascending infection.

Always undertake abdominal palpation first.

Do not undertake vaginal examination if there is a possibility of placenta praevia, if there are ruptured membranes and the woman is not in labour, or if there is active herpes simplex infection in ruptured membranes unless the patient is in labour.

If you are using a speculum, offer to demonstrate it, explain how it is inserted and ensure that the correct size is used.

Document any blood loss, discharge and its characteristics, and any amniotic fluid and its characteristics. If female genital cutting is present, record this and describe the type.

Document the cervical length, position, dilatation, and application to the presenting part of the fetus. Determine if possible the presentation of the fetus and whether there is caput and/or moulding present. Evaluate pelvic size by examining the ischial spines and suprapubic arch.

At the end, provide a clean sanitary pad, auscultate the fetal heart, describe the results of the examination to the woman, and record the findings in the notes.