Introduction

HOW TO USE THIS MANUAL

This is a comprehensive manual designed for all health workers caring for pregnant women and adolescent girls, infants and children in hospitals. It can be used by those with limited resources and also where greater resources are available.

Minimum standards required to practice well are given in a highlighted box at the beginning of each section addressing clinical practice.

Aspects of care where resources are so limited that they cannot at present be undertaken in most poorly resourced settings are highlighted in grey.

Key points, especially those where inappropriate actions might be dangerous, are presented in **bold font**.

This in-depth manual has been written for doctors, midwives and nurses caring for pregnant women and adolescent girls, newborn infants and children in the poorest, most disadvantaged, countries of the world, particularly concentrated in sub-Saharan Africa and South Asia. It is primarily designed to develop a minimum standard of care in hospitals for every woman, baby and child, regardless of the resources available for the country as a whole.

The startling numbers in the Tables below illustrate the unethical and unacceptable mortality rates for pregnant women, newborn infants and children in resource-poor countries. The continued presence of armed conflict and, in many cases, the associated and deliberate targeting of healthcare (see www.ihpi.org) has contributed to a worsening situation in many countries.

ARTICLE 25 of the Universal Declaration of Human Rights adopted in 1948 states the following: 'Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control. Motherhood and childhood are entitled to special care and assistance. All children, whether born in or out of wedlock, shall enjoy the same social protection'.

There is no question that a considerable burden of unnecessary suffering is endured by women and children in hospitals; not only those in poorly-resourced settings. This situation is not all related to a lack of funds; much also relates to deficiencies in the training of health workers. Often, the training and continuous professional development of doctors, midwives and nurses is a low priority and even after training they are often not provided with adequate salaries, professional recognition or up to date evidence-based teaching and clinical materials. Standard medical textbooks for health workers in disadvantaged countries are usually too expensive and out-of-date, hampering their continuing medical education.

TABLE 1 Comparison of maternal and child mortality rates in rich versus poor countries in the world

	47 high income countries defined as those with GNI ≥ 12,616 USD per capita per annum†		33 low income countries defined as those with GNI ≤ 1035 USD per capita per annum†	
	Range	Median	Range	Median
Under 5 year mortality rate per 1000 live births: 2012 data	2–21	5	40–182	90
Maternal mortality ratio (MMR)* per 100,000 live births: 2010 data 'adjusted'	2–47	8	70–1100	460

Data from State of the World's Children (2014) by UNICEF.

*MMR is the number of deaths of women from pregnancy-related causes per 100,000 live births during the same period. The data that are 'adjusted' refer to 2010 United Nations inter-agency maternal mortality estimates released in May 2012.

†GNI = Gross National Income from World Bank data; USD = United States Dollars

TABLE 2 Details of individual numbers of maternal and under 5 year deaths comparing low and high income countries

	Total number of births 2012	Total number of maternal deaths 2010 adjusted*	Total number of child deaths under 5 years 2012	Number of live births resulting in 1 maternal death	Number of live births resulting in 1 child death
Low income countries (N = 33, 32 with data on maternal deaths and 33 with data on under 5 year child deaths)	26,007,000	110,376 (median number for individual countries = 2049)	2,197,982 (median number for individual countries = 43,228)	**236**	**12**
High income countries (N = 47, 45 with data on maternal deaths and 47 with data on under 5 year child deaths)	14,149,000	2190 (median number for individual countries =7)	84,479 (median number for individual countries = 420)	**6461**	**167**

Data from State of the World's Children (2014) by UNICEF.

Editing and writing this book has been challenging for the editors and authors. We have identified what we regard as the acceptable minimum standards of treatment for all major diseases and injuries that affect the pregnant woman, newborn baby, infant and child, wherever they are cared for. But we also wanted to offer a set of ideal standards for care where resources are adequate. Therefore, we have incorporated the essential minimum standard of care alongside some of the best standards currently available. However, readers will notice that for most of the treatments recommended, the minimum and gold standards are identical because there are certain treatments that should be provided as essential hospital care, whatever the pressures. This manual should ideally be supplemented by scenario- and skill-based short training courses, combined with apprenticeship and small group teaching on the wards and in the operating theatre.

We believe in the continuing value of printed books to the practical application of healthcare, recognising that with time and improved access to high-speed internet in low resource settings, electronic materials, particularly videos and an easily accessed internet, will introduce major benefits. In the meantime books should be available for all health workers regardless of their ability to pay for them. We hope that you will find this in-depth manual helpful.

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  - Simpson J, Robinson K, Creighton SM, Hodes D. Female genital mutilation: the role of health professionals in prevention, assessment and management. *BMJ.* 2012; **344**: e1361.
  - Hobbs CJ, Wynne JM. The sexually abused battered child. *Arch Dis Child*. 1990; **65**(4): 423–7.
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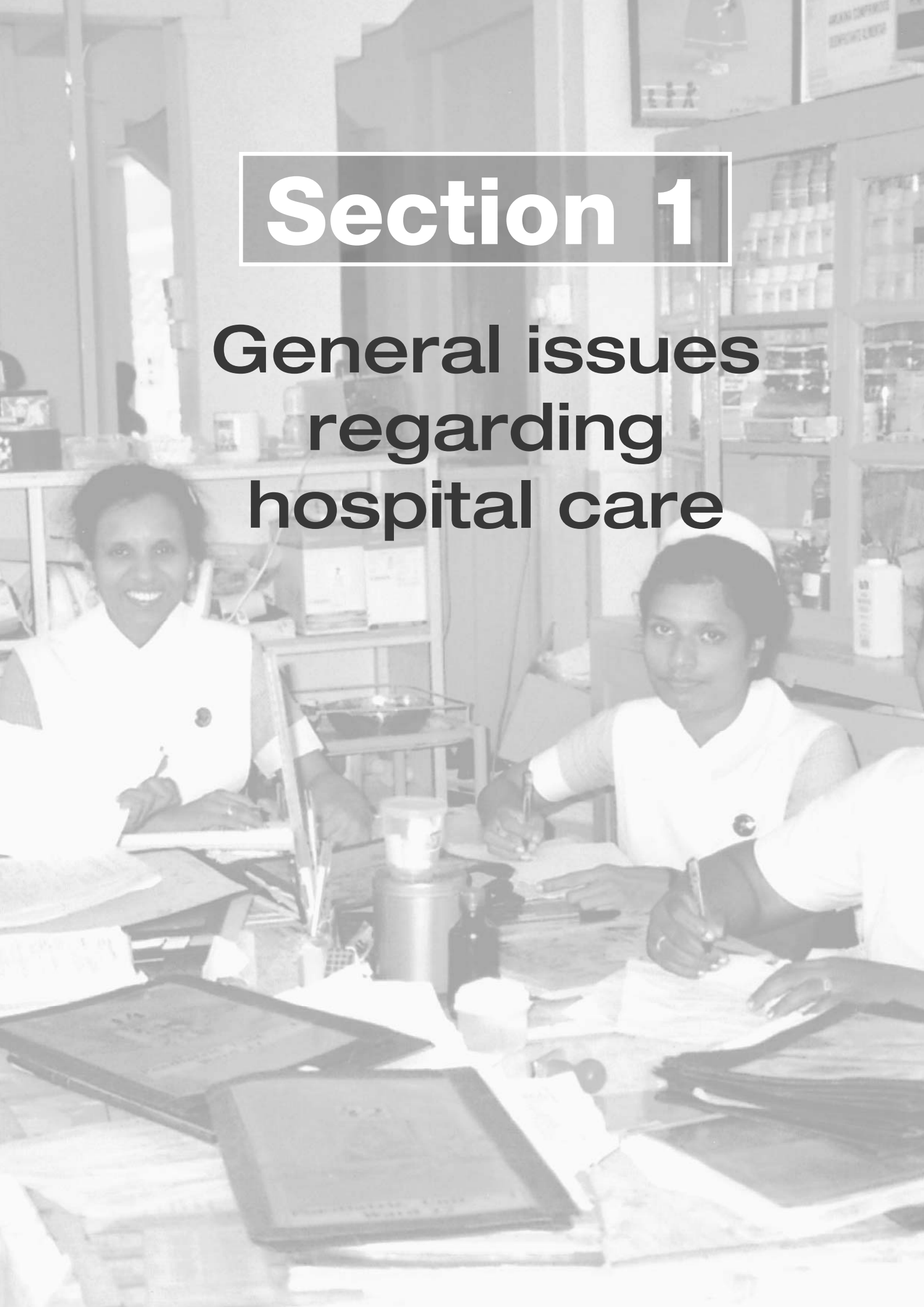
Disclaimers

1. The authors and editors have done all they can to ensure that drug doses and other facts in this book are accurate. While every effort has been made to ensure the accuracy of the information, as publishers we can give no guarantee on information about drug dosages or the applications of the drugs or procedures described in this textbook. In every individual case the user must check current indications and accuracy by consulting relevant pharmaceutical literature and following the guidelines laid down by manufacturers of specific medical devices. Users must also follow the guidelines of relevant authorities in the countries in which they are practising. The publishers cannot accept responsibility or legal liability for any errors in or misuse of material in this textbook.
2. The Advanced Life Support Group (ALSG) is very pleased to be a partner in this landmark text which presents up-to-date and practical information in an accessible form to clinicians working in low resource settings. ALSG clinicians have made a significant contribution to the textbook but the organisation must make it clear that their contribution has been confined to emergency topics as this is the organisation's field of experience and expertise in both high and low resource settings.



Section 1

General issues regarding hospital care

1.1 Hospital management: non-clinical support and facilities

Introduction

For effective delivery of healthcare, a secure financial strategy with robust financial and manpower controls, a properly maintained technical infrastructure, clear lines of accountability, and good management and communication lines all need to be in place. Ideally there should be clearly defined written personnel procedures, good training systems, and written policies and guidelines for all staff functions. The facilities and functions described in this section need to be in place, and are as important as the quality of medical care given. The services and facilities discussed in this text are basic, not comprehensive; well-resourced countries may have many additional ones. **If these services and facilities are in place, and are managed efficiently, supported and maintained, mainline healthcare delivery will be effective.**

Giving advice on generic hospital management is difficult, since the ability to deliver a minimum standard of care depends on the political, social and economic context in which the hospital is situated. Ideally there should be a named person responsible for each facility and service, in addition to an overall hospital manager or management team. The hospital manager or management team should have overall responsibility for finances, estates and facilities, human resources, direct clinical patient care and support services (laboratories, radiology, therapies, pharmacy, etc.), training for all staff and the administrative services necessary to support all of these activities. There should always be a head nurse, a head of support services and a senior doctor within the management team.

Staff management

Staff motivation and retention (human resource management) is an essential component of hospital management.

In order to provide good-quality essential health services to the people whom they serve, hospitals must put in place strategies and mechanisms to retain staff and help them to provide the best possible care for patients. The reasons for the healthcare worker crisis in hospitals in resource-limited countries include inadequate numbers of healthcare professionals, who are poorly distributed due to an unplanned 'brain drain' both regionally and internationally (attrition). According to the World Health Organization (2006), this phenomenon is caused by workers experiencing **low salaries, poor, unsafe work environments, a lack of defined career paths, and poor-quality education and training.**

Another most important issue is the support of every healthcare worker's family. Ministries of Health must not disrupt such vital bonds by moving staff away from their families, without their full and freely given agreement.

In the light of the above factors that face health services and compromise hospital-based care, managers must endeavour to motivate the limited human resources available to ensure retention.

A systematic review of six papers evaluating the management and leadership strategies that promote healthcare worker retention in resource-limited countries has identified a number of key lessons, which can be summarised as follows.

Payment of financial incentives to healthcare professionals

This particularly refers to professionals working in unpopular rural areas. Hospitals are run by boards which, as such, should be able to autonomously initiate better financial incentives for their staff. The above-mentioned review found that 86% of the studies showed payment of an attractive salary and allowances was a key motivational strategy for maintaining healthcare workers in their posts. Often what made most healthcare workers leave their jobs, particularly in the public health sector, was being unable to provide basic support for their families on the meagre salaries provided. According to a study conducted in South Africa, an increase in salary of healthcare workers has resulted in many health professionals who had previously left the public health sector, to work in private facilities, returning to the public sector.

Appreciation of healthcare workers

The community loyalty, personal commitment and willingness to make personal sacrifices that are shown by healthcare workers must be recognised and encouraged. This means that both the hospital management and the communities that they serve must demonstrate their appreciation of these attitudes.

Staff must be respected for and thanked for the work they do. Personal appraisal followed by periodic awards is a motivating factor for staff retention. The views of all staff should be listened to, and they must be involved in decision making to enable the best problem-solving approaches to be identified and implemented – it is their hospital and their community.

Orderlies, porters and cleaners are just as important in patient care as doctors and nurses, and this needs to be made clear to all staff. It can be helpful for doctors, nurses and hospital managers to participate and help the cleaners during, for example, the monthly deep cleaning of a ward.

An annual awards ceremony can be very helpful. For example, each department could be awarded certificates for:

- the most punctual member of staff
- the most improved member of staff
- the best dressed member of staff
- an award of excellence for the best all-round member of staff.

The awards could also include special categories, such as:

- the most long-serving member of staff (e.g. the refuse collector)
- an award for providing services above and beyond the 'call of duty'.

This allows awards to be made to staff who might not be in a position to further their education and to receive a certificate.

Receiving such recognition in front of management and invited guests who are prominent in the hospital's catchment area is a huge honour and boost to morale.

Training and supervision

Studies conducted on human resource management for health services in Africa indicate healthcare workers' frustration at having to be assigned to responsibilities and functions for which they have limited or no training. This can be effectively managed by providing 'on-the-job' support through the provision of simple and clear guidelines on clinical procedures. Although resources may be limited for specialised advanced training, priority should be given to locally conducted ongoing training that is cost-effective and sustainable, aimed at equipping healthcare staff with the knowledge necessary to provide efficient and good-quality patient care.

Providing a programme, space and encouragement for healthcare workers to take turns to train and update their peers (e.g. an internal continuing medical education programme) can also be a low-cost and effective way for healthcare workers to share new or updated practice, as well as to develop their own teaching skills.

Similarly, provision of basic information technology, computers and an Internet connection where possible is an important way of reducing professional isolation, helping healthcare workers to remain updated in their practice and to connect with the wider health community.

Some hospitals have benefited greatly by training the locally recruited nurse attendants (healthcare assistants) to second level (state-enrolled nurses) at the local nurse training school. Such nurses are usually born locally and their families live nearby, which often ties them to continuing to serve the community in which they live. In one site that has used this approach, the hospital has been able to train over 30 nurse attendants to the second level.

The introduction of an on-call support service to nurses working out of hours can be valuable. Senior nursing staff who are knowledgeable and experienced have volunteered to help with difficult health or social problems that arise. This provides a link between management and the nursing and clinical staff, facilitating resource mobilisation and ensuring that staff are on duty at the right time and filling gaps where necessary. Many social problems for both staff and patients can be heard and addressed appropriately.

Similarly, it is important to have a suggestions box that allows any member of staff to air their views anonymously if they wish to do so.

Provision of essential equipment and supplies

The lack of or inadequate provision of medical supplies, drugs and equipment in hospitals is one of the most difficult situations that healthcare workers have to cope with. Research has shown the demotivating situation that healthcare workers face when trying to treat patients without the necessary drugs and equipment. The provision of adequate and regular medical supplies, drugs and equipment is part of the answer to the ongoing question of how health systems in developing countries can best retain their health workforces. Such provision should be a management priority.

Provision of social and family amenities

Provision of basic facilities such as housing and good accommodation for healthcare staff is found to have contributed immensely to retention in many parts of the resource-limited countries where such projects have been implemented as part of a retention package.

For example, this is evident in Bansang Hospital, Gambia, West Africa, where staff retention for the past 5 years has been well recognised by authorities. Healthcare workers in Bansang Hospital are given fully furnished accommodation with water and electricity at no cost to the staff. This helps staff to increase their savings and thus boost their income, as they do not have to pay rent or utility bills. This initiative has not only enabled the hospital to retain its staff, but has also served to attract other healthcare workers to come and work there.

A particular challenge for recruiting and retaining experienced healthcare professionals in remote regions is the provision of education for their children, particularly at secondary level. Arrangements for children to be educated and looked after elsewhere are offered in some countries, but this remains a barrier to retention.

Nutrition is an important aspect of medical care for inpatients, particularly those whose relatives cannot provide the nutritious or special diets required. Encouraging all staff to grow their own vegetables and fruit for both patients and staff gives staff a sense of belonging, and extends their care for patients. In Bansang Hospital, Gambia, staff have for the past 3 years formed their own 'Charitable Farming Association'. They pay to become a member, and in return for this they can sustain the feeding of the patients with couscous and beans. Farming activities are to increase in 2014, as the hospital has been given 20 hectares of land, and will now grow rice.

A social centre for staff (with a television, sports facilities, etc.), particularly those who are not living close to or with their families, can be very helpful.

In conclusion, financial incentives can contribute to retention, but other non-financial incentives are equally likely to lead to sustainable retention. Given the economic situation in most resource-limited countries, the wages paid to healthcare workers in prosperous economies might not be realistic in low-income countries. However, the implementation of cost-effective human resource strategies is a more realisable step forward.

Furthermore, the implementation of one strategy at the expense of others is unlikely to result in the long-term aim of achieving healthcare worker retention. Therefore there is a need to adopt both financial and non-financial strategies to retain healthcare staff. Strategies might differ between low-income countries, due to socio-cultural and economic differences.

Essential services and facilities

Hospital security and access

The security and accessibility of the hospital are of paramount importance, especially given the relative lack of police resources in many resource-limited countries. There is also a need for governmental and international agencies to ensure that hospitals are protected and do not become targeted during armed conflict.

At the local level, the hospital should have a perimeter fence with secure entrances where all persons attending

have to demonstrate a legitimate reason for entry. No weapons should be allowed into the hospital, and in some countries it may be necessary to have a metal detector to screen all visitors.

A well-organised car parking system is required, with strictly policed access areas for emergency vehicles and for parents or relatives bringing very sick patients to and from the hospital.

Safety and cleanliness

There should be clear written evacuation and fire policies, together with appropriate equipment (e.g. fire extinguishers). The perimeter fence should be of a construction that will keep out animals.

Communication systems

Good communication systems for staff, visitors and patients are essential. Ideally both outside and internal telephone systems should be available. If telephone systems are not feasible, alternative effective reliable systems of communication should be used. A hospital paging system for doctors, senior nurses and managers aids communication in emergency situations.

Internet access is invaluable for information sharing and education, both within a country and globally. Provision can be sought via governmental or non-governmental donor sources. A nominated person with overall responsibility for hospital computer systems predisposes to a cohesive service both internally and externally, avoiding duplication and ensuring appropriate usage.

Effective communication between groups of staff improves the effectiveness and efficiency of care. Regular meetings should discuss individual patients, debrief following deaths and clinical incidents, and audit specific aspects of clinical and unit management, such as infection control. The outcome of audit, particularly any changes in practice, needs to be available to those staff it affects, but such meetings should be educational and not used for apportioning blame.

Utilities

Water and sanitation

Hygiene within the hospital is paramount, and is dependent on a constant and high-quality water supply and adequate sanitation and washing facilities (i.e. bathrooms, showers, toilets and accessible sinks with an effective, functioning drainage system), all of which are vital if hospital-related infection (*see* Section 1.2) is to be minimised.

Electricity

An electricity supply within the hospital, which functions independently of any power losses to the rest of the area, is mandatory. Therefore a generator of sufficient power should be an essential item of equipment (the generator size is calculated from bed dependency and operating theatre requirements). In resource-limited countries where an erratic power supply is common due to high fuel costs, solar back-ups are needed for hospitals to function efficiently and effectively. There should be special emergency circuits. Power-cut simulations should be carried out regularly to test the system.

Heating and ventilation

Ideally there should be a functioning central heating system within the hospital. For this to work, there will also need to be a continuous water supply. If either of these cannot be ensured, electric heaters should be installed in all areas where there are patients.

In hot weather, there should be sufficient windows (that can be opened) to allow a comfortable temperature to be maintained during the hottest part of the day. An air-conditioning system or fans, either electric or manual (to be operated by relatives), should be available in areas of the hospital that become particularly hot, and for patients who must be kept cool (e.g. children with high fevers or head injuries).

Laundry service

Bedding and other items must be frequently washed. Therefore the hospital must have a staffed laundry service, ideally with a sufficient number of industrial washing machines and drying facilities. Where hand washing is the only option, staff should wear protective clothing and high-quality thick gloves. Clean bedding, towels and nappies must be available. A small supply of nightwear and other clothing may be needed on the wards for families who do not have a change of clothes with them.

Cleaning services

Patients who are being cared for in hospital are particularly vulnerable to nosocomial (hospital-acquired) infection (*see* **Section 1.2**). **To reduce this risk, sufficient staff should be employed on a rota over the 24-hour period to keep all areas of the hospital and grounds clean at all times. Written cleaning policies and training for cleaners should be in place, and a supply of appropriate cleaning materials and disinfectants readily available.**

Clean hospital grounds, pathways and entrances reduce the risk of dirt being transmitted to the ward and other patient areas by staff, relatives and other visitors. Stray animals must be kept away from the hospital premises.

Vermin must be kept away from the hospital buildings. Professional advice must be sought as soon as any signs of vermin are found.

Toilets, bathrooms and other facilities needed for personal hygiene and for equipment cleaning are of particular importance, and these areas should always be kept scrupulously clean.

Certain areas, such as operating theatres, as well as certain items of equipment, must always be aseptic (*see* Section 1.5). Ideally there should be a central sterilising service. If this is not possible there should be suitable sterilisers and a supply of appropriate disinfectants at a range of dilutions. Wherever possible the manufacturers' instructions for specific items of equipment should be followed.

Waste disposal system

A powerful incinerator that operates 24 hours a day is essential for the safe disposal of clinical waste. A system for handling and disposal of all clinical and non-clinical waste, including 'sharps', is also needed. Written policies for various types of waste disposal, and appropriate training, should be available to all staff.

Facility and utility maintenance services

Buildings, utilities and equipment

It is essential for these to be maintained to as high a standard as possible. Suitably trained engineers, builders and other maintenance staff are necessary. **There is no point in having expensive medical and surgical equipment if it cannot be maintained or used.** A sufficient number of trained bioengineers are therefore essential. All equipment that is used in the hospital should be robust, compatible if at all possible, suitable for the conditions and level of expertise available, and, when new, should be purchased with accompanying staff training and servicing arrangements.

Porters

For the functional relationships between different departments (e.g. the movement of patients to and from the operating theatres), a well-organised, trained and sympathetic team of porters is essential.

Caterers

Hospital food must be prepared under scrupulously hygienic conditions, and by staff who do not have gastroenteritis or superficial skin infections. Ideally, nutritious food should be provided free of charge. Special diets for malnourished children should be available (*see* Section 5.10.B).

Administrative support

Rather than diverting away the skills of a trained nurse, dedicated reception and other administrative support staff need to be employed to aid facility managers and other non-clinical and clinical staff. There must be a staffed system for storing and processing medical and nursing records. There should be strict rules about who has access to these records, where they are stored and for how many years they are kept.

Human resource issues

Hiring and dismissing staff

There should be transparent procedures for advertising for, interviewing and employing staff. These must include non-discriminatory policies, in particular with regard to gender, age, and ethnic and religious status.

Employment and financial issues

It is essential that the medical and nursing professions in all countries are highly regarded and respected, so it is important that the salaries for doctors and nurses in the national health services reflect this. If not, the staff may have to undertake other jobs during the day, and will not feel valued for their work. A lack of funding for salaries also increases the risk of corrupt practices, with some doctors taking supplies and equipment from their hospital to use in private clinics, thus depriving the poorest and most needy in the community.

Individual job descriptions and responsibilities should be agreed between healthcare professionals, their professional organisations and hospital management.

Arbitrary and compulsory transfer of staff from one place to another, at short notice and without consultation, is damaging both to morale and to the effectiveness of health services, and should be avoided.

There should be systems for ensuring the regular and secure recording of the time spent at work and the appropriate payment arrangements based on the contracted number of hours worked (part- or full-time). On-call emergency work and its payment should also be part of the contract.

There should be a professional registration system for each country, which ensures a basic level of training, as well as a system that validates experience and ability at specific intervals after initial registration.

Concern about individual performance should be addressed by a senior staff member on a one-to-one basis. Written guidelines should be used in a transparent way. Sometimes a period of supervised practice or retraining is appropriate.

Training and continuing staff education (*see also* Section 1.3)

Induction training concerning hospital policies should be mandatory for all staff.

Governments in well-resourced countries could encourage a support system of education for those working in less well-resourced regions.

New teaching techniques, such as skill- and scenario-based teaching (e.g. EMNCH courses) (*see* Section 1.3), should be introduced.

Professional registration requirements for healthcare workers

These will vary from one country to another. However, some form of governmental registration is essential. There should also be procedures governing the employment of expatriate staff in the health service.

Vetting of healthcare workers

All staff who are working with patients, whether they are local or from abroad, should be checked to ensure that they are suitably trained and have not been involved in the abuse of children. This is also important with regard to expatriate staff.

Staff health (*see also* Section 1.17)

There needs to be a system to advise the hospital management about staff health problems that may affect patient care. Staff with health-related problems that are affecting their performance need access to a supportive **occupational healthcare system**. There should be systems in place to protect patients from staff who are ill. This is a difficult but extremely important issue, particularly with regard to illnesses such as TB, HIV and hepatitis. Sometimes other support is necessary so that a healthcare worker's performance can be restored in the interests of all.

Needlestick injury

Although the risk of infection is very small, a policy should be in place to deal with this issue urgently, especially in hospitals where there are many patients with HIV infection and hepatitis.

Needlestick injuries are the commonest type of sharps injury, although other contaminated sharp instruments may also cause injuries. All healthcare workers must be educated about the potential exposure that can occur during their duties, and should have appropriate vaccinations. The risk of hepatitis B, hepatitis C and HIV infection should be assessed and appropriate immunisation or chemoprophylactic steps taken after an incident. Immediate treatment of such injuries should encourage washing thoroughly with

running water and an antiseptic solution. Consult the infection control team for further advice, and follow their basic protocol. An incident-reporting system should be in place. This should not be seen as punitive; active support by managers should encourage prompt and accurate reporting.

Exposure to human immunodeficiency virus (HIV)

The route of transmission of HIV is from person to person via sexual contact, sharing of needles contaminated with HIV, infusions that are contaminated with HIV, or transplantation of organs or tissues that are infected with HIV. The risk of a healthcare worker acquiring HIV after a needlestick or other 'sharps' injury is less than 0.5%. Risk reduction must be undertaken for all bloodborne pathogens, including adherence to standard precautions using personal protective equipment, appropriate safety devices, and a needle disposal system to limit sharps exposure. Training for healthcare workers in safe sharps practice should be ongoing.

Information on preventive measures must be provided to all staff who may potentially be exposed to blood and blood products. Policies that are in line with the local and national guidelines must include screening of patients, disposal of sharps and wastes, use of protective clothing, management of inoculation accidents, and sterilisation and disinfection procedures. Hospital policy must include measures to obtain serological testing of source patients promptly where necessary, usually with the patient's informed consent. Post-exposure prophylaxis should be started as per local or national guidelines.

A suggested strategy for use when a healthcare worker has been potentially exposed to HIV

1 Discuss with the patient (or in the case of a child, the family) what has happened, and ask whether the patient's HIV status is known. If it is not, discuss the possibility of testing, if the injury occurred during normal working hours. Remember that anyone undergoing an HIV test has the right to counselling. If the injury occurred out of hours, or the family decline testing, proceed to Step 3.
2 If the patient has negative HIV ELISA and is over 18 months of age, infection is extremely unlikely. If they are under 18 months of age, a positive ELISA may reflect maternal antibodies. However, any positive test result should lead to Step 3. If the result is negative, the healthcare worker is not at risk of HIV infection. However, further testing of both the child and the healthcare worker for hepatitis B and C may be warranted.
3 Arrange a baseline HIV ELISA for the healthcare worker after appropriate counselling. If the result is positive, they will need to discuss further treatment with their own doctor.
4 If the healthcare worker's baseline serology is negative and the patient is HIV positive, antiretroviral prophylaxis should be started urgently. Current recommendations advise 1 month of treatment. The healthcare worker will need a repeat ELISA after 3 to 6 months to check their status.

Exposure to hepatitis B virus

The route of transmission of hepatitis B virus is through body fluids such as blood, saliva, cerebrospinal fluid, peritoneal, pleural, pericardial and synovial fluid, amniotic fluid, semen, vaginal secretions and any other body fluid containing blood, **and also through blood products**. It is important to follow standard precautions, but immunisation is the best way of preventing transmission to healthcare staff. All healthcare workers who are in contact with patients or body fluids must be vaccinated against hepatitis B.

Staff who are infected with bloodborne pathogens may transmit these infections to patients, and therefore require careful evaluation with regard to their duties. This status should not be used to discriminate against them.

Exposure to hepatitis C virus

The route of infection is mainly parenteral. Sexual transmission does occur, but is far less frequent. No post-exposure therapy is available for hepatitis C, but seroconversion (if any) must be documented. As for hepatitis B viral infection, the source person must be tested for hepatitis C virus infection. For any occupational exposure to bloodborne pathogens, counselling and appropriate clinical and serological follow-up must be provided.

Confidentiality

Systems need to be in place to ensure that patient' records and the personal files of employed staff are kept confidential.

Other services for patients and their relatives

Health information should be available (*see* the Maternal and Child Healthcare Initiative (MCHI) manual).

Toilets should be available for visitors, as well as facilities for those visitors with a disability. If possible, telephones should also be available for visitors.

Ideally there should be written policies concerning the rights and responsibilities of patients, resident parents/carers and visitors. These policies should be prominently displayed around the hospital, and should include issues such as the prevention of smoking, the effects of alcohol, violence (verbal and physical) and weapons in the hospital. Smoking is particularly important in relation to children's health, but in the case of stressed parents it may be inappropriate to ban it altogether. Instead it should be limited to defined areas.

Family-centred care

The role of families in caring for patients alongside and in partnership with professional staff is vital, but must be handled extremely carefully. Families must not be exploited, but equally in resource-limited countries hospital care would not be possible without their assistance. Good understanding of roles and effective communication are of paramount importance (*see also* Section 1.20 and the MCHI manual).

Play, sensory stimulation and support for children's wards

The importance of play and developmental support cannot be overemphasised. A friendly and stimulating environment helps the child to understand and cope with their hospitalisation and to get better far more quickly (as advocated in the World Health Organization recommendations for the recovery management of children with malnutrition). It also helps to support the parents, and can provide them with additional skills that they can continue to use at home once the patient has been discharged. Many mothers cannot

afford to stay at the hospital for long periods because there is strong pressure to return to their village, where they are pivotal to the daily routine, farming, etc. Mothers can be supported by passing on the knowledge of play as taught by a play worker. Giving the sick child access to play and information facilities in hospital also helps to reduce loneliness and fear.

Some well-resourced countries have training programmes and qualifications for play specialists. These are not available in most low-income countries. However, much can be achieved by recruiting suitable people to support therapeutic, informational and recreational play with children in hospital. It is effective, as both an adjunct and core part of treatment, in the hands of a skilled play worker, and any resources can be made of local and low-cost materials.

Play workers need to have good communication and empathy skills with children and families. They also need to have a good understanding of child development and the particular needs of children in hospital (especially children who are alone and/or who have disabilities or other additional needs). In addition, play workers need to be trained in how to deal with some specific situations, such as the comatose child (the fact that these children can hear and have feelings when touched, and how to encourage the parents to talk and play with the child).

Conclusion

The provision, organisation and financing of these services, facilities and functions, and the management of the human resources needed to service them, are as important as those needed to provide the clinical and clinical support services. A sound hospital infrastructure and management are of paramount importance for the provision of good-quality care.

Further information on other work-related issues concerning healthcare staff can be found in Sections 1.17 and 1.20.

1.2 Prevention of hospital-acquired infection

Introduction

Nosocomial or hospital-acquired infection is a major problem not only in terms of cost but also, more importantly, because it increases morbidity and mortality in patients. Such infections may affect up to 10% of all patients. Nosocomial infection requires a source of microorganisms and a chain of transmission. It is essential that all healthcare staff scrutinise their own practice to ensure that they are not part of this chain of transmission.

Please see the *Maternal and Child Healthcare Initiative Manual* for more information on standards of care relating to the prevention of hospital-acquired infection (http://media.wix.com/ugd/dd2ba4_ef4f40edd7a8993a8621a2caea7e4338.pdf).

The combination of use of powerful antibiotics and poor hygiene also predisposes to the development of antibiotic-resistant microorganisms, which are difficult both to eradicate from the environment and to treat.

Pregnant women and girls, as well as children with chronic and debilitating illness, are particularly at risk of infection. However, not all infections are related to their particular disease process, but rather they may be caused by failure of both hospital management and individual healthcare workers to introduce and adhere to strict infection control policies.

Every research study relating to the prevention of infection and cross-infection in hospitals during the last 100 years has emphasised the importance of hygienic conditions **in the entire hospital**.

Requirements and procedures

The following measures are essential in order to minimise the risks of infection and cross-infection.

A clean and adequate water supply

Just as water and sanitation are of central importance in the prevention of cross-infection in emergency refugee camps, they are also of vital importance in hospitals, particularly where there are vulnerable patients. Running water (both hot and cold) is preferable. Hot water should be stored at 65°C, distributed at 60°C, and the temperature then reduced to 43°C to be used from the taps. This process helps to ensure that water-borne infections such as Legionnaire's disease are not passed on to staff or patients.

Accessible sinks in all areas

These should preferably be equipped with elbow-operated taps, and there should be **adequate washing and toilet facilities for staff and patients**.

Effective cleaning policies

The whole of the hospital, including the grounds, should be kept clean. Entrances should screen visitors' shoes for dirt, and corridors need to be cleaned at least twice a day with a disinfectant (see below). **Ward areas, floors, window-sills, light fittings and curtains need to be kept scrupulously clean, but the priority is the adequacy and cleanliness of the toilets and bathrooms.** These should be kept scrupulously hygienic by frequent cleaning and disinfection. **Staff appointed as cleaners should be given adequate status and salaries to reflect the importance of the work they are doing, as well as training in how to keep the hospital clean and why this is so important.**

Effective services for disposal of human and other waste

Human and other waste should be disposed of and collected separately. Foot-operated bins are preferable, and frequent rubbish collections are essential. Ideally the hospital should have its own incinerator.

Laundry service

All bedding, towels, flannels and curtains must be regularly washed with a detergent and disinfectant. Industrial washing machines are essential.

Strict hand-washing policies

Viruses and bacteria can survive on the hands for 2 to 3 hours. **Correct hand-washing technique for all staff, visitors and patients is the most important factor in the prevention of cross-infection.** It is easily taught, and frequently an improvement in practice is demonstrated in the short term. However, when examined over a longer period of time, old habits and short cuts reappear.

Good hand-washing techniques are dependent on adequate supplies of clean water, ideally elbow-operated taps, a liquid soap supply and an effective method of hand drying (*see* Figure 1.2.1). Where it is impossible to provide liquid soap and paper towels, some ingenious solutions have been attempted. Bar soap suspended in a net bag over the sink area and individual cloth towels for each patient, changed every 24 hours or at the discharge of the patient and kept within their bed space, can be effective. Added emollient protects the hands from chafing. Antiseptics can be added to liquid soap to improve antimicrobial activity, and chlorhexidine is a cheap and effective antiseptic that is widely available throughout the world. However, there is no good evidence that this increases the effectiveness of hand washing substantially. Antiseptics should be used before invasive procedures and where there is heavy soiling with potentially contaminated body fluids or other human waste. Povidone iodine should be reserved for use as a surgical scrub.

When running water is not available or hand washing is difficult, a 70% alcohol gel is useful. This is a new but fairly expensive product that has a significant part to play in the prevention of introduction of cross-infection in high-risk areas. When rubbed on and allowed to dry, it is effective in disinfecting the hands. After initial conventional hand washing it can be used between each patient contact, but further hand washing is still recommended after every five to six rubs.

All of the above-mentioned items may be regarded as a considerable extra cost for a health service, but are cost saving when balanced against an increased length of hospital stay due to infection, the additional medications required and sometimes unnecessary deaths caused.

All staff should have a personal responsibility for hygiene, but every ward should also identify an individual (ideally a nurse with the support of a microbiologist, if available) to be responsible for the education of all staff in techniques that will prevent the spread of infection, particularly effective hand washing and drying. This education programme will need to be ongoing, as even in the best centres these programmes are only effective for relatively short periods of time. The organisation needs to support the identified staff member in reinforcing that all grades and members of staff have responsibility for their practice (especially doctors, who should act as role models). In addition, it needs to become the norm for this identified staff member, no matter how junior they are, to be recognised as the expert in their unit, and anyone who is asked to carry out hand washing must immediately and unquestioningly comply with this request.

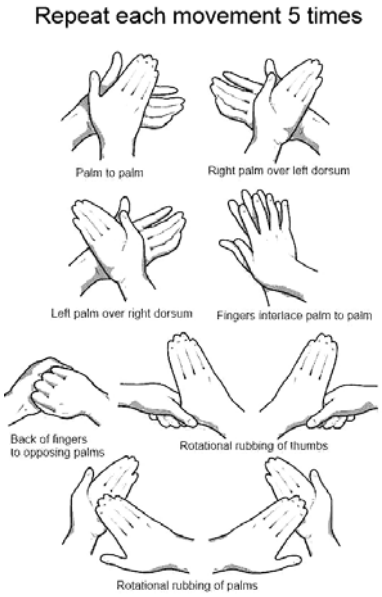


FIGURE 1.2.1 Effective hand washing.

Disposal of body fluids

Each ward or unit must have an area set aside for this purpose. It and all the equipment that it contains must be kept scrupulously clean and body fluids disposed of quickly, with any spillage removed immediately. If there is likely to be a risk of body fluids being contaminated with life-threatening organisms, additional precautions should be taken. After hand washing, disposable clean gloves should be used by all staff and family members who will be assisting with the toileting of patients. Care must be taken with sharp objects such as hypodermic needles, in order to protect the patient, their family, other unit visitors and staff. An empathetic approach is necessary to ensure that the patient and their family do not feel stigmatised and undeserving of normal care and attention.

Cleaning, disinfection and sterilisation of equipment and furniture

The manufacturer's instructions for individual items of equipment must always be followed. These will usually clearly state which items need to be sterilised and where disinfection will be sufficient. They will also indicate appropriate dilutions for disinfectants. All equipment should be cleaned before being sterilised or disinfected.

Sterilisation

This is the complete elimination and destruction of all forms of microbial life. This is frequently achieved by steam under pressure, dry heat, gas or liquid chemicals. Such a sterilisation system must be available in every ward where invasive procedures are undertaken, and such systems are also required for instruments and towels used in the operating theatre.

Disinfection

This is a process that eliminates the majority of microorganisms, with the exception of the most resistant endospores. It is usually accomplished using liquid chemicals called disinfectants. Hypochlorites are inexpensive and effective disinfectants. They are active against most microorganisms, including HIV and hepatitis B. However, they do have a corrosive effect on metals, and if used on fabric or carpet can bleach out colours. Hypochlorites in a diluted form (usually 0.1% solution) for domestic use are contained in household cleaners available worldwide. These household cleaners can be used in the hospital environment for general cleaning, but stronger solutions (0.5% chlorine solution) must also be available, particularly for the disposal of body fluids, for initial cleaning of bloodstained instruments, and following outbreaks of notifiable infections. A 0.5–1% solution is recommended for the treatment of blood and body fluid spills, and 0.05–0.1% solution can be used for all surfaces. Hypochlorites are available as tablets, which makes the process of dilution easier.

How to prepare high-level disinfectant solutions

The best compound for the preparation of chlorine solutions for disinfection is household bleach (also known by other names such as Chlorox® and Eau de Javel). Household bleach is a solution of sodium hypochlorite which generally contains 5% (50 g/litre or 50 000 ppm) available chlorine.

Thick bleach solutions should never be used for disinfection purposes (other than in toilet bowls), as they contain potentially poisonous additives.

When preparing chlorine solutions for use, the following points should be noted:

- Chlorine solutions gradually lose strength, and freshly diluted solutions must therefore be prepared daily.
- Clear water should be used, because organic matter destroys chlorine.
- A 1:10 bleach solution (0.5%) is caustic. Avoid direct contact with the skin and eyes.
- Bleach solutions give off chlorine gas, so must be prepared in a well-ventilated area.
- Use plastic containers for mixing and storing bleach solutions, as metal containers are corroded rapidly and also affect the bleach.

Two different dilutions of bleach are used for disinfection.

1:10 bleach solution (containing 0.5% chlorine)

This is a strong disinfectant, which is used to disinfect the following:

- excreta
- bodies
- spills of blood or body fluids
- medical equipment (e.g. delivery sets, kidney dishes, suture instruments, catheters, speculum).

To prepare a 1:10 bleach solution, add one volume (e.g. 1 litre) of household bleach to nine volumes (e.g. 9 litres) of clean water.

Always wear gloves. Immediately after delivery or examination, clean the instruments below the level of solution in the plastic bucket using a brush. Leave for 10 minutes and then place them in soapy water, wash with a brush, and flush every catheter with a 10–20 mL syringe. Next rinse with clean water and air dry, and then sterilise or boil for 20–30 minutes. Store dry in a metal bowl.

Change the solution after 24 hours or when it becomes bloodstained.

Label buckets with tape indicating the date and time when the solution was prepared and when it needs to be changed.

0.5% solution is also used to prepare 1:100 bleach solution.

1:100 bleach solution (containing 0.05% chlorine)

This is used for the following:

- disinfecting surfaces
- disinfecting bedding
- disinfecting reusable protective clothing before it is laundered
- rinsing gloves between contact with different patients (if new gloves are not available)
- rinsing gloves, aprons and boots before leaving a patient's room
- disinfecting contaminated waste before disposal.

To prepare 1:100 bleach solution, add one volume (e.g. 1 litre) of 1:10 bleach solution to nine volumes (e.g. 9 litres) of clean water.

Note that 1:100 bleach solution can also be prepared directly from household bleach by adding 1 volume of household bleach to 99 volumes of clean water (e.g. 100 mL of bleach to 9.9 litres of clean water), but making it up from 1:10 bleach solution is easier.

Cleaning

This is often the most neglected of the three processes, and it must precede sterilisation and disinfection. When undertaken using a disinfectant detergent, cleaning alone will effectively reduce the number of microorganisms and make safe those items that come into contact with the intact skin (e.g. blood pressure cuffs, bed rails, intravenous poles).

Isolation of patients with specific infections

For isolation procedures to be effective they need to be instituted early. Two or more patients with the same infection can be isolated together. Different isolation techniques will be needed, and the use of gowns, gloves and masks will be necessary if the infection is very contagious and/or very serious. In some cases, nursing the patient in a cubicle or single room until medical tests are complete is all that is necessary. When there is a need for gowns, gloves and masks, these will require frequent changing or washing to ensure their efficacy, and must be used by everyone who comes into contact with the patient, including medical staff and carers. Ideally, they should be used only once and then removed and discarded or sent for laundering on leaving the isolation area. An area will need to be set aside for changing, with supplies of gowns, gloves, aprons and masks. Gowns made of cotton material will need to be worn with plastic aprons. Children's compliance with isolation techniques will improve if the element of fear is removed. This can be achieved by all medical staff allowing the child to see their face (through a window) before donning a mask. It is also essential that when children are in hospital, infection control policies do not interfere with the child's contacts with their parents.

Infection control measures following the death of a patient

When a patient dies, the amount of time that the parents

and other family members are able to spend with them will vary according to the facilities that are available. Rituals and beliefs concerning the death of an individual, and the management of the body, usually involve religious or cultural observance. There are many beliefs surrounding the distinction between physical and spiritual life, in particular the belief that something of the individual survives death, either to be reborn through reincarnation or to fulfil their spiritual destiny in the afterlife. It is important that the correct funerary procedures, if any, are followed in order to ensure that the bereaved are not distressed by any omission which they consider important.

All societies, whether religious or not, have to deal with the problem of the death of their patients and the bereavement of parents and other close family members. Like other transitions in an individual's life, death is usually marked by a rite of passage in which central values are restated and important social bonds re-emphasised. Precise customs vary in different religions and traditions, but common features include the washing and laying out of the corpse (which may be embalmed), and the wake, or watching over the dead body. These customs may need to be modified to prevent the spread of infection to other members of the community, or because of the need to perform post-mortem examinations to establish an exact cause of death. Effective hand-washing procedures remain of paramount importance.

In countries where the climate is characterised by extremes of temperature, refrigeration of dead bodies until they can be returned to the family is essential. Each hospital should have a mortuary building adjacent to, but separate from, the hospital. To prevent the spread of infection, staff working in the mortuary will need to be provided with separate clothing for use in that department. The use of two pairs of gloves, or thick rubber gloves and protective clothing, will be necessary for the post-mortem examination if there is suspected infection of the body with life-threatening bacteria or viruses.

The mortuary department will need to have facilities for families to see and spend time with their dead relative, and a separate comfortable area where documentation can be completed and any necessary interviews with local government officials can be conducted. The mortuary department not only provides facilities for post-mortem examination, but also, in large centres, it can be part of the government facilities for forensic post-mortems, which may provide additional resources for the hospital. Having these centres within a hospital may improve services for families, but care needs to be taken that there is a culture of openness that involves families in the consent procedures for all examinations performed after the patient's death.

Conclusion

Each member of the hospital has a role to play in the prevention of hospital-acquired infections. The greatest responsibility lies with the healthcare professionals, particularly nurses and doctors, who in the hospital setting are in contact with patients and their families 24 hours a day, and because of this are the main perpetrators of cross-infection. However, they can also demonstrate good practice by, for example, being the catalysts for change, and improving the education of other hospital staff and families.

Further reading

Alvarado CJ (1999) Sterilization vs disinfection vs clean. *Nursing Clinics of North America*, **34**, 483–91.

Purssell E (1996) Preventing nosocomial infection in paediatric wards. *Journal of Advanced Nursing*, **5**, 313–18.

Wilson J (1995) *Infection Control in Clinical Practice*. London: Bailliere Tindall.

Yost AJ and Serkey JM (1999) Rule-makers who establish infection control standards. *Nursing Clinics of North America*, **34**, 527–53.

World Health Organization (2002) *Prevention of Hospital-Acquired Infections: a practical guide*, 2nd edition. www.who.int/csr/resources/publications/whocdscsreph200212.pdf

World Health Organization (2009) *WHO Guidelines on Hand Hygiene in Health Care. First global patient safety challenge: clean care is safer care.* http://whqlibdoc.who.int/publications/2009/9789241597906_eng.pdf

World Health Organization (2010) *Guide to Local Production: WHO-recommended Handrub Formulations*. www.who.int/gpsc/5may/Guide_to_Local_Production.pdf

1.3 Continuing medical education for healthcare professionals

Continuing medical education takes many forms, including the following:

- on-the-wards training
- short courses on the management of emergencies
- use of a readily available pocketbook
- the availability of a postgraduate education centre with library and Internet facilities
- departmental meetings
- online websites and organisations
- local (Ministry of Health) guidelines and publications
- courses and conferences
- Internet-based membership organisations (e.g. HIFA 2015 and CHILD 2015).

Every healthcare professional needs to engage in continuing medical education in order to keep up with the pace of change. They may be a long way away from a university. They may have no library within reach. They may not be sent any journals to read. They may not be able to go away for further education. In resource-limited countries they may not be able to afford a computer or Internet access, or to print out the myriad of teaching materials available on the web.

On-the-wards training

This is probably the most effective way of keeping front-line staff up to date, especially with regard to the management of emergencies such as eclampsia or the newborn infant who does not breathe at birth. For these mini-teaching sessions, as little as 1 to 2 hours a week can be very effective, and ideally a senior staff member who has been trained in medical education (e.g. through the Generic Instructor Course of the Advanced Life Support Group, ALSG) should lead. Manikins (e.g. of the newborn infant), in which the lungs expand only when the airway is positioned correctly and the face mask is properly applied, can be helpful. It can also be useful to include refreshments and to make the teaching sessions friendly and socially supportive so that staff look forward to them and are keen to participate and learn.

Short courses on the management of emergencies

The ALSG in collaboration with Maternal and Childhealth Advocacy International (MCAI) has designed and made available for low-income countries 3- to 5-day courses in the emergency management of obstetric, neonatal and paediatric emergencies (see www.alsg.org and www.mcai.org.uk). These courses, which are certified, consist of a combination of lectures, workshops, skill stations and clinical scenarios, undertaken by volunteer instructors who have been through a Generic Instructor Course (GIC) on medical education, and who are skilled in the clinical components of the course.

Pocketbook

A pocketbook that is available at all times is one of the best ways of accessing up-to-date evidence-based information, and is particularly valuable for the management of emergencies when there is no time to go and look for a textbook.

The new edition of the WHO *Pocket Book of Hospital Care for Children* (www.who.int/maternal_child_adolescent/documents/child_hospital_care/en/index.html) is a valuable adjunct to the ward care of sick children in low-resource situations. A useful supplement to this pocketbook is the 2012 WHO publication 'Recommendations for management of common childhood conditions: Newborn conditions, dysentery, pneumonia, oxygen use and delivery, common causes of fever, severe acute malnutrition and supportive care' (http://whqlibdoc.who.int/publications/2012/9789241502825_eng.pdf).

Postgraduate education centre with library and Internet facilities

A postgraduate medical education centre that can be accessed by all healthcare staff is a good way of providing continuing medical education support. This education centre could, at the very minimum, consist of a reasonably sized, comfortable room containing a library and if possible at least one computer. This could function as the area where regular departmental meetings are held. All non-governmental organisations (NGOs) are concerned with sustainable development, and most of them regard education as a priority that requires major investment. If you are unable to obtain funding from your health service, cultivate a relationship with an NGO or similar organisation, and try to gain investment from them or other sources.

- The library should contain the basic textbooks, in editions that are as up to date as possible.
- If possible, subscriptions for the major obstetric and paediatric journals should be obtained or accessed online.
- It may be that none of the standard textbooks are published in your language. English is the major international scientific language, so it seems reasonable to focus on English language texts.
- If your centre has an electricity supply, if you are able to obtain a computer with CD-ROM, and if it is possible to install a telephone line or mobile Internet sticks are available, this will allow you to communicate by email with specialists in other countries, and to access the Internet in order to obtain up-to-date information on diseases and their treatment. The organisation Teaching-aids At Low Cost (TALC) (www.talcuk.org) is useful in this regard. Computers are now being designed solely for Internet use, and these are less expensive than the standard personal computer (PC). This investment, for the price of perhaps six good books, can make available a vast amount of up-to-date information. In most countries a subscription is required for access to the Internet, and there will be telephone line usage charges, for which funding will be needed. Again, English is likely to be the language of choice for your global communication.
- Security may be a problem. The postgraduate education centre will need to be designed with this in mind, so that books and computers are not stolen.

Departmental meetings

Many departments will need to hold regular meetings. Cases can be presented and discussed, and a journal club can be organised. Morbidity and mortality audit meetings are very useful for identifying areas where practice can be improved by the team. However, it is very important that this kind of meeting is supportive, non-judgemental, and does not to assign blame. It is a good idea for each department to hold one of their weekly meetings in English.

Online websites and organisations

The Internet has many millions of pages. A number of websites are listed below, which will give you an introduction to online obstetric and paediatric information.

- **World Health Organization (www.who.int).** It is important to remember the WHO when working in low-resource settings. It is tempting to compare standards of care with those in the UK and other well-resourced countries. However, the WHO has produced numerous publications and guidelines on minimum standards of care and is a very valid resource.
- UNICEF: www.unicef.org
- UNFPA: www.unfpa.org

UNICEF and UNFPA, like the WHO, can be an invaluable resource.

- Paediatric Information Education Resource (PIER): http://pediatriceducation.org
- International Paediatric Association (IPA): www.ipa-world.org
- Hong Kong College of Paediatrics: www.paediatrician.org.hk
- American Academy of Pediatrics: www.aap.org/en-us/Pages/Default.aspx
- Canadian Paediatric Society: www.cps.ca/en
- Regional and General Paediatric Society (RGPS), Royal

Australasian College of Physicians: www.racp.edu.au/page/educational-and-professional-development
- British Paediatric Surveillance Unit: www.rcpch.ac.uk/what-we-do/bpsu/british-paediatric-surveillance-unit
- *Archives of Disease of Childhood* (journal): http://adc.bmj.com
- *Developmental Medicine and Child Neurology* (journal): www.cambridge.org
- *Ambulatory Child Health* (journal): http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1467-0658
- *Pediatrics* (journal): http://pediatrics.aappublications.org
- European Society for Paediatric Research: www.espr.info
- Neonatal and Paediatric Pharmacists Group (NPPG): www.networks.nhs.uk/nhs-networks/nppg-neonatal-and-paediatric-pharmacists-group
- Institute of Child Health of London: www.ich.ucl.ac.uk
- *British Medical Journal* (journal): www.bmj.com
- Systematic Review Training Unit: www.ucl.ac.uk/ich/homepage
- OMIM (genetics syndromes): www.ncbi.nlm.nih.gov/omim
- Bibliography of online texts: www.drsref.com.au/books.html
- Children's Hospital of Philadelphia: www.chop.edu
- Paediatric X-rays: http://radiologyeducations.com
- American Academy of Pediatrics: www.aap.org
- Facts for families: www.aacap.org/info_families/index.htm
- British Society of Paediatric Endocrinology: www.bsped.org.uk
- International Society for Paediatric and Adolescent Diabetes: www.ispad.org
- Johns Hopkins Program for International Education in Gynecology and Obstetrics (Jhpiego): www.jhpiego.org
- Videos on maternal and child healthcare for low-resource settings: www.glowm.com
- http://globalhealthmedia.org
- http://www.healthynewbornnetwork.org/multimedia/video/born-too-soon-kangaroo
- http://medicalaidfilms.org

Local (Ministry of Health) guidelines and publications

Some countries are beginning to develop professional bodies (e.g. paediatric societies, obstetric societies, groups for nurses and midwives). Some of these professional bodies are developing guidelines and have access to resources which will be useful.

In addition, some Ministries of Health are working with organisations such as the WHO, UNICEF, the Johns Hopkins Program for International Education in Gynecology and Obstetrics (Jhpiego) and Save the Children to develop programmes and guidelines to improve local healthcare. It is important for those working in low-resource countries to be aware of the activities of the relevant government.

Courses and conferences

These will differ from one country to another, and will be linked with the Ministry of Health and professional bodies.

Web-based membership organisations: HIFA 2015 and CHILD 2015

- HIFA 2015: www.hifa2015.org and https://dgroups.org/groups/child2015/
- CHILD 2015: www.hifa2015.org/child2015-forum

The goal of these organisations is that, by 2015, every person worldwide will have access to an informed healthcare provider.

HIFA 2015 is a campaign and knowledge network with more than 5000 members representing 2000 organisations in 167 countries worldwide. Members include healthcare workers, publishers, librarians, information technologists, researchers, social scientists, journalists, policy makers and others – all working together towards the HIFA 2015 goal.

HIFA 2015 contributes to the broader goal of the Global Health Workforce Alliance: 'All people everywhere will have access to a skilled, motivated and supported healthcare worker, within a robust health system.'

Members interact via two email discussion forums: HIFA2015 and CHILD2015. Together these organisations are building the HIFA2015 Knowledge Base, a picture of information needs and how to meet them. Membership is free and open to all.

1.4 Essential imaging facilities

Introduction

Despite the fact that the use of ionising radiation ('X-rays') for diagnostic purposes was discovered more than 100 years ago, up to two-thirds of the world's population still have no access to primary care diagnostic imaging services. Some rural clinics may be located in remote impoverished areas such that imaging equipment is impossible for the population to access. However, clinics in larger towns, and certainly **every institution that merits the title of 'hospital' should have, at the very least, simple radiographic and ultrasound equipment available**. This will necessitate the training of healthcare workers to use the equipment appropriately and safely. Local healthcare workers will also interpret most of the examinations performed, and therefore need training in radiographic interpretation. Many African countries, for example, do not have a single radiologist. As most radiographic equipment is now digital, in the absence of a specialist opinion, teleradiology services are an option in

a few areas. Various teleradiology solutions exist in different regions and are expanding, but they are not widespread. For the under-resourced setting, charitable specialist opinions would need, of necessity, to be provided free of charge.

A basic service

In the context of severely limited resources, health planners have to be selective in their choice of imaging technology. Some radiographic equipment can be so expensive that its purchase might be to the detriment of other important components of a basic health service. The radiographic equipment should nevertheless reflect the standard of care in each clinic or hospital. Albeit suboptimal, very basic orthopaedics can be carried out utilising plain radiographs alone. Proper fracture reduction necessitates that a C-arm fluoroscopy unit should ideally be available. A CT scanner should be on site at a regional centre where there are surgeons available with basic neurosurgical skills (e.g. capable of making burr holes for extradural haematoma evacuation).

- The majority of radiographic studies in hospitals everywhere are plain radiographic examinations. In a small rural or suburban hospital, plain radiography will account for approximately 90% of all the necessary examinations and, where available, ultrasound will meet the needs of much of the remaining 10%.
- Good diagnostic imaging frequently leads to less hospitalisation, allows for quicker and more accurate diagnosis, and results in less suffering and pain. The WHO recommends that even small hospitals and clinics with only one doctor should have imaging equipment.
- Access to most of the equipment described below should be available to all sick and injured children.

Diagnostic radiographic equipment

- Radiographic equipment that is easy to operate and maintain, such as the World Health Imaging System for Radiography (WHIS-RAD). This is based on much practical experience, and is ideally suited to radiology departments in disadvantaged countries.
- WHIS-RAD was fully specified in 1995. A WHIS-RAD unit is easily applicable to children and small infants, is relatively inexpensive, is safe for patients and operators, and produces high-quality images.
- In recent years the cost of obtaining and processing X-ray film has become problematic, particularly in developing countries. Fortunately, WHIS-RAD is now available in digital format or retrofit. The use of computed radiography (CR) with reasonably priced liquid crystal display (LCD) monitors allows for easy data storage, archiving and retrieval, as well as the potential for utilising teleradiology resources.
- A CR plate has the added advantage of a large dynamic range such that repeat X-rays are seldom necessary.
- Radiation doses from a WHIS-RAD unit are typically lower than those from many conventional radiographic machines, which is particularly appealing where standards of radiation protection, the use of cones, lead protection and dosimetry may be variable and often non-existent.
- The X-ray generator specified for WHIS-RAD may be used with almost any power supply, however variable. WHIS-RAD batteries can operate for up to 3 weeks before they need to be recharged.
- Patients can be examined in a standing, sitting or recumbent position.
- The WHO has produced a range of radiology manuals for the developing world setting. The *WHO Manual of Diagnostic Imaging: Radiographic Techniques and Projections* provides a very clear explanation of how to use the equipment, even for those with no formal training in radiography. Operators can be trained in a matter of months. This and other useful information is available from the Diagnostic Imaging for Clinics and Small Hospitals website (www.dicsh.info).
- The proposed publication of the *WHO Manual of Diagnostic Imaging: Paediatric Examinations* has unfortunately been severely delayed.
- Donations of old but functional radiographic equipment by well-resourced countries, although laudable, are often worthless. Bulky outdated equipment often cannot be installed, operated or maintained locally. The service manuals are often missing, obtaining spare parts is a major problem, and many of these machines break down irreparably.
- Portable X-ray equipment typically requires reliable power sources and expert radiography, such that its use is only practicable in larger centres.

A comprehensive list of the indications for diagnostic radiography is too long to include here. Suffice it to say that all children with a serious pneumonia, suspected tuberculosis or fractured limbs, to name a few examples, merit radiography. In practice, chest and skeletal examinations are the most frequent indications for diagnostic imaging worldwide. Where resources are less stretched, radiographic machines with slit-beam technology could be considered. These units, such as the LODOX Statscan, are also fully digital, have sufficiently low radiation doses to permit their use within a ward without special protective barriers, and offer flexibility for those with little radiographic positioning skill. In addition, they provide rudimentary CT information which is useful for head trauma patients, at a fraction of the price of CT scanners.

Diagnostic ultrasound scanning equipment

The wide range of applications of ultrasound in children and pregnant women, its versatility and its safety probably make it better suited to disadvantaged countries than any other imaging modality. Sonography is harmless – it does not generate ionising radiation, and is thus particularly suitable for imaging children, adolescent girls in particular, and pregnant women.

- Ultrasound machines are simple to operate, but the images are also easy to misinterpret. It is therefore critically important that the person performing and interpreting an ultrasound study is suitably trained and competent. **Sonography must be taught on a supervised practical basis in a local environment.** The WHO recommends a 6-month minimum training period for diagnostic sonography.
- Initiatives such as that by Imaging the World (http://imagingtheworld.org) allow for alternative basic sonographic training to be shortened to as little as a few days. Reliance instead is placed on transmission of images over the Internet to a secure server, from which the images can be accessed and read anywhere in the world.

The WHO recommends minimum specifications for a general-purpose ultrasound scanner.

- The scanner should be able to operate from the local electrical power supply.
- Servicing should be available locally.
- It must be possible to store the unit safely under adverse conditions.
- When scanning children, at least two different MHz transducers (sector and linear array) are desirable.
- Doppler techniques are included on all modern ultrasound equipment, such that exclusion of a deep venous thrombosis, for example, should be possible.
- Some form of archived permanent hard-copy record is recommended for patient follow-up, and in the interests of teaching and training in general.

Additional points

- Mobile ultrasound scanners can be operated at the bedside or in the Emergency Department.
- Abdominal and pelvic ultrasound has a well-established role in the assessment of adolescent gynaecological conditions and paediatric emergencies.
- Sonography plays a major role in the management of pregnancy, from dating the age of the fetus to identifying multiple pregnancies, ascertaining the position of the placenta and generally identifying potential problems, thus allowing the clinician to plan safe delivery.
- Sonography can quite simply resolve mass lesions from organomegaly.
- It is noteworthy that hydronephrosis is the commonest abdominal mass in the neonate and infant, and this is easily diagnosed with ultrasound scanning.
- Evaluation and drainage of pleural effusions or ascites is relatively straightforward, particularly with ultrasound guidance.
- Ultrasound scanning can be a useful tool for guiding other interventions, such as drainage of larger abscesses or an image-guided biopsy of a solid mass.
- Alternatively, evaluation of solid mass lesions and cysts should at least be possible, to aid patient referral to larger regional centres.
- Sonography of the infant brain is easily performed at the bedside, and can provide useful information in the infant who is febrile, unconscious or has seizures.
- In trauma patients, abdominal ultrasound scanning can prevent unnecessary surgery.
- Finally, ultrasound studies frequently reduce the need for plain abdominal radiographs and yield more diagnostic information.

1.5 Essential operating-theatre resources

Design of the operating theatre (OT)

- Ideally it should be located next to the labour ward.
- It should be of adequate size (minimum 7 m × 7 m) for the placement of essential equipment and the unobstructed movement of staff.
- It should not be used for storing purposes, for which a separate side room should be available which can also be used for hand washing.

Essential equipment

- Ordinary OT table with a facility for the lithotomy position and lowering and raising the height of the table, preferably mechanically operated.
- A good focusing OT light is very important.
- A simple anaesthetic machine suitable for the resources available in the country (e.g. Diamedica-Glostavent, for resource-limited countries), with an uninterrupted oxygen and nitrous oxide supply, is the most essential item of equipment for the anaesthetist. Reserve cylinders for both oxygen and nitrous oxide should always be available. If nitrous oxide is not available, the patient can be maintained on ether or halothane, but the level of anaesthesia has to be deep, requiring more intensive post-operative monitoring.
- The suction machine (which should have both electrical and manual functions, in case of electrical failure) should be periodically emptied and cleaned with antiseptic solution after every individual patient. It must be constantly checked.
- A fumigation machine is essential for the sterilisation of the OT.
- Anaesthetic equipment and supplies (*see* Section 1.22 for a list of essentials).
- All emergency drugs (e.g. lignocaine, adrenaline, atropine, sodium bicarbonate, 25% dextrose, morphine, etc.), with syringes, should be readily available in the OT (*see* Section 1.22).
- A boiler is essential for sterilisation if an autoclaving facility is not available. A heater of some kind is also essential for warming up crystalloid infusions to be used during surgery to prevent hypothermia.
- Monitoring equipment (*see* Section 1.22 for a list of essentials).
- Room heaters are essential, especially for surgery on infants. The OT temperature should be in the range 28–32°C to prevent hypothermia in babies. Hot-water bottles can provide heat for infants and are inexpensive, but it is essential to be vigilant about safety. Radiant warmers, incubators and electric blankets are helpful if they are available. Equally, air conditioning is also required in hot countries to ensure appropriate working temperatures for patient and OT staff.
- A cautery machine is useful for reducing blood loss

during surgery. An ordinary unipolar cautery will suffice for most procedures. A probe that has been heated with a Bunsen burner until it is red hot can provide thermocoagulation on touching the bleeding sites. This is a low-cost and effective method when a cautery machine is not available.

- Adequate supply of linen, towels, gowns and gloves.
- The minimum instruments required for minor surgery are as follows:

Artery forceps:	
Mosquito	6
Kelly's	6
Towel clips:	
Bulldog	6
Scissors:	
Metzenbaum	1
Mayo's	1
Thumb forceps:	
Tooth	1
Non-tooth	1
Intestinal clamps:	
Non-crushing	2 (4)
Martin artery forceps	2
Right-angled forceps	1
Needle holders (paediatric) which can hold 3.5 to 5.0 sutures	2
Retractors:	
Right-angled	2
Zerneys	2
Devers	2
Malleable	2
Suction tip	1
Eye goggles for protection of staff from splashing	3

  Durbin (formally ECHO) (www.durbin.co.uk) provides complete instrument kits, which are particularly relevant for Caesarean section and laparotomy.
- A whiteboard and pens with which to document the use of swabs and needles, aiming to ensure that none are left in the patient when surgery ends.

Operating-theatre staff

Apart from the surgeon, an adequately trained doctor or nurse anaesthetist is essential.

- **Nursing staff** should be adequately trained in the care and handling of instruments and equipment in the OT. They should be made responsible for the proper functioning of all equipment, and trained in the sterilisation of the OT and the instruments used.
- **OT assistants** are important for transporting patients to and from the ward. They should be aware of the function of the equipment in the OT. They should also be counselled about the hazards of contact with blood and other patient body fluids, and especially made aware of the risks of infection with HIV and hepatitis B and C.
- **OT cleaners** should also be aware of the threat of these communicable diseases. It is essential to clean the OT between one case and the next to prevent nosocomial infections.

Practices and procedures to reduce the risk of infection in the OT

- The floors, walls, table and all equipment in the OT should be cleaned and disinfected at least once a day, and also after every case involving infection.
- Autoclaving is the standard method of sterilisation, but if it is not available, boiling for 1 hour should be used instead.
- Spirit flaming of all the instruments (whereby the instruments are placed in a kidney tray, spirit is poured into the tray and a matchstick is used to flame it) can be undertaken where minimal equipment is available.
- There must be restricted entry to the OT, and this should only be permitted after a complete change of clean clothes (except for underwear) and shoes, and with the wearing of a proper clean head covering and mask (these items should be used once only before discarding or washing). Hand and forearm washing for at least 5 minutes before gowning and gloving up, using an antiseptic soap solution, will reduce the incidence of infection.
- The OT should be situated in the most inaccessible part of the hospital so that there is minimum encroachment by the general hospital patients.
- Ideally there should be an air-purifying/air-conditioning system in the OT.
- All tubing (suction, oxygen, anaesthetic) should be regularly cleaned and disinfected according to the individual manufacturer's instructions, in order to reduce the risk of nosocomial infection.
- Proper waste disposal bins for clinical and non-clinical waste from the OT are essential.

Set-up of the recovery room

- The recovery room should be adjacent to the OT so that the surgeon and the anaesthetist have immediate access to the patient.
- Nursing care, oxygen, suction and emergency medicines should be available, as should resuscitation and monitoring equipment (*see* Sections 1.12 and 1.13).
- **An adequately trained doctor or nurse anaesthetist, who is proficient in resuscitative measures and critical care management, should be present whenever patients are in the recovery room.** Frequent evaluation and monitoring of surgical patients should be undertaken during the first 24 hours following a major operation. This should include observations/measurements of hydration, urine output, output from drains, soakage from the wound, pulse, respiratory rate and blood pressure. Post-operative pain management is most important, and a relatively 'pain-free' patient has a better outcome (*see* Section 1.15).

Further reading

Integrated Management for Emergency and Essential Surgical Care (IMEESC) toolkit: www.who.int/surgery/publications/imeesc/en/index.html

World Federation of Societies of Anaesthesiologists (WFSA) *Guide to Infrastructure, Supplies and Anesthesia Standards at Three Levels of Health Care Facility Infrastructure and Supplies*: www.ncbi.nlm.nih.gov/pmc/articles/PMC2957572/table/Tab1

Lifebox: www.lifebox.org

1.6 Drug and fluid administration

Enteral fluids

- The best method of maintaining caloric intake is through enteral feeding.
- If the patient is unable to drink then pass a gastric tube (*see* Section 8.5).

When commencing feed by naso- or orogastric tube:

1. Fill the syringe to the required amount with feed.
2. Draw the plunger back as far as possible.
3. Attach the syringe to the tube.
4. Kink the tube and remove the plunger.
5. Allow feed to pass into the stomach using gravity.
6. Observe the patient's colour and respiratory rate for any signs of aspiration.

- Breast milk is the best food for infants. It is always available at the correct temperature, no preparation is required, and no sterilising equipment is involved. If the infant is too ill to suck and is fed through a gastric tube, encourage the mother to express milk into a sterile receptacle.
  1. To encourage the release of milk and ease of expression, it may help if the mother expresses milk while holding the baby.
  2. Store excess milk in a in a refrigerator (<5°C) for up to 5 days or freezer (minus 20°C) for up to 6 months.
  3. Defrost the quantity needed for 4 hours of feeding at a time.
- Oral rehydration solutions are used in gastroenteritis to maintain electrolyte balance. Prepare by **adding 1 sachet to 210 mL (7 oz) of clean water**. (One ounce = 30 mL.)

Intravenous fluids

Intravenous (IV) fluids must only be used when essential and enteral feeds are not available or not absorbed. Always check the container before use, to ensure that the seal is not broken, the expiry date has not been passed, and the solution is clear and free of visible particles.

Choice of crystalloid fluid

Dextrose/gluose-only fluids

It is clear that although glucose or dextrose is necessary to prevent or manage hypoglycaemia, fluids containing only dextrose which are hypotonic should never be used for IV fluid replacement or maintenance, or for the emergency management of shock.

This is because the dextrose is rapidly metabolised, so the effect of a dextrose-only IV fluid on the child's body in shock may produce hyponatraemia, which could lead to brain damage or death. In addition, this solution is rapidly moved out of the circulation and into the cells, and the state of shock will not be resolved.

Sodium-containing fluids

The fluid traditionally infused into the circulation for the management of shock has been normal saline (0.9% NaCl). 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 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 which are safer because 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 solution as soon as possible. Not all hospitals will have access to these solutions immediately, so 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, one of the safer alternatives should be used in very sick children if at all possible.

Putting dextrose into Ringer-lactate or Hartmann's solution

A crystalloid containing approximately 5% dextrose can be obtained by adding 50 mL of 50% dextrose to a 500-mL bag of Ringer-lactate or Hartmann's solution.

A crystalloid containing approximately 10% dextrose can be obtained by adding 100 mL of 50% dextrose to a 500-mL bag of Ringer-lactate or Hartmann's solution.

(It will therefore be necessary to remove 50–100 mL of fluid from the 500-mL bag first.)

Ensure that the above process is performed with a

TABLE 1.6.1 Comparison of electrolytes, osmolality and pH levels in IV fluids with those in human serum

Fluid	Na^+ (mmol/L)	K^+ (mmol/L)	Cl^- (mmol/L)	Ca^{2+} (mmol/L)	Lactate or bicarbonate (mmol/L)	Osmolarity (mOsmol/L)	pH
Human serum	135–145	3.5–5.5	98–106	2.2–2.6	22–30	276–295	7.35–7.45
Ringer-lactate/ Hartmann's solution	131	5.0	111	2.0	29	279	6.0
0.9% normal saline	154	0	154	0	0	310	5.4

sterile no-touch technique, swabbing the entry point to the bag with an alcohol swab.

Dextrose/glucose solutions that are not in Ringer-lactate or Hartmann's solution are dangerous for replacing fluid losses.

Never infuse plain water IV: this causes haemolysis and will be fatal.

Always specify the concentrations of dextrose and saline solution to be infused.

Maintenance requirement of electrolytes

Daily sodium and potassium requirements in IV fluids:

- sodium (Na^+): 3–4 mmol/kg/24 hours in children; 150 mmol/24 hours in pregnancy
- potassium (K^+): 2–3 mmol/kg/24 hours in children; 100 mmol/24 hours in pregnancy.

Crystalloids containing a similar concentration of sodium to plasma (Ringer-lactate or Hartmann's solution) are used to replace vascular compartment losses. When infused IV, only around 25% remains inside the vascular compartment; the rest passes into the extracellular space.

All fluids should be prepared and administered using an aseptic technique. It is important to observe the cannula site directly (by removing the dressing) for redness and swelling before each IV injection. Observe the patient for pain or discomfort at the IV site. If there are any signs of inflammation, stop all fluids, reassess the need for continuing IV fluid drugs, and resite the cannula if necessary.

The rate of administration of fluids can be calculated in drops per minute as follows:

In a standard giving set with a drop factor of 20 drops = 1 mL, then mL/hour divided by 3 = drops/minute.

- Record that rate of fluid intake per hour on a fluid balance chart.
- Ensure that the IV site is kept clean.
- Flush the cannula with 0.9% saline or Ringer-lactate or Hartmann's solution 4-hourly if continuous fluids are not being given.

Prescribing practice and minimising drug errors

Introduction

- Oral administration is safer and less expensive, if it is tolerated and if the condition is not life-threatening.
- The following antibiotics are as effective when given orally as when administered intravenously, although initial IV doses will increase the blood levels more quickly:
  - amoxicillin, ampicillin, chloramphenicol, ciprofloxacin, co-trimoxazole, erythromycin, flucloxacillin, fluconazole, metronidazole, sodium fusidate.
- If a drug is given down an orogastric or nasogastric tube, flush the tube through afterwards so that the drug does not remain in the tube.
- Rectally administered drugs are less reliably absorbed than those given orally.
- Liquid formulations are better than suppositories for rectal administration of drugs in infants.

Prescribing

- Use approved names.
- Dosages should be in grams (g), milligrams (mg) or micrograms. **Always write micrograms in full.** Volumes should be in millilitres (mL).
- Avoid using numbers with decimal points if at all possible (e.g. write 500 mg, not 0.5 g). If decimal points are used, they should be preceded by a zero (e.g. write 0.5 mL, not .5 mL).
- Write times using the 24-hour clock.
- Routes of administration can be abbreviated to IV (intravenous), IM (intramuscular), PO (orally), SC (subcutaneous), NEB (nebuliser) and PR (rectally).
- 'As-required' prescriptions must be specific with regard to how much, how often and for what purpose the drug is being given (also indicate the maximum 24-hour dose).
- 'Stop dates' for short-course treatments should be recorded when the drug is first prescribed.

Measuring drug doses

- Multiple sampling from drug vials increases the risk of introducing infection, as the vials do not contain preservatives or antiseptic.
- Dilute drugs so that volumes can accurately be measured. For example do not use doses of less than 0.1 mL for a 1-mL syringe without diluting sufficiently for you to be able to give an accurate amount of the drug.
- Do not forget to consider the dead space in the hub of the syringe for small volumes.
- For dilutions of more than 10-fold, use a small syringe to inject the active drug, connected by a sterile three-way tap to a larger syringe, and then add diluent to the large syringe to obtain the desired volume.

Delivery

- All IV solutions, including drugs, must be given aseptically.
- Give IV drugs slowly in all cases.
- After injecting into the line (e.g. through a three-way tap), use the usual rate of the IV infusion to drive the drug slowly into the patient.
- If there is no ongoing infusion, give sufficient follow-up (flush) of 0.9% saline, Ringer-lactate or Hartmann's solution or 5% dextrose to clear the drug from the cannula or T-piece.
- Repeat flushes of 0.9% saline can result in excess sodium intake in infants, so use Ringer-lactate or Hartmann's solution if possible.
- Flush over a period of 2 minutes to avoid a sudden surge of drug (remember the hub).

Infusions

- These must be given aseptically.
- Adjust the total 24-hour IV fluid intake so that additional infusions for drugs do not alter the total fluid volume.
- Never put more drug or background IV into the syringe or burette than is needed over a defined period of time.
- Check and chart the rate of infusion, and confirm this by examining the amount left every hour.
- Use a cannula, **not butterfly needles**, for infusions if available.
- **Do not mix incompatible fluids IV.**
- Do not add drugs to any line containing blood or blood products.
- Infusions of glucose higher than 10%, calcium salts and adrenaline, can cause tissue damage if they leak outside the vein.
- Most IV drugs can be given into an infusion containing

0.9% saline, Ringer-lactate or Hartmann's solution or up to 10% glucose (the exceptions include phenytoin and erythromycin).
- If you are using only one line, wait 10 minutes between each drug infused, or separate the drugs by infusing 1 mL of 0.9% saline or Ringer-lactate or Hartmann's solution.

Safe IV infusions when no burettes are available

Mark the infusion bottle with tape for each hour of fluid to be given, and label each hour.

or

Empty the infusion bottle until only the exact amount of fluid to be given is left in the bottle.

Intravenous lines

Placement of the line

- Always place the cannula aseptically and keep the site clean.
- **Use sterile bungs, *not* syringes**, for closing off cannula/butterfly needles between IV injections.

Care of the line

- Change the giving set every 3 or 4 days.
- Change the giving set after blood transfusion, or if a column of blood has entered the infusion tubing from the vein, as this will be a site of potential bacterial colonisation.
- Always inspect the site of the cannula tip before and during drug injection. Never give a drug into a drip that has started to tissue. Severe scarring can occur, for example, from calcium solutions.
- Always use luer lock connections to minimise extravasation.

Sampling from the line

- Clear the dead space first (by three times its volume).
- Glucose levels cannot be accurately measured from any line through which a glucose solution is infused.
- Blood cultures should always be taken from a separate fresh venous needle or stab sample.
- After sampling, flush the line. **Remember that repeat flushes of 0.9% saline can result in excess sodium intake in infants.**

Complications

Infection

- Local infection can become systemic, especially in neonates or the immunosuppressed (e.g. HIV-infected patients).
- If there is erythema in the tissue, remove the cannula.
- If lymphangitis is present, remove the cannula, take a blood culture from a separate vein and start IV antibiotics.

Air embolism

- Umbilical or other central venous lines are particularly high risk.
- Another source of air embolus is through the giving set, especially when infusion pumps are used. **Infusion pumps must not be used if there are not enough nurses to closely monitor the infusion.**
- Always use a tap or syringe on the catheter, especially during insertion.
- If air reaches the heart it can block the circulation and cause death.

Haemorrhage

- In neonates this can occur from the umbilical stump.
- All connections must be luer locked.
- The connections to the cannula and its entry must be visualised at all times.

Minimising errors with IV infusions

- Prescribe or change infusion rates as infrequently as possible.
- Always have the minimum possible number of IV infusions running at the same time.
- Use a burette in which no more than the prescribed volume is present (especially in infants and young children, or with drugs such as quinine or magnesium sulphate in pregnancy).
- Record hourly the amount given (from the burette, syringe or infusion bag) and the amount left.
- Check the infusion site hourly to ensure that fluid has not leaked outside the vein.
- Ensure that flushes are only used if they are essential, and are given slowly over a period of at least 2 minutes.
- Be careful with potassium solutions given IV (use the enteral route when possible).
- Check and double check the following:
  - Is it the right drug? Check the ampoule as well as the box.
  - Is it at the right concentration?
  - Is the shelf life within the expiry date?
  - Has the drug been constituted and diluted correctly?
  - Is it being given to the right patient?
  - Is the dose correct? (Ideally two healthcare workers should check the prescription chart.)
  - Is it the correct syringe? (Deal with one patient at a time.)
  - Is the IV line patent?
  - Is a separate flush needed? If so, has the flush been checked?
  - Are sharps disposed of (including glass ampoules)?
  - Has it been signed off as completed (ideally countersigned)?
  - If the drug has not been received, is the reason stated?

Intramuscular (IM) injections

- **IM injections are unsafe for patients in shock**, especially opiates, where a high dose can be released once recovery of the circulation occurs.
- To avoid nerve damage, only the anterior aspect of the quadriceps muscle in the thigh is safe in infants.
- Use alternate legs if multiple injections are needed.
- Do not give IM injections if a bleeding tendency is present.
- **Draw back the plunger to ensure that the needle is not in a vein before injecting** (especially if administering adrenaline or lidocaine).

In very resource-limited situations, the IM route might be preferred because the drug may reach the patient sooner than if the patient had to wait in a queue to have an IV line sited. It also requires less nursing time and is less expensive;

venous cannulae are often in short supply. The IM route is as effective as the IV route in many situations.

Storage of drugs

Hospitals have struggled for many years to ensure that appropriate medicines are available when needed, while at the same time avoiding the problems of controlling the abuse and illegal use of these substances. Medicines that are of most concern in this respect are narcotics and sedatives. Supplies of these drugs must be available for the treatment of acutely ill patients, at the point of admission, in high-dependency care and post-surgical areas, and in all areas involved in the care of patients with terminal illness. Tragically, many care settings have solved the problem of storage by refusing to have stocks of these drugs readily available, either in the belief that patients, especially children, due to their physiological immaturity, do not feel pain, or due to fear of abuse by the patients and their families or healthcare staff.

The responsibility for the safe custody and storage of all medicines and drugs on a ward or department is that of the nurse in charge at any one time. Designated cupboards for the different types of drugs should be available. All cupboards, which should be permanently fixed to an inside wall, should have secure locks that make them inaccessible to unauthorised staff and visitors. Drug cupboards should be kept locked at all times, the keys being the responsibility of the nurse in charge.

Correct storage of drugs is paramount for prolonging the shelf life of the drug, as well as for complying with safety and legal requirements.

Due to the shelf life of some drugs, they need to be stored in a refrigerator, with the temperature set to store the drugs at between 2°C and 8°C. Drugs that need to be stored under these conditions include the following:

- reconstituted oral antibiotics
- eye drops
- rectal paracetamol
- some vaccines
- insulin (although this can be stored for up to 1 month at room temperature)
- oral midazolam
- pancuronium/vancuronium
- ergometrine
- oxytocin.

Calculating and giving the correct dose

Children should be weighed naked and their weight (in kg) recorded on the prescription chart. The use of a drug formulary should be considered when calculating the therapeutic dose. To ensure that the correct amount of drug is given from the stock bottle or vial, the following calculation should be used:

(prescribed dose divided by concentration of the stock solution) × (volume of stock dose).

For example, 125 mg (the amount prescribed) divided by 250 mg/5 mL (concentration of the stock solution) × 5 mL (volume of stock dose)
= 125/250 × 5 mL = 2.5 mL.

So the amount given would be 2.5 mL.

Medical staff should change the prescribed dose if after using the above calculation the dose is not easily measurable (e.g. 1.33 mL, 2.46 mL). To ensure that the calculated dose is given accurately, a pre-marked syringe should be used. The smaller the required dose, the smaller the syringe that should be used, as it will give a more accurate measurement (i.e. a 1- or 2-mL syringe should be used, not a 10-mL syringe).

Other forms of measurement can be used for larger doses, such as 5 or 10 mL. These include a pre-measured medicine pot or a 5-mL pre-measured medicine spoon. For safety, the calculation should ideally be done by two trained nurses, and the amount dispensed checked by the same two nurses. Although it is recognised in some hospitals that one trained nurse can check oral medication on their own, ideally IV and IM drugs should be checked by two trained nurses or a nurse and a doctor.

Safe use of morphine in hospital

Narcotic drugs, which may be controlled by law within the country concerned, should have a separate cupboard permanently fixed to the wall and locked. The keys to drug cupboards should be kept separately to all other keys and be carried by a qualified nurse for the period of each shift, and then handed over to the nurse taking over the next shift.

A logbook is necessary for recording the ordering and use of narcotic drugs. It is completed to order stocks, using one page for each order. It also records the use of each ampoule, tablet or dose of liquid. The name of the patient, hospital identification, date and time when the drug was given, and whether or not any portion of the drug was discarded is entered in the register (*see* Figure 1.6.1). Then each entry is signed by two staff members. Ideally, both must hold a nursing, medical or pharmacology qualification, and one must be a member of the ward or unit staff.

In addition, two members of unit staff must check the stock levels once in every 24-hour period and sign to confirm that the stocks are correct. Any discrepancy must be reported immediately to the senior nurse manager for the hospital.

Each hospital should have a policy for dealing with unauthorised use of narcotic drugs, and in some countries this will involve national law enforcement agencies.

When new drug stocks are required, the order book is sent to the central pharmacy, ideally in a container with a tamper-proof seal. Once the pharmacist has placed the order in the container, it is sealed and must not be opened until its arrival in the receiving ward or department.

When the stock arrives in the unit, the seal is broken in the presence of the messenger and the contents are checked against the order book, which is then signed by both. Drugs are then entered in the drug register, with two staff members checking and signing. The drugs are placed in the appropriate cupboard, which is then relocked.

In most hospital wards and units, these precautions will both ensure that adequate narcotic drugs are available when they are needed by patients, and prevent provision of supplies to those who may abuse them.

Use of morphine

- Morphine is a safe drug if administered by doctors and nurses who know how to use it and how to monitor patients who have been given it. It is not addictive if used only in the short term for severe pain.

NAME, FORM OF PREPARATION AND STRENGTH.....

AMOUNT(S) OBTAINED					AMOUNT(S) ADMINISTERED				
Amount	Date received	Serial no. of requisition	Date	Time	Patient's name	Amount Given	Given by (signature)	Witnessed by (signature)	Stock balance

FIGURE 1.6.1 Page of a controlled drugs record book.

- It is not difficult to use, but because it is a controlled drug it requires special procedures to ensure its security.
- It is relatively inexpensive.
- It is a powerful and effective drug that is recommended by the WHO as the first-line medication for the treatment and prevention of severe pain.

Special procedures required to ensure the secure and appropriate use of morphine

1 Morphine must be stored in a secure locked box attached to the wall of each ward/area where it might be needed.
2 The box must always contain sufficient quantities for any anticipated clinical need.
3 The keys to the box must be readily available to staff who are caring for patients, and held by the senior person on the ward 24 hours a day.
4 A logbook recording every individual dose given and the name of the patient to whom it was administered must be signed by two members of staff.
5 Any unused morphine must be safely disposed of.
6 Every vial must be accounted for and the vials counted to check that the number tallies with the logbook at the beginning of each shift.

Morphine is usually available in 1- or 2-mL ampoules at a concentration of 10 mg/mL. **Always check the strength.**

The dose is 10 mg IV for pregnant women (5 mg initially and then another 5 mg after 5 minutes if necessary).

The dose is 200 micrograms/kg IV for children (100 micrograms/kg initially and then another 100 micrograms/kg after 15 minutes if necessary). **Two people must check the calculation.**

The volume is small, so dilute with 0.9% saline or 5% dextrose up to 10 mL.

Check the dilution.

The prescription of morphine must be clearly written, dated and signed (do not use fractions for doses).

The antidote, naloxone, must also be kept in the secure box.

The patient's notes must record the prescription and use of morphine.

All patients who are receiving morphine need regular monitoring and charting of ABC in particular:

- respiratory rate
- blood pressure
- oxygen saturation
- AVPU score.

Oxygen and a bag-valve-mask system of appropriate size must be available near to every patient who is receiving morphine.

An example of a page of a controlled drugs record book, such as would be used for morphine, is shown in Figure 1.6.1.

Summary

- Morphine is an essential drug that must be used when severe pain is present or likely to occur.
- To ensure its safe use, attention to the logistics of secure storage is of paramount importance.
- Close monitoring of ABC and D (disability) is essential, and naloxone must be available at all times.
- The prescribing and recording of doses of morphine and naloxone must be carefully undertaken.

1.7 Safe blood transfusion practice

Introduction

Blood or blood products should be transfused only when they are needed to save life or to prevent major morbidity.

The risk of transmission of infection is a major concern in countries with limited resources and poorly organised blood transfusion services.

Blood must be stored safely, or a bank of adequately screened donors must be available 24 hours a day, especially for obstetric emergencies or major trauma.

When giving a blood transfusion, care must be taken to ensure that the blood is compatible with that of the recipient, is infection free and is given safely.

Clinical situations that require blood transfusion

Normal haemoglobin (Hb) levels (after the neonatal period) are around 129 g/L (12.9 g/dL). Children with severe anaemia have Hb levels of 50 g/L or less. An Hb level of 50 g/L is widely accepted as the level at which transfusion might be indicated, and less than 40 g/L if there is severe malnutrition. Note: g/L divided by 10 = g/dL.

The WHO defines anaemia as any Hb level below 110 g/L. However, in pregnancy, normal haemodilution means that a cut-off value of less than 10 g/dL is more appropriate. In a pregnant woman, transfusion may be considered at an Hb level of 60–70 g/L, taking into account other factors.

In addition to Hb level, the following factors must be taken into account when considering transfusion.

- **Heart rate.** If it is rapid, this will favour the decision to transfuse. Remember that normal values for heart rate and respiratory rate vary with the age of the child.
- **Respiration rate.** If it is rapid, this will favour the decision to transfuse.
- **Is the patient grunting?** If so, this will favour the decision to transfuse.
- **Is the patient already in circulatory collapse (shock)?** If so **the need for transfusion is very urgent**.

Some patients will not show any of these features, and it might then be justifiable to delay transfusion and use haematinics (i.e. iron and folic acid). Some patients may show the above features and have an Hb level higher than 50 g/L. It will also be necessary to transfuse such patients if their symptoms are caused or significantly worsened by the anaemia and not an alternative pathology only (e.g. heart failure).

After birth, the haemoglobin level drops to less than 100 g/L in term infants at 8–12 weeks of age, but in premature infants it can drop to 70–100 g/L even earlier, at 6 weeks. (Oxygen delivery is well maintained because of rising levels of haemoglobin A, which releases oxygen more freely than haemoglobin F, which is found in the fetus.)

Causes of anaemia in neonates

- Hypovolaemic shock can result from acute blood loss, as for example in premature separation of the placenta or feto–maternal haemorrhage, twin-to-twin transfusion, and other causes of fetal or neonatal haemorrhage.
- Neonates may lose a considerable blood volume as a result of sampling for laboratory tests. Therefore samples should be minimised.
- Reduce the need for transfusion in neonates by providing adequate antenatal care, to reduce the risks of premature delivery and when possible prevent nutritional anaemia in the mother.
- Encourage breastfeeding.
- Ensure that there is early provision of vitamin K prophylaxis, iron, vitamins and other haematinics, especially in premature babies.

Causes of anaemia in children

These include the following:

- surgery
- haematological malignancies
- malaria
- sickle-cell disease
- congenital haemolytic anaemias (thalassaemia, glucose-6-phosphate dehydrogenase deficiency)
- burns
- major trauma.
- malnutrition (*see* Section 5.10.B).

Causes of anaemia in pregnancy

These include the following:

- obstetric emergencies such as antepartum and postpartum haemorrhage
- severe anaemia that is untreated or unresponsive to haematinics
- major trauma.

Transfusion policies and guidelines

- In hypovolaemic shock, erythrocyte-free volume expanders may be used to maintain tissue **perfusion**. Oxygen and top-up blood transfusion (10–20 mL/kg. over 5–10 minutes) may be required when tissue **oxygenation** is compromised.
- Transfuse for anaemia only when there are clinical signs, such as tachycardia, tachypnoea, recurrent apnoea, failure to thrive or early signs of anaemia-induced heart failure.
- When possible, provide malaria prophylaxis, particularly in pregnant women and children (*see* Sections 2.8.D and 6.3.A.d) with sickle-cell disease. Early treatment of clinical malaria reduces the profound haemolysis that is a major reason for transfusion in endemic areas.
- Anaemia due to malaria responds to treatment with antimalarial drugs and folic acid.
- Blood transfusion is not required for sickle-cell disease in the steady state. It may be indicated in severe anaemia with incipient or established cardiac failure,

acute splenic enlargement, sequestration crisis with rapidly falling haemoglobin levels, aplastic crisis, acute chest syndrome, stroke, and sometimes as exchange transfusion for severe priapism (*see* Section 5.11.B on sickle-cell disease).
- National programmes for thalassaemia and other congenital haemolytic disorders, such as glucose-6-phosphate dehydrogenase deficiency, help to reduce transfusion requirements.

In situations where blood transfusion is unavailable or potentially unsafe, the following recommendations have been made:
- Transfusion is not necessary if the Hb level is more than 50 g/L.
- Transfusion may be necessary if the Hb level is less than 50 g/L and there is incipient cardiorespiratory distress (air hunger, hypotension, tachycardia and oedema).
- Transfusion may be necessary if the Hb level is less than 40 g/L and complicated by malaria or bacterial infection, even without incipient cardiac failure.
- Transfusion may be necessary if the Hb level is less than 30 g/L, with no apparent complications.

In situations where blood transfusion is safe and available, recommendations for its use are as follows.

Neonates and infants less than 4 months old
- Blood loss of more than 15% over 2 days.
- Haemoglobin level of less than 70 g/L with clinical manifestations of anaemia.

Infants aged 4 months or older
- Acute blood loss that is unresponsive to crystalloid and colloid infusions.
- Intra-operative blood loss of more than 15% of total blood volume and post-operative haemoglobin level of less than 80 g/L with clinical symptoms.
- Haemoglobin level of less than 110 g/L with severe pulmonary disease.
- Acute haemolysis with haemoglobin level of less than 80 g/L with signs of anaemia.
- To suppress endogenous haemoglobin in sickle-cell disease crises and thalassaemic syndrome.

Red-cell-free components
- Fresh frozen plasma (FFP) is only recommended when a specific haemostatic defect has been identified. In the absence of specific testing, consider administering FFP to a patient with signs of disseminated intravascular coagulation who is acutely unwell, as it may be life-saving.
- Freeze-dried plasma is now available, and its advantages include a long shelf life and the lack of need for refrigeration.
- Platelets are prepared from fresh blood using a special, simple centrifugation method, and the remaining blood can be given back to the donor. Once extracted by this method, platelets can last for up to 5 days at room temperature (around 23°C). Platelets should not be stored in a refrigerator. Transfused platelets survive only briefly, and repeated infusion may be required for active bleeding, or before essential procedures such as a lumbar puncture in a child with severe thrombocytopenia.

Blood donation and provision
- Ideally blood is obtained by routine whole blood collection from an established panel of blood donors with quality standards for testing, processing and distribution.
- Most transfusions are required and given as an emergency procedure. Ideally, emergency collection of blood for paediatric use should not be necessary (see below).
- Safe transfusion is enhanced by the following measures:
  - collection of blood from repeat regular donors screened using a standard health-check questionnaire, and who are found negative for all markers for transfusion-transmissible infection
  - collection in a multi-pack which allows each donation to be divided into small volumes, in a closed sterile system to reduce wastage and donor exposure
  - multiple, small-volume packs can be used for multiple transfusions in one child or neonate without having to repeat the pre-transfusion tests.
- Group O rhesus-negative small-volume packs facilitate transfusion across the ABO barrier. They must be checked for high-titre anti-A or anti-B by a suitable antiglobulin method.
- Establish a routine procedure for collection, testing and processing which should cover routine and emergency transfusions.
- Maternal blood is not recommended for transfusing into the newborn infant, even in an emergency, although theoretically it can be used after compatibility testing with the recipient's serum.

Pre-transfusion testing
Minimum acceptable tests on blood prior to transfusion
1 ABO and Rhesus D grouping.
2 Screening for hepatitis B antigen and antibodies to HIV-1 and -2, hepatitis C virus and syphilis.
3 Additional tests for locally prevalent infections, such as malaria and Chagas disease.
   - 0.1–0.2 mL blood in an EDTA bottle is required for grouping, and 2 mL of clotted blood in a plain bottle for compatibility testing.
   - In infants under 4 months of age, maternal blood testing for compatibility is always required: 4 mL of EDTA plus 5 mL of clotted blood.
   - Blood group the neonate using a cord, capillary or small venous sample (2–3 drops and specific standard reagents Anti-A, Anti-B, Anti-A+B and Anti-RhD). Red cells only are used, because antibody levels in the sera of neonates are too low to be of significant value.
   - The inclusion of control A, B, O, RhD-positive and RhD-negative cells in the procedure is part of good laboratory practice, and should be part of the testing method.
   - If possible, two methods should be used for grouping, to ensure reliability.
   - For neonates and infants up to 4 months of age, compatibility testing is not required if the mother's serum is negative for allo-antibodies. Compatibility between the mother's serum and red cells to be transfused is required only if the mother has antibodies or if there is a previous history of haemolytic disease of the newborn.

The most suitable method for compatibility is the anti-human globulin technique at 37°C for 1 hour. Agglutination should be read before and after the addition of the anti-human globulin reagent.

Blood groups

There are four major blood groups: A, B, AB and O. To avoid ABO incompatibility, the blood group of both the donor and the receiver must be known. Blood can only be donated in the direction of the arrows shown in Figure 1.7.1.

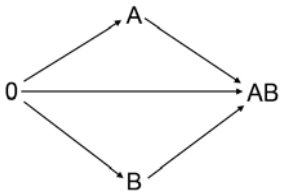


FIGURE 1.7.1 Safe transfusion of ABO blood groups.

- Donors with blood group O can donate to patients (receivers) with blood group A, B, AB or O.
- Donors with blood group A can donate to patients with blood group A or AB.
- Donors with blood group B can donate to patients with blood group B or AB.
- Donors with blood group AB can donate only to patients with blood group AB.

Blood is also categorised according to its rhesus status. Therefore:

- Rhesus-negative donors can give to Rhesus-positive and Rhesus-negative patients.
- Rhesus-positive donors can only give to Rhesus-positive patients.

If the blood group is unknown and blood is required before a cross-match can be performed, give O-Rhesus-negative blood if this is available.

Exchange transfusion

- This is used for haemolytic disease of the newborn with severe anaemia and/or severe hyperbilirubinaemia (*see* Section 3.4). Exchange of double the neonate's blood volume is often required using 160–180 mL/kg of whole blood and/or plasma reduced red cells. The latter are prepared by removing approximately 100 mL of plasma to create a haematocrit of 0.5–0.6.
- Patients with sickle-cell anaemia and acute chest syndrome or impending cerebrovascular episodes may benefit from exchange transfusion (*see* Section 2.5.B).
- Blood should be fresh (less than 5 days old), and also screened for HbS if it is issued for sickle-cell disease.

Use Rhesus-negative blood, group O or the same ABO group as the infant compatible with maternal and infant serum.

The blood should be warmed with a heating coil or stood for 1 hour at room temperature or under the mother's clothing.

Exchange transfusion: indications and technique

Indications

- Severe haemolytic anaemia: use double volume exchange.
- Severe hyperbilirubinaemia: use double volume exchange.
- Polycythaemia: use partial exchange with Ringer-lactate or Hartmann's or 0.9% saline (*see* Section 3.4).

$$\text{Double volume exchange (mL)} = 2 \times 80 \times \text{weight (kg)}.$$

$$\frac{80 \times \text{weight (kg)} \times (\text{actual haematocrit} - \text{desired haematocrit})}{\text{actual haematocrit}}$$

Technique

1 Exchange transfusion should preferably be through umbilical or peripheral venous and arterial catheters so that simultaneous withdrawal and transfusion of blood/volume occurs. If this is not possible, a single large-bore venous cannula may be used with a three-way tap to allow alternate withdrawing and transfusing of aliquots. An aseptic technique must be maintained.
2 Use a 5- or 10-mL syringe to draw 5- or 10-mL aliquots (depending on the baby's weight) from the baby via the arterial line over a 3-minute cycle, and discard them. Simultaneously infuse 5- or 10-mL aliquots through the venous line over a 3-minute cycle.
3 The baby's temperature, pulse, respiratory rate and blood pressure must be monitored as for transfusions, and in addition blood glucose levels must be monitored every 30 minutes.
4 Use a nasogastric tube to evacuate the stomach contents, and keep the patient nil by mouth.
5 Use a separate IV line to administer dextrose solution to maintain blood glucose levels and hydration.
6 Check the baby's haemoglobin, bilirubin, glucose and calcium levels at the beginning and end of the procedure.
7 Check a blood film, Coombs' test, and if possible coagulation and arterial or capillary blood gas at the beginning of the procedure.

Potential complications include hypoglycaemia, electrolyte disturbance, thrombocytopenia, coagulopathy, sepsis, air embolus, circulatory overload and gastrointestinal complications (e.g. acute dilation of stomach, intestinal ischaemia).

Bedside transfusion

A child's body contains 80 mL of blood for every kg of body weight. For example, a 3-year-old weighing 12 kg will have 960 mL of blood in their body.

A pregnant mother's body contains 100 mL of blood for every kg of body weight.

- Venous access for bedside transfusion should be chosen with no smaller than a 22- to 24-gauge vascular catheter, and a much larger one in pregnant mothers.
- Blood is usually cleaned and filtered in the lab, so when transfusing it to a patient the only filter that needs to be used is the usual on-line filter in a standard giving set.
- Blood should be treated like any other IV fluid, and given using an accurate measurement of rate and time. **A burette should be used for infants or in children for whom**

too rapid an input could be dangerous (e.g. in incipient or actual heart failure).

Blood transfusion reactions

Blood transfusion can be life-saving and provides great clinical benefit to many patients. However, it is not without risks, which include the following:

- immunological complications
- errors and 'wrong blood' episodes
- infections (bacterial and viral).

Causes of acute complications of transfusion

Acute haemolytic transfusion reaction

- Incompatible transfused red cells react with the patient's own anti-A or anti-B antibodies or other alloantibodies (e.g. anti-rhesus (Rh) D) to red cell antigens. Complement can be activated and may lead to **disseminated intravascular coagulation (DIC)**.
- Infusion of ABO-incompatible blood is almost always a result of errors in labelling sample tubes and/or request forms, or inadequate checks at the time of transfusion. When red cells are mistakenly administered, there is about a 1 in 3 risk of ABO incompatibility and a 10% risk of mortality, with the most severe reaction seen in a group O individual receiving group A red cells.
- Non-ABO red cell antibody haemolytic reactions tend to be less severe.

Infective shock

- Bacterial contamination can be fatal.
- Acute onset of tachycardia, low pulse pressure, hypotension, rigors and collapse rapidly follows the transfusion.

Transfusion-related acute lung injury (TRALI)

- TRALI is a form of acute respiratory distress due to donor plasma containing antibodies against the patient's leukocytes.
- Transfusion is followed within 6 hours of transfusion by the development of a prominent non-productive cough, breathlessness, hypoxia and frothy sputum. Fever and rigors may be present.
- Chest X-ray if available shows multiple perihilar nodules with infiltration of the lower lung fields.

Fluid overload

- This occurs when too much fluid is transfused or it is transfused too quickly, leading to **pulmonary oedema** and **acute respiratory failure**.
- Patients at particularly high risk are those with severe or chronic anaemia, or severe malnutrition and who have normal blood volumes (i.e. who are not bleeding), and those with symptoms of **cardiac failure** prior to transfusion.
- These patients should receive packed cells rather than whole blood via slow transfusion, with diuretics if required.

Non-haemolytic febrile reactions to transfusion of platelets and red cells

- Fevers (more than 1°C above baseline) and rigors may develop during transfusion due to the patient's antibodies to transfused white cells.
- This type of reaction affects 1–2% of patients.
- Multiparous women and those who have received multiple previous transfusions are most at risk. Reactions are unpleasant but not life-threatening. Usually symptoms develop towards the end of a transfusion or in the subsequent 2 hours. Most febrile reactions can be managed by slowing or stopping the transfusion and giving paracetamol.

Severe allergic reaction or anaphylaxis

- Allergic reactions occur when patients have antibodies that react with proteins in transfused blood components.
- Anaphylaxis occurs when an individual has previously been sensitised to an allergen present in the blood, and subsequently, on re-exposure, releases immunoglobulin E (IgE) or IgG antibodies. Patients with anaphylaxis become acutely dyspnoeic due to bronchospasm and laryngeal oedema, and may complain of chest pain, abdominal pain and nausea.
- Urticaria and itching are common within minutes of starting a transfusion.
- These symptoms are usually controlled by slowing the transfusion and giving antihistamine, and the transfusion may be continued if there is no progression at 30 minutes.
- Pre-treatment with an antihistamine should be given if the patient has experienced repeated allergic reactions to transfusion.
- For treatment of anaphylaxis, *see* Sections 2.7.C and 5.1.B.

Presentation

Symptoms or signs may occur after only 5–10 mL of transfusion of incompatible blood, so **patients should be observed very closely at the start of each blood unit transfused**.

Symptoms

These include the following:

- a feeling of apprehension or that 'something is wrong'
- flushing
- chills
- pain at the venepuncture site
- muscle aches
- nausea
- pain in the abdomen, loins or chest
- shortness of breath.

Signs

These include the following:

- fever (a rise in temperature of 1.5°C or more) and rigors
- hypotension or hypertension
- tachycardia
- respiratory distress
- oozing from wounds or puncture sites
- **haemoglobinaemia**
- **haemoglobinuria**.

Investigations and management

- If a serious acute transfusion reaction is suspected, **stop the transfusion**, take down the donor blood bag and giving set, and send the donor bag back to the blood bank with notification of the event. Set up a new giving set with Ringer Lactate, Hartmann's or 0.9% saline solution.
- To detect a haemolytic reaction, send post-transfusion

blood (for full blood count and clotting, repeat typing and cross-matching, antibody screen and direct Coombs' test) and a urine specimen (if available, for detection of urinary haemoglobinuria) from the transfusion recipient.

- Where bacterial contamination is suspected, send blood cultures from the patient and also bag remnants.
- If the patient is dyspnoeic, obtain a chest X-ray if possible and check for fluid overload and pulmonary oedema.

TABLE 1.7.1 Investigations for blood transfusion reactions

Type of reaction	Investigation findings
Acute haemolytic reactions	• Visual inspection of centrifuged plasma: pink-red discoloration (haemoglobinaemia) indicates significant intravascular haemolysis • Visual inspection of centrifuged urine: red discoloration indicates haemoglobinuria • Retyping of donor and recipient red blood cells (RBCs): any discrepancy suggests that the transfusion has been mismatched and blood samples have been mixed up • Direct antiglobulin ('Coombs') test (DAT): ABO-related acute transfusion reactions usually cause a positive DAT test • Evidence of increased RBC destruction (e.g. a fall in haemoglobin and/or rise in bilirubin levels) • There may be evidence of DIC • Negative blood cultures
Febrile non-haemolytic reactions	• Visual inspection of the recipient's plasma and urine is normal • Retyping shows no incompatibility • DAT test is negative
Allergic and anaphylactic reactions	• Urticaria, itching and dyspnoea (for symptoms and signs of anaphylaxis, *see* Section 2.7.C)
TRALI	• Pulse oximeter shows hypoxaemia • Chest X-ray (if available) shows bilateral lung infiltrates • Full blood count frequently shows low white blood cell count and high eosinophil count
Transfusion-transmitted bacterial infection	• Blood cultures are positive and congruent for both donor and recipient blood

Management

- Where the only feature is a rise in temperature of less than 1.5°C from baseline, or urticaria, recheck that the correct blood is being transfused, give paracetamol and antihistamine, reset the transfusion at a slower rate and observe the patient more frequently.
- Although fever or rigors are not uncommon in response to a transfusion and may represent a non-haemolytic febrile reaction, they may also be the first sign of a severe adverse reaction.
- Where the reaction is more severe:
  - Stop the transfusion and call a doctor urgently to review the patient.
  - Vital signs (temperature, blood pressure, pulse, respiratory rate and oxygen saturation levels) and respiratory status (dyspnoea, tachypnoea, wheeze and cyanosis) should be checked and recorded. Look for signs of heart failure (basal lung crepitations and enlarged liver).
  - Check the patient's identity and recheck against details on the blood unit and compatibility label or tag.
- Initial management if **ABO incompatibility** is suspected is as follows:
  - Take down the blood bag **and** the giving set with blood in it.
  - Keep the IV line open with Ringer-lactate or Hartmann's solution.
  - Give oxygen and fluid support.
  - Monitor urine output, usually following catheterisation, and maintain it at more than 2 mL/kg/hour in infants, > 1 mL/kg/hour in children and > 30 mL/hour in pregnancy, giving furosemide if it falls below this.
  - Consider inotropic support if hypotension is prolonged.
  - Treat DIC by giving fresh new blood fully matched to the recipient.
  - Inform the hospital transfusion department immediately.
- If **another haemolytic reaction or bacterial infection of blood unit** is suspected:
  - Send haematological and microbiological samples for investigations as outlined above.
  - General supportive management is as for ABO incompatibility.
  - Start broad-spectrum IV antibiotics if bacterial infection is considered likely.
- If **anaphylaxis or severe allergic reaction** is suspected:
  - Follow the anaphylaxis protocols for women and children (*see* Section 2.7.C and Section 5.1.B).
- If **TRALI** is suspected:
  - Give high-concentration oxygen, IV fluids and inotropes (as for acute respiratory distress syndrome).
  - Ventilation may be urgently required; discuss this with an anaesthetist.

TRALI improves within 2–4 days in over 80% of cases if there is adequate management and respiratory support.

- If **fluid overload** is suspected:
  - Give IV furosemide and high-concentration oxygen.

Delayed complications of transfusion

Delayed haemolysis of transfused red cells

- In those who have previously been immunised to a red cell antigen during pregnancy or by transfusion, the level of antibody to the blood group antigen may be so low as to be undetectable in the pre-transfusion sample.
- However, after transfusion of red cells bearing that antigen, a rapid secondary immune response raises the

antibody level dramatically, leading to the rapid destruction of transfused cells.
- At 5–10 days post-transfusion, patients present with fever, falling haemoglobin levels (or an unexpectedly poor rise in haemoglobin levels), jaundice and haemoglobinuria.
- A rise in bilirubin levels and positive direct antiglobulin test (DAT) will also be present.

Development of antibodies to red cells in the patient's plasma (alloimmunisation)
- Transfusion of red cells of a different phenotype to that of the patient will cause alloimmunisation (e.g. development of anti-RhD in RhD-negative patients who have received RhD-positive cells).
- This is dangerous if the patient later receives a red cell transfusion, and can cause **haemolytic disease of the newborn (HDN)**.

Iron overload
- Each unit of blood contains 250 mg of iron, and those receiving red cells over a long period of time may develop iron accumulation in cardiac and liver tissues.
- Chelation therapy (with **desferrioxamine**) is used to minimise iron accumulation in those most at risk.

Infection
- The risk of becoming infected with HIV, hepatitis B or hepatitis C from transfusion is now small. However, since there is always the potential for unrecognised or unknown infection to be spread via transfusion, **all non-essential transfusions should be avoided.**
- Blood must be stored at the correct temperature at all times (at 1–6°C for up to 35 days if using citrate-phosphate-dextrose adenine anticoagulant *or* up to 21 days if using citrate-phosphate-double dextrose). Ideally each blood bag should be labelled with a temperature-sensitive strip that changes colour when the correct temperature for storage has been exceeded for a clinically significant period of time.

Improving safety

Reducing transfusion errors
- Introduce robust hospital transfusion protocols.
- Provide training for all staff involved in blood administration/taking samples for cross-matching.
- An understanding of transfusion medicine should be a core curricular component for all doctors in training.
- Improved information technology, such as use of a unique barcode on the patient's wristband/blood sample and prepared blood, is important.
- Appoint specialist transfusion practitioners.

Reducing unnecessary transfusion
- Transfusion risks related to the use of allogeneic blood can be eliminated by the use of autologous blood (whereby patients collect and store their own blood for use in planned surgery). However, this practice is not risk-free.
- Ensure that blood products are only used when the patient is judged more likely to benefit from than be harmed by a transfusion.
- Always record in the patient's notes the indication for giving blood.
- Adopt procedures such as checking for and correcting anaemia prior to planned surgery, stopping anticoagulants and antiplatelet drugs before surgery, minimising the amount of blood taken for laboratory samples, and using a simple protocol to guide when haemoglobin should be checked and when red cells should be transfused.
- Accept a lower haemoglobin concentration as a trigger for transfusion.
- Accept a lower post-transfusion target haemoglobin level.

1.8 Essential laboratory services

Basic services provided in the laboratory and on the ward

Whenever possible, the regional or central laboratory should procure the chemicals, prepare the reagents and standards, and distribute them with the necessary controls and approved testing procedure to district laboratories. Details on how to prepare the required reagents, standards and controls can be found in the 1995 WHO publication *Production of Basic Diagnostic Laboratory Reagents*.[1]

For all small hospitals, the WHO recommends six basic investigations as an absolute minimum:
- haemoglobin or packed cell volume
- blood smear for malaria
- blood glucose levels
- microscopy of cerebrospinal fluid (CSF) and urine
- blood grouping and cross-matching
- for newborn care, blood bilirubin levels.

Tests that can be performed on the wards

These include the following:
- blood grouping
- rapid diagnostic test for *Plasmodium falciparum* (or urgent thick blood film for malarial parasites)
- urine microscopy (*see* Sections 5.6.A and 8.5)
- HIV rapid screening test
- HBsAg screening test
- 'hot stool' examination (for *Entamoeba histolytica*)
- rapid haemoglobin (WHO paper-based method)

- CSF/gland/chancre aspirate/wet preparation for trypanosomes.

Tests to be performed in the laboratory

These include the following:

- thick and thin blood films for malaria and/or rapid diagnostic test for *Plasmodium falciparum*
- smears for *Leishmania amastigotes*
- rapid rk39 Ab test for *Leishmania* antibodies
- Ziehl–Neelsen sputum smears for TB
- Ziehl–Neelsen slit skin smears for leprosy
- Gram-stained smears
- haemoglobin estimation and platelets
- total and differential white cell count
- erythrocyte sedimentation rate (ESR)
- sickle-cell test
- HIV and hepatitis screening tests
- blood grouping and cross-matching
- urine deposits
- formol-ethyl acetate concentration and Kato-Katz thick smears for stool parasites.

Essential equipment

A functioning **microscope** is essential, and also saves time and therefore salary costs. Ideally a binocular instrument should be available, with × 10 eyepieces and × 10, × 40 and × 100 (oil immersion) objectives with integral illumination. LED light sources and options for using solar-powered batteries are now available.

A robust **bench-top centrifuge** is also needed. Ensure that lidded conical tubes (15 mL) can be used, and that there is an inner safety lid. A built-in timer and variable rotor speed are also desirable.

Haematological investigations

Haemoglobin

- **Haemoglobin colour scale** (WHO) filter paper 'matching method' (visual comparative technique): simple, cheap and portable, but is not suitable for use with artificial light. Available from WHO, Geneva.
- **Haemoglobinometer (BMS)** visual comparator method: a useful method for testing small numbers of sample. No dilution or measurement of sample is required, and standard is included. Available from Cascade HealthCare Products Inc., USA (www.1cascade.com).
- **DHT Hb523 haemoglobinometer:** portable, battery-operated and requires 0.04% ammonia. Suitable when multiple investigations are required (www.haemoglobinometer.co.uk).
- **Microhaematocrit centrifugation:** if no other method is available this can be used for estimation. Note that there may be raised values caused by plasma loss (e.g. due to burns or dehydration).

White blood cell count

- **Improved Neubauer haemocytometer:** spare cover glasses, Turk's solution (white blood cell diluent), 20-µl micropipette and hand tally counter are required.

Erythrocyte sedimentation rate (ESR)

- The **Westergren method** is recommended.

Differential white cell counts

- Thin blood film stained with Leishman's/Rapyd Giemsa (pH 6.8). Tally counters are required.
- **Film may also be used to examine red cell morphology for cases of suspected nutritional anaemia (e.g. iron deficiency).**

Sickle-cell test

- A simple slide test using 2% sodium metabisulphite (prepared daily) will enable the morphology of sickled red blood cells to be seen, but cannot differentiate between sickle-cell disease and trait. The HbS solubility filtration test can differentiate sickle-cell anaemia from sickle-cell disease.

HIV test

- Rapid antibody tests are easy to use for blood transfusion screening purposes and for diagnostic screening. Many brands are available, their sensitivities and specificities vary, and brand use may depend on local availability.

Hepatitis B and C testing

- Rapid tests are available to detect HBsAg and anti-HCV antibody (refer to **WHO Blood Safety Unit** for details of appropriate tests).

Blood groups

- **Blood grouping/cross-matching sera should be available.**

Biochemical investigations

Low-cost, easily maintained equipment is urgently required in low-resource settings to measure plasma sodium and potassium levels. Hyponatraemia and hypokalaemia are common and dangerous conditions that need early detection and management.

Important biochemical investigations include the following:

- Tests on whole blood, serum or plasma:
  - urea, creatinine and electrolytes
  - glucose
  - albumin
  - bilirubin
  - amylase
  - AST (aspartate aminotransferase).
- In specialised hospitals, the following can be measured:
  - alkaline phosphatase
  - ALT (alanine aminotransferase)
  - calcium
  - cholesterol
  - cholinesterase
  - iron
  - triglycerides.
- Urine clinical chemistry tests:
  - protein
  - glucose
  - bilirubin and urobilinogen
  - ketones
  - haemoglobin
  - nitrite
  - specific gravity.

- Faecal clinical chemistry tests:
  - occult blood
  - lactose
  - excess fat.
- Cerebrospinal fluid clinical chemistry tests:
  - protein (*c*. 1 mL of CSF)
  - glucose (0.5 mL into a fluorite oxalate bottle).

Investigations for specific diseases

Malaria

- Thick blood film stained with Field's/Giemsa) stain; use finger prick or venous blood.
- Using Field's the film can be stained within 20 seconds (compound stain powders 'A' and 'B' are available to mix with water).
- To confirm diagnosis of the species, a methanol-fixed thin blood film (hand stained at pH 7.2) using Rapyd Giemsa/Leishman's *or* reverse Field's stain may be useful.
- Thick blood films may also reveal *Borrelia*, microfilariae and trypanosomes.
- The WHO has recommended the use of rapid diagnostic tests (RDTs) as a parasite-based diagnosis **where good-quality microscopy cannot be maintained** (for guidance on choosing the most appropriate RDT, visit www.who.int/tdr).

African trypanosomiasis

- Immediate examination of a wet preparation and/or thick blood film stained as described above is the simplest way of diagnosing *Trypanosoma brucei rhodesiense* (if a chancre is present, a sample may be taken from between the edge and the centre of the lesion and examined as for blood).
- Gland fluid from a swollen posterior cervical gland may be examined (this is particularly useful in *T.b. gambiense*), with immediate examination for motile trypanosomes or stained as for blood.
- If these tests are negative, up to four microhaematocrit (MHCT) tubes of blood should be taken. These are centrifuged for 5 minutes, stuck to microscope slides and the buffy coat area examined for motile trypanosomes (Woo test).
- All samples must be examined as soon as possible to avoid parasite lysis.
- If the blood is positive for trypanosomes, or it is suspected that the patient has late-stage (stage II) CNS disease, a lumbar puncture must be taken and CSF examined microscopically **within 30 minutes of the procedure in order to visualise trypanosomes**. The number of white blood cells should be counted using a haemocytometer.

Leishmaniasis

- For cutaneous leishmaniasis, a smear taken from the raised red edge of a lesion may be taken and stained with rapid Giemsa/Leishman's (diluted with buffered water at pH 7.2) to demonstrate amastigotes.
- For suspected visceral leishmaniasis, haematological investigations plus an antibody detection test such as the Rapyd Leishman's which utilises rk39 antigen are the most useful and safe investigations. Note that in HIV-positive individuals false-negative antibody test results are common.

TB and leprosy

For suspected TB

- If possible, up to three consecutive morning sputum samples should be examined.
- The Ziehl–Neelsen (ZN) method of staining should be used.
- The addition of bleach to liquefy the sample may improve sensitivity, and lowers the risk of laboratory infection.

For suspected leprosy

- The ZN method of staining should be used on slit skin smears.

Diarrhoeal diseases

For suspected parasitic cause

- Direct microscopy using saline smears (plus iodine to aid identification of cysts) should be used. A concentration technique such as formol-ether (or ethyl-acetate/petrol) concentration or the Kato–Katz cellophane technique (WHO) is particularly useful when looking for parasites such as *Schistosoma mansoni*, where the female worm only produces around 200 eggs per day.

For suspected bacteriological cause

- Ideally the specimen should be sent for culture and sensitivity testing.
- Culture may not be possible due to the need for sterile facilities and supplies of media.
- If possible, samples should be sent to a reference laboratory for culture.
- Supplies of the following transport media and sterile swabs should be available:
  - Stuart's medium or Amies medium for suspected *Salmonella typhi* and *Shigella*
  - alkaline peptone water and Cary-Blair medium for *Vibrio cholerae*.
- If microscopy of a fluid stool containing blood shows red blood cells, white blood cells/macrophages and numerous bacteria, **bacterial dysentery** is likely.
- If the sample is loose with blood and mucus, then a 'hot stool' (examined within 30 minutes of voiding) should be examined for motile *Entamoeba histolytica* trophozoites.

Urinary infections and renal diseases

Urine examination

- Urine 'dipstick' tests are useful for detecting blood, protein, glucose, bilirubin, urobilinogen, infection, nitrites and white blood cells.
- A midstream urine (MSU) sample may be examined microscopically for the following:
  - *Schistosoma haematobium* ova (or terminal urine)
  - pus (white blood cells)
  - erythrocytes
  - casts
  - bacteria (suspected urinary tract infection).
- The addition of a drop of 1% methylene blue in physiological saline may aid microscopical examination.
- If urine is to be sent for culture, 20 mL of an MSU sample should be mixed with 3 mg of boric acid (a preservative).
- It is important to give instructions to ward staff on how to obtain an MSU sample, bag urine and suprapubic aspirate.

Ulcers and exudates

- For suspected bacterial (and fungal) infections, a smear of the pus or exudate should be stained with Gram stain.

Meningitis

- A Gram-stained CSF deposit may be useful in cases of suspected meningitis.
- The India ink stain is used for cryptococcal meningitis.

References

1 World Health Organization (1995) *Production of Basic Diagnostic Laboratory Reagents.* Can be obtained from WHO Regional Office, PO Box 1517, Alexandria.
2 Cheesbrough M (2005) *District Laboratory Practice in Tropical Countries. Part 1*, 2nd edn. Cambridge, UK: Cambridge University Press.

1.9 Records, history taking and examination

Records

- Records can be held by patients or parents, or by the hospital, or both.
- If they are patient or parent held, they can be developed into health booklets containing advice on how to manage illnesses (possibly in the form of pictures for illiterate parents). Immunisation information, if included, should comply with national immunisation programmes.
- Hospital records need to be kept confidentially in a logical system for audit purposes, with easy access to previous notes.
- Discharge information and advice should be entered in the patient- or parent-held booklet.
- If possible, diagnoses should be coded and entered according to the International Classification of Diseases (ICD) or in accordance with local policy and coding.

History taking

- The medical history should, when age appropriate, include the child's own input. The source of the information may be the mother, the father or the child him- or herself, and the source should be documented.
- It is important to listen, especially to the mother's worries about her child, taking into account her general frame of mind, her experience with previous children and her ability to communicate.
- Time can be a restricting factor due to the workload, but it is important to ask about the following:
  - pregnancy and previous deliveries (including stillbirths)
  - infant or young child feeding history
  - the immunisation record (best kept by the parents)
  - previous admissions or visits to hospital
  - existing medical problems
  - social circumstances at home, and the family history
  - the family's cultural beliefs and their religion and/or tribe
  - medication taken by the patient, and any allergies
  - the patient's presenting complaints and current treatment, if any.
- Most patients and their families are anxious. They need reassurance, kindness and understanding.

Examination

The following basic equipment is required:

- stethoscope
- otoscope (if available)
- ophthalmoscope (if available)
- tendon hammer
- bright torch light (or mobile phone light)
- thermometer
- Pinard's stethoscope or Sonicaid (a hand-held Doppler)
- microscope (if available).

Conducting the examination

- A triage nurse (*see* Section 1.10) can be helpful for making a preliminary assessment of patients. They can assess each patient and use the recorded body temperature, weight, general condition and pain score of the patient to decide how urgently he or she should be seen by the doctor.
- Do not rush the examination. A thorough examination is often needed, and taking time can help to gain the confidence of the patient and their family.
- If the patient is critically ill, quick action is required and questions can be asked later.
- Try to be gentle and avoid palpating a painful body part before everything else has been done. You want to avoid having a crying patient whom you cannot examine or auscultate.
- Small children and infants are best examined on the parent's lap; older ones can be asked to lie down.
- In general, the examination of a child will follow the same systematic approach as in adults. However, you may need to be more opportunistic.

Essential emergency examination checklist

Always check the following in the order shown:

- **A**irway
- **B**reathing
- **C**irculation
- **D**isability
- **E**xposure.

In the case of a critically ill patient, proceed to basic and/or advanced life support using the structured approach (*see* Section 1.11).

Patients who are not in need of immediate resuscitation

- **Introduce yourself to the patient and parent, if present.**
- **Interact with any child throughout the examination.**
- **General inspection:** document dysmorphism, skin rashes or bruises, nutritional status, weight and height for age, jaundice, pallor, clubbing, (for child) relationship with parent, and state of consciousness.
- **Respiratory system:** document chest wall expansion (is it symmetrical? is there recession?), respiratory rate, cyanosis, palpation, percussion, and auscultation.
- **Cardiovascular system:** remember to feel all of the pulses, particularly the femoral pulses. Measure the blood pressure (the cuff **must** cover two-thirds of the upper arm circumference), examine the jugular venous pressure, palpate the cardiac impulses (i.e. for left and right ventricles), and auscultate the apex, left sternal edge, pulmonary and aortic areas and carotids and over the back.
- **Abdominal system:** if the patient is pregnant, assess the size of the uterus, the presentation of the fetus and listen for the fetal heart. In an infant check the genitals for cryptoorchidism, hernias and gender. Rectal examinations are occasionally necessary but need to be explained to the patient, parent and child (where appropriate). Inspect the mouth and teeth.
- **Neurological system:** use the AVPU or Glasgow Coma Scale score (*see* Section 1.11). Observe infants for their degree of responsiveness and rapport appropriate for age, social and motor skills, and look for neurocutaneous stigmata. Test for age-appropriate reflexes and saving reactions when assessing developmental delay. Leave sensation testing until last. Ideally, fundoscopy needs mydriatics, a dark room and (occasionally) sedation.
- **Motor system:** Always examine infants for dislocated/dislocatable hips. Check the gait.
- **Urine:** Test for protein, glucose and blood, and ideally for infection using a microscope or appropriate stick tests.

Patients and parents have the right to be told any abnormal findings, and the actual process of the examination should be explained to the patient in age-appropriate language.

The history and examination findings, including the patient's weight and height, should be recorded, with daily entries on management and progress. (Be aware of the local guidelines on nutritional assessments, especially in settings where malnutrition is common.) When the patient is discharged they should be given discharge information about the admission and any further treatment and advice that needs to be shared with their primary care healthcare workers.

See Section 9 (Appendix) for examples of various charts, including those for vital signs, fluid balance, growth and body mass index (BMI).

1.10 Triage: seeing the sickest first

Triage involves **determining the priority of a patient's treatment based on the severity of their condition, not on when they arrived or their place in a queue**.

Introduction

The word 'triage' comes from the French word 'trier' (meaning 'to sort'). It is the process by which patients presenting to a health facility with an illness or injury are assigned a clinical priority. It is an essential step in clinical risk management, as it means that, if done correctly, those patients who are most in need of care receive it first. Triage should have a robust mechanism to ensure that patients at imminent risk of death or who are seriously ill or injured, requiring immediate resuscitation or emergency management, are provided with treatment before patients with conditions that are less critical, who can wait for further assessment and treatment.

Triage divides patients into the following three categories:

1 those who are at imminent risk of death, and require immediate resuscitation
2 those who are seriously ill or injured, and who need timely emergency management
3 those who have conditions which can wait before further assessment and possible treatment.

Of course, it is not always immediately apparent which category a patient is in, so most methodologies are based on a rapid physiological assessment of vital functions (airway and breathing, circulatory status and conscious level).

The models of decision making, of which there are many, require three steps:

1 rapid initial assessment
2 determination of the appropriate categories
3 selection of the most appropriate category.

Triage scheme for children and pregnant women

Rapid initial assessment

When a woman or girl who is or might be pregnant presents to a health facility she is of immediate concern and should be given priority through triage without disadvantaging seriously affected men or older women. Infants and children can also become dangerously ill quickly, and therefore need urgent triage.

This process requires the ability to recognise, first, those patients who need resuscitation **(immediate management, group 1, 'red')**, and, second, those who need **urgent treatment (group 2, 'orange')** (*see* Table 1.10.1). This process must take only a few seconds, as any delay can be fatal.

TABLE 1.10.1 A possible triage scale (adapted from the Advanced Life Support Group)

Triage number	Type of action	Colour	Maximum target time to action (minutes)
Category 1	Immediate	Red	0
Category 2	Urgent	Orange	15
Category 3	Non-urgent	Green	60 (1 hour)

From the moment of arrival at the health facility (some information may be given before arrival, by contact between the ambulance crew and the facility), a decision on those who need resuscitation must be made. The decision making is based on the clinical signs listed in the second column of Tables 1.10.2 and 1.10.3.

Once a triage category has been identified, the patient should have observations of respiration rate and characteristics (e.g. wheeze, stridor, recession), pulse rate, blood pressure, temperature and a rapid measure of conscious level, such as AVPU score (Alert, responds to Voice, responds to Pain, Unconscious; *see* Sections 1.11 and 1.12), measured and recorded.

Table 1.10.2 (for pregnant women) and Table 1.10.3 (for infants and children) show those features which, on rapid examination, determine that immediate resuscitation is required.

TABLE 1.10.2 Clinical signs on simple observation or from the history which indicate the need for immediate resuscitation in pregnant mothers

Underlying mechanism	What does the healthcare worker undertaking triage see in the patient or hear from the relatives?
A problem that is obstructing, or might obstruct, the upper airway A: AIRWAY	The patient is unconscious The patient is fitting or has been fitting There is major trauma to the face or head, including burns There is severe stridor or gurgling in the throat
Any problem producing apnoea, severe respiratory distress or cyanosis B: BREATHING	The patient is not breathing The patient is gasping The patient is cyanosed The patient is having so much difficulty breathing that they cannot speak
Any problem producing cardiac arrest, shock or heart failure C: CIRCULATION	The patient has heavy vaginal bleeding The patient has suffered major trauma The patient appears shocked (very pale/white, cannot sit up, has a reduced conscious level)

TABLE 1.10.3 Clinical signs on simple observation or from the history which indicate the need for immediate resuscitation in infancy and childhood

Underlying mechanism	What does the healthcare worker undertaking triage see in the patient or hear from the parents?
A problem that is obstructing, or might obstruct, the upper airway A:AIRWAY	The patient is unconscious The patient is fitting or has been fitting There is major trauma to the face or head, including burns There is severe stridor or gurgling in the throat The child has inhaled a foreign body which is still in the throat
Any problem producing apnoea, severe respiratory distress or cyanosis B: BREATHING	The patient is not breathing The patient is gasping The patient is cyanosed The patient is having so much difficulty breathing that they cannot speak or vocalise (cry)
Any problem producing cardiac arrest, shock or heart failure C: CIRCULATION	The patient has suffered major trauma The patient appears shocked (very pale/white, cannot sit up, weak, very rapid or absent pulse, and has a reduced conscious level)

Tables 1.10.4 and 1.10.5 list those features which indicate the need for urgent management (orange) within 15 minutes.

TABLE 1.10.4 Clinical signs on simple observation or from the history in a pregnant mother which indicate the need for urgent management but not resuscitation

Underlying mechanism	What does the healthcare worker undertaking triage see or hear from the patient or the relatives?
A problem that might obstruct the upper airway in the future A: AIRWAY	There is trauma to the face or head, or burns to this area, but the patient is conscious and able to speak Ingestion or accidental overdose of drugs which may alter the conscious level?
A problem producing respiratory distress B: BREATHING	The patient has difficulty breathing but can speak, and there is no cyanosis
Any problem that might, unless rapidly treated, lead to shock or heart failure C: CIRCULATION	The patient has vaginal bleeding which is heavy*, but is not yet shocked (they are able to stand or sit up and speak normally) The patient has suffered major trauma and is not yet shocked, but may have internal bleeding (they are able to stand or sit up and speak normally) Any burns covering more than 10% of the body The patient has fainted and has abdominal pain (this includes possible ruptured ectopic pregnancy) but they are now able to stand or sit up and speak normally The patient has passed products of conception and is still bleeding, but is not shocked (they are able to stand or sit up and speak normally) The patient has severe abdominal pain, but is not shocked (they are able to stand or sit up and speak normally) The patient is extremely pale, but is not shocked (severe anaemia) (they are able to stand or sit up and speak normally)
Possible severe pre-eclampsia and impending eclampsia	The patient is complaining of a headache and/or visual disturbance
Severe dehydration	The patient is complaining of severe diarrhoea/vomiting and is feeling very weak, but is not shocked (they are able to stand or sit up and speak normally)
Possible complication of pregnancy	The patient has abdominal pain not due to uterine contractions of normal labour
Possible premature labour	The patient is not yet due to deliver, but has had ruptured membranes (with or without contractions)
Infection that might become dangerous	The patient has a high fever > 38°C (they are hot to touch or shivering, but are able to stand or sit up and speak normally)
Possible intrauterine death	After 24 weeks of pregnancy the patient has not felt fetal movements for 24 hours or more
Prolapsed cord	The patient says that her membranes have ruptured and she can feel the umbilical cord

*Heavy bleeding is defined as a clean pad or cloth becoming soaked within less than 5 minutes.

Note that a low blood pressure in a pregnant woman or a child is a late and ominous sign.

Helping to ensure that triage works well

The following actions will help to prevent life-threatening delays:

1 Train all staff (including clerks, guards, door keepers and switchboard operators) to recognise those who need resuscitation.
2 Practise triage and the structured approach to emergencies with all staff in the facility.
3 Ensure that access to care is never blocked. Emergency equipment must always be available (not locked away) and in working order. This requires daily checks and the keeping of logbooks. Essential emergency drugs must be constantly available.
4 Give proper training of appropriate staff in the use of the equipment and drugs required.
5 A special trolley containing equipment and drugs for emergencies must be available at all times.
6 Protocols on the structured approach to emergencies (see below) must be available. Pathways of emergency care should be prominently displayed on the walls in areas where emergencies are managed.
7 Implement systems by which patients with emergencies can be exempted from payment, at least temporarily. These include local insurance schemes and health committee emergency funds. This exemption must be made known to all gatekeepers and security staff.

Special priority signs

Haemorrhage

Haemorrhage is a feature of many presentations, particularly in pregnancy and following trauma.

Category 1 patients (red) are those who are exsanguinating. Death will occur quickly if the bleeding is not arrested.

A haemorrhage that is not rapidly controlled by the application of sustained direct pressure, and which continues to bleed heavily or soak through large dressings quickly, should also be treated **immediately (Category 1, red)**.

TABLE 1.10.5 Clinical signs on simple observation or from the history in an infant or child which indicate the need for urgent management but not resuscitation

Underlying mechanism	What does the healthcare worker undertaking triage see or hear from the patient or relatives?
A problem that might obstruct the upper airway in the future A: AIRWAY	There is trauma to the face or head, or burns to this area, but the patient is conscious and able to speak/cry An overdose of respiratory depressant substance has or may have been taken
A problem producing respiratory distress B: BREATHING	The patient has difficulty in breathing but can speak/cry and there is no cyanosis
Any problem that might, unless rapidly treated, lead to shock or heart failure C: CIRCULATION	The patient has suffered major trauma and is not yet shocked, but may have internal bleeding (they are able to stand or sit up and speak/cry normally) Any burns covering more than 10% of the body The patient has fainted and has abdominal pain (a post-pubertal girl might have a ruptured ectopic pregnancy) but they are able to stand or sit up and speak/cry normally The patient has severe abdominal pain but is not shocked (they are able to stand or sit up and speak/cry normally) The patient is extremely pale but not shocked (severe anaemia) (they are able to stand or sit up and speak/cry normally)
Severe dehydration	The patient has severe diarrhoea/vomiting and is feeling very weak, but is not shocked (they are able to stand or sit up and speak/cry normally); the eyes may be sunken and a prolonged skin retraction time will be present
Infection that might become dangerous	The patient has a high fever > 38°C (they are hot to touch or shivering, but are able to stand or sit up and speak/cry normally)
The child shows evidence of severe malnutrition	Any child with visible severe wasting (especially of the buttocks), and swelling (oedema) of both feet, who is unwell or considered unwell by their parents, but is able to stand or sit up
Any neonate or young infant (less than 2 months old) who is unwell	**This indicates a possibility of dangerous sepsis**

Conscious level

Category 1 or immediate priority (red) includes all unconscious patients (U or P on the AVPU scale).

In patients with a history of unconsciousness or fitting, further dangerous events are possible. Those who respond to voice are categorised as **Category 2 urgent (orange)**.

Pain

Patients with severe pain should be allocated to **Category 1 immediate (red)**, and those with any lesser degree of pain should be allocated to **Category 2 urgent (orange)**.

For patients who have sustained **significant trauma or other surgical problems**, anaesthetic and surgical help is required **urgently**.

If there is an **urgent referral** from another healthcare facility or organisation, the patient must be seen **immediately** or **urgently**, depending on the circumstances.

Importance of regular reassessment

Triage categories may change as the patient deteriorates or gets better. It is important, therefore, that the process of triage (clinical prioritisation) is dynamic rather than static.

To achieve this, all clinicians involved in the pathway of care should rapidly assess priority whenever they encounter the patient. Changes in priority must be noted, and the appropriate actions taken.

All patients with symptoms or signs in the **immediate (red)** or **urgent (orange)** categories represent emergencies or potential emergencies, and need to undergo the structured approach to emergencies as outlined in Section 1.11.

Non-urgent cases

Proceed with assessment and further treatment according to the patient's needs once the immediate and urgent patients have been stabilised.

1.11 Structured approach to managing emergencies in pregnancy and childhood

Approach to emergencies

Training

Members of the clinical team must know their roles. They will ideally have trained together in:

- clinical situations and their diagnoses and treatments
- drugs and their use, administration and side effects
- emergency equipment and how it functions.

The ability of a facility to deal with emergencies should be assessed and reinforced by the frequent practice of emergency drills.

Initial management

- Stay calm.
- **Do not leave the patient unattended.**
- Have a team leader in charge to avoid confusion.
- **Shout for help.** Ask one person to go for help and another to get emergency equipment and supplies (e.g. oxygen cylinder and emergency kit). Ideally resuscitation equipment and drugs should be available on one dedicated trolley.
- Assess and resuscitate in sequence using the structured approach – **Airway, Breathing, Circulation, Disability (Neurological Status)** (see below).
- If the patient is conscious, ask what happened and what symptoms they have.
- **Constantly reassess the patient**, particularly after any intervention.

Structured approach to any pregnant woman, infant or child presenting as an emergency

Approach emergencies using the structured ABCD (Airway, Breathing, Circulation, Disability) approach, which ensures that all patients with a life-threatening or potentially life-threatening problem are identified and managed in an effective and efficient way whatever their diagnosis or pathology.

The structured approach to the seriously ill patient, which is outlined here, allows the health worker to focus on the appropriate level of diagnosis and treatment during the first hours of care. Primary assessment and resuscitation are concerned with the maintenance of vital functions and the administration of life-saving treatments, whereas secondary assessment and emergency treatment allow more specific urgent therapies to be started.

Secondary assessment and emergency care require a system-by-system approach in order to minimise the risk of significant conditions being missed.

Following cardiac and/or respiratory arrest, the outcome both for pregnant women and for children is poor. Earlier recognition and management of potential respiratory, circulatory or central neurological failure which may progress rapidly to cardiac and/or respiratory arrest will reduce mortality and secondary morbidity. The following section outlines the physical signs that should be used for the rapid primary assessment, resuscitation, secondary assessment and emergency treatment of pregnant women, and of babies and children.

Primary assessment and resuscitation involves sequential assessment and resuscitation of vital functions – Airway, Breathing and Circulation.

If there are no life-threatening signs, the primary assessment can be completed within about 1 minute. If life-threatening signs are identified, resuscitation procedures are required.

If you are working on your own and have been unable to summon help, you must resuscitate Airway before Breathing, and Breathing before Circulation. This is because oxygen cannot be carried around in the blood to the vital organs if the blood is not oxygenated first, and the lungs cannot oxygenate the blood if there is no airway to allow air containing oxygen to enter the lungs.

If assistance is available, one person can deal with Airway, another with Breathing and a third with Circulation, all working simultaneously, but there must be a 'team leader' to take overall control.

During resuscitation, interventions that are either life-saving or designed to prevent the patient reaching a near-death situation are performed (see below). These include such procedures as basic airway opening procedures, suction, oropharyngeal airway insertion, intubation, assisted ventilation, venous cannulation and fluid resuscitation (when safe and appropriate). At the same time, oxygen is provided to all patients with life-threatening Airway, Breathing or Circulatory problems, vital signs are recorded, and essential monitoring is established.

This sequential primary assessment and any necessary resuscitation occur **before** any illness-specific diagnostic assessment or treatment takes place. Once the patient's vital functions are working safely, secondary assessment and emergency treatment can begin.

After each intervention, its effects should be tested by reassessment. Regular reassessments are a key component of the structured approach.

During **secondary assessment**, illness-specific pathophysiology is sought and emergency treatments are instituted. Before embarking on this phase, it is important that the resuscitative measures are fully under way. During the secondary assessment, vital signs should be checked frequently to detect any change in the patient's condition. If there is deterioration, primary assessment and resuscitation should be repeated in the in the 'Airway, Breathing, Circulation' sequence.

Primary assessment and resuscitation

Assessment and resuscitation occur at the same time. The order of assessment and resuscitation enables identification of immediately life-threatening problems, which are treated as they are found.

A rapid examination of vital ABC functions is required. **If at any stage a life-threatening A, B, or C problem is identified:**

CALL FOR HELP.

After ABC, always assess for neurological problems, and resuscitate their components (sometimes referred to as 'D' for disability of the ABC approach).

Primary assessment and resuscitation of airway

The first priority is establishment or maintenance of airway opening. If there is a need for resuscitation in a patient who is bleeding (e.g. in cases of massive postpartum haemorrhage or trauma), try to stop this at the same time as you are opening the airway.

PRIMARY ASSESSMENT
LOOK – for chest or abdominal movement.
LISTEN – for breath sounds.
FEEL – for breath.
Talk to the patient.
A patient who can speak or cry has a clear airway.

Signs associated with airway obstruction may include any of the following:

- an absence of breathing
- stridor, snoring, or gurgling in the throat
- cyanosis
- chest wall recession
- agitation, reduced consciousness, or coma.

Be alert for foreign bodies (*see* Section 1.12 on choking).

Airway obstruction is most commonly due to obstruction by the tongue in an unconscious patient.

Resuscitation

Open the airway and keep it open.

If there is no evidence of air movement, open the airway using the following:

- a head tilt, chin lift or jaw thrust manoeuvre (*see* Section 1.12 on basic life support). If this opens the airway and breathing starts, keep the airway open manually until it can be secured. Be careful when using head tilt if the cervical spine is at risk, but **opening the airway is always the priority**
- suction/removal of blood, vomit or a foreign body.

If there is no improvement after adjusting the airway manually and trying different techniques, place **an oropharyngeal airway**, which may be helpful **if the patient is unconscious and has no gag reflex**. Avoid using a nasopharyngeal airway if there is any suspicion of base of skull injury.

If the airway is still obstructed, a definitive airway by intubation or surgical airway may be needed.

Give oxygen to all patients.

Be careful not to distress young children with partial upper airway obstruction due to infections such as epiglottitis and severe croup, as this may precipitate acute worsening of their airway obstruction. Having a parent or other known adult present will help to keep the child calm.

Identify the 'at-risk' airway

Reassess the airway after any airway-opening manoeuvres. If there continues to be no evidence of air movement, then airway opening can be assessed by performing an airway-opening manoeuvre while giving rescue breaths. Proceed to Breathing (see below).

Advanced airway management

Advanced airway management techniques for securing the airway by **intubation** may be required in patients with any of the following:

- persistent airway obstruction
- altered level of consciousness, with failure to protect the airway, especially from vomiting
- facial trauma, including burns, penetrating neck trauma with expanding haematoma, and severe head injury (*see* Section 7).

This should be performed by skilled professionals such as an anaesthetist (if available) (*see* Section 1.24 for details). The following sequence should be followed:

1 pre-oxygenation with 100% oxygen with manual lung inflation if required
2 administration of a carefully judged, reduced dose of an anaesthetic induction agent
3 application of cricoid pressure
4 suxamethonium 1–2 mg/kg
5 intubation with a correctly sized tracheal tube.

Confirmation of correct placement of the tube

Signs such as chest movement and auscultation remain helpful, but are occasionally misleading, especially in inexperienced hands. The most important point is to see the tube pass through the vocal cords. The correct size is a tube that can be placed easily through the cords with only a small leak. Intubation of the right main bronchus is best avoided by carefully placing the tube only 2–3 cm below the cords and noting the length at the teeth before checking by auscultation (best in the left and right lower axillae). Capnography, if available, is a useful adjunct for helping to confirm correct tube placement.

If it is not possible to provide an airway using intubation, a **surgical airway** may be required.

NOTE: It is extremely risky to proceed to Circulation (and IV/IO cannulation) when partial upper airway obstruction is present in young children (e.g. due to epiglottitis, severe croup or a foreign body), as invasive procedures can precipitate complete airway closure. Stabilise the airway first. This will require help from an anaesthetist.

Emergency treatment situations

1 For **severe croup**, nebulised adrenaline can be helpful (5 mL of 1 in 1000). Always give oral steroid as soon as possible (150 micrograms/kg of dexamethasone or 1 mg/kg of prednisolone).
2 For upper airway obstruction due to **anaphylaxis**, nebulised adrenaline (5 mL of 1 in 1000) and IM adrenaline (1 mg IM in pregnancy and 10 micrograms/kg in children).
3 **Inhaled foreign body** (*see* Section 1.12).
4 For **severe bronchiolitis**, clear the nasal airways by using gentle suction.

If the patient has major trauma or postpartum haemorrhage and is obviously bleeding rapidly, to the point of exsanguination (*see* Section 7.3.A), measures to stop the exsanguination must be instituted at the same time as Airway resuscitation.

Throughout primary assessment and resuscitation, protect the cervical spine with a collar, sand bags and tape if the patient is likely to have an unstable cervical spine and if subsequent surgical stabilisation is possible (*see* Section 7.3.A.).

Primary assessment and resuscitation of breathing

An open airway does not guarantee adequate ventilation. The latter requires an intact respiratory centre and adequate pulmonary function augmented by coordinated movement of the diaphragm and chest wall.

Primary assessment

Assess whether breathing is adequate by:

- assessing **effort:**
  - recession
  - rate
  - added noises
  - accessory muscles
  - alar flaring
- assessing **efficacy**:
  - listening for reduced or absent **breath sounds**, or any wheezing, with a stethoscope or ear on chest wall
  - **chest and/or abdominal expansion** (symmetrical or asymmetrical)
  - abdominal excursion
  - SaO_2 if available
- assessing effects on **heart rate**
- assessing effects on **skin colour** (check the possibility of cyanosis)
- assessing effects on **mental status**.

Evidence of life-threatening respiratory difficulty

This includes the following:

1 absence of breathing (apnoea)
2 very high or very low respiratory rates
3 gasping, which is a sign of severe hypoxaemia, and may indicate impending respiratory arrest and death
4 severe chest wall recession, usually with increased respiratory rate, but pre-terminally with a fall in rate
5 severe hypoxaemia (cyanosis)
6 signs of tension pneumothorax (respiratory distress with hyper-resonant percussion) (*see* Section 7.3.A)
7 major trauma to the chest (e.g. tension pneumothorax, haemothorax, flail chest) (*see* Section 7.3.A)
8 signs of severe asthma (severe respiratory distress with wheezing, but a silent chest in severe asthma can be a near-fatal situation).

Evidence of respiratory difficulty which can progress if not treated

This includes the following:

1 increased respiratory rate
2 inspiratory stridor
3 reduced or absent breath sounds on auscultation
4 expiratory wheezing
5 chest expansion (most important), and reduced abdominal excursion
6 pulse oximetry showing oxygen saturation (SaO_2) of less than 94% (normal SaO_2 in a patient at sea level is 94–100% in air).

Fast breathing is caused by either an airway problem, lung disease or metabolic acidosis.

TABLE 1.11.1 Respiratory rates 'at rest' for different age groups

Age (years)	Respiratory rate (breaths/minute)
< 1	30–40
1–2	25–35
2–5	25–30
5–12	20–25
> 12	15–20
In pregnancy	15–20*

* In pregnancy, respiratory rate does not change although tidal volume increases resulting in approximately 50% increase in minute ventilation.

The WHO suggests a breathing rate of 30 per minute or more in pregnancy as evidence of shock.

Care should be taken when interpreting single measurements. Infants can show rates of between 30 and 90 breaths/minute depending on their state of activity. It is more useful to use trends in measurements as an indicator of improvement or deterioration.

WHO definitions of fast breathing in young children are as follows:

- < 2 months: ≥ 60 breaths/minute
- 2–12 months: ≥ 50 breaths/minute
- 12 months to 5 years: ≥ 40 breaths/minute

Slow breathing rates may result from fatigue or raised intracranial pressure, or may immediately precede a respiratory arrest due to severe hypoxaemia.

Other signs of breathing difficulty

Chest wall recession

- Intercostal, subcostal or sternal recession reflects increased effort of breathing, which is seen in particular in infants, who have more compliant chest walls.
- The degree of recession indicates the severity of respiratory difficulty.
- In the patient with exhaustion, chest movement and recession will decrease.

Inspiratory or expiratory noises

- Stridor, usually inspiratory, indicates laryngeal or tracheal obstruction.
- Wheeze, predominantly expiratory, indicates lower airway obstruction.
- Volume of noise is not an indicator of severity.

Grunting

- This is observed in infants and children with stiff lungs to prevent airway collapse (it represents the noise made by closure of the larynx during expiration, which is the body's attempt to increase lung volume).
- It is a sign of severe respiratory distress.

Accessory muscle use

- In infants, the use of the sternocleidomastoid muscle creates 'head bobbing' and does not help ventilation.
- Flaring of the alae nasi is also seen in infants with respiratory distress.

Exceptions

Increased effort of breathing does not occur in three circumstances:

1 exhaustion
2 central respiratory depression (e.g. from raised intracranial pressure, poisoning or encephalopathy)
3 neuromuscular disease (e.g. poliomyelitis).

Effects of breathing failure on other physiology

Heart rate: this is increased with hypoxia, but decreases when hypoxia is severe, when bradycardia is a sign of impending cardiorespiratory arrest.

Skin colour: hypoxia first causes vasoconstriction and pallor. Cyanosis is a late sign and may indicate impending cardiorespiratory arrest. In an anaemic patient it may never be seen, however hypoxic the patient is.

Mental status: hypoxia causes initial agitation, then drowsiness, followed by loss of consciousness.

Resuscitation of breathing

In the patient with absent or inadequate breathing, it is essential to breathe for the patient using:

- mouth-to-mouth or mouth-to-mouth-and-nose ventilation, *or*
- bag-valve-mask ventilation: if using oxygen, add a reservoir to increase the oxygen concentration.

Intubate (if skilled professionals are available) and provide assisted ventilation through the tube if long-term ventilation is needed or bag–mask ventilation is ineffective.

However, do not persist with intubation attempts without ventilating the patient intermittently with a bag and mask as necessary to prevent hypoxaemia during the intubation process.

Give high-flow oxygen to all patients with respiratory difficulty.

Give as much oxygen as possible through a mask with a reservoir bag to any patient who is breathing but has respiratory difficulty or the other signs of hypoxia (e.g. cyanosis).

Situations in which emergency treatment is given

1 Perform **needle thoracocentesis** if the diagnosis is tension pneumothorax (*see* Figure 8.3.1). This should be followed by a chest drain.
2 Consider inserting a chest drain if there is major trauma to the chest (*see* Figure 8.3.2).
3 Give **nebulised salbutamol** if the patient has severe, life-threatening asthma (2.5 mg for children < 5 years of age, or 5 mg for children > 5 years of age and pregnant mothers). If a nebuliser is not available, use a spacer and metered-dose inhaler (100 micrograms/puff; 10 puffs initially for all age groups).
4 Give **nasal continuous positive airway pressure (CPAP)** if a neonate has severe respiratory distress (*see* Section 8.3).
5 Give **IM adrenaline** (1 mg in pregnancy and 10 micrograms/kg in children) and **nebulised salbutamol** (see above) if wheezing is due to anaphylaxis.
6 Give **anticoagulant** (IV unfractionated heparin) if pulmonary embolus is diagnosed in pregnancy or post delivery (*see* Section 2.5.H).
7 Give **calcium gluconate** (10 mL 10% IV over 10 minutes) if respiratory arrest is due to magnesium toxicity in a patient treated for eclampsia with magnesium sulphate.

Primary assessment and resuscitation of circulation

Primary assessment

The circulatory system is more difficult to assess than airway and breathing, and individual measurements must not be over-interpreted.

If there is no palpable pulse, a very slow heart rate (< 60 beats/minute in an infant, or < 40 beats/minute in a child or pregnant woman) or no 'signs of life' (e.g. movements, coughing, normal breathing), cardiac arrest or near-cardiac arrest is likely, and basic life support must be started (*see* Section 1.12).

Agonal gasps (irregular, infrequent breaths) do not provide adequate oxygenation and are not for these purposes a 'sign of life'.

In addition to cardiac arrest or near-arrest, shock and heart failure are additional life-threatening issues that it is important to identify.

Shock

The following clinical signs can help to identify shock (inadequate circulation) (*see* Sections 2.5.A and 5.5.A).

TABLE 1.11.2 Heart rates 'at rest' at different ages

Age (years)	Heart rate (beats/minute)
< 1	110–160
1–2	100–150
2–5	95–140
5–12	80–120
> 12	60–100
Pregnancy	70–115*

* The heart rate in pregnancy increases by 10–15 beats per minute.

Heart rate

- Heart rate increases in shock and heart failure.
- Severe bradycardia due to hypoxaemia may be a sign of near cardiorespiratory arrest.

The **WHO definition of tachycardia** is a heart rate of > 160 beats/min in children aged under 1 year, and > 120 beats/minute in those aged 1–5 years.

The WHO defines a heart rate in pregnancy of 110 beats per minute or more as evidence of shock.

Pulse volume

Absent peripheral pulses or reduced strength of central pulses can signify shock.

Capillary refill time (CRT)

- Pressure on the centre of the sternum or fingernail for 5 seconds should be followed by return of the circulation to the skin within 3 seconds or less. CRT may be prolonged by shock, cold environment, or the vasoconstriction that occurs as a fever develops.
- Prolonged CRT is not a specific or sensitive sign of shock, and should not be used alone as a guide to the need for or the response to treatment.

Blood pressure

- The cuff should cover at least 80% of the length of the upper arm, and the bladder should be more than two-thirds of the arm's circumference. In pregnant mothers, the largest possible cuff should be used to avoid missing a raised blood pressure.
- Korotkoff phase 5 (K5, disappearance of sound) should be used to measure diastolic pressure. Korotkoff phase 5 (K5A, muffling or softening of sound) should only be used if the sound does not disappear until near to zero cuff pressure.
- In pregnancy the patient should ideally be sitting or lying in the lateral tilt positions when pressure is measured. In both of these positions, the cuff must be level with the heart.
- Hypotension is a late sign of circulatory failure in both children and pregnant mothers, and will be rapidly followed by cardiorespiratory arrest unless it is treated urgently.

TABLE 1.11.3 Systolic and diastolic blood pressure in children

Age (years)	Systolic blood pressure (mmHg) 5th centile	Systolic blood pressure (mmHg) 50th centile
< 1	65–75	80–90
1–2	70–75	85–95
2–5	70–80	85–100
5–12	80–90	90–110
> 12	90–105	100–120

Blood pressure may be difficult to measure and interpret, especially in infants and children under 5 years of age. The following formula can be used to calculate average systolic blood pressure in children (50th centile):

$$85 + (2 \times \text{age in years})$$

WHO defines normal adult BP as 120/80 mmHg. Blood pressure falls early in pregnancy due to a decrease in systemic vascular resistance. It is usually 10 mmHg below baseline and reaches a lowest mean value of 105/60 mmHg in the second trimester. During the third trimester it gradually returns to the pre-pregnancy level at term.

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.

The WHO suggests a systolic BP of < 90 mmHg in pregnancy as evidence of shock. A systolic BP < 95 mmHg should prompt a search for other possible indicators of developing shock.

The cardiovascular system in children and pregnant mothers compensates well initially in shock.

Hypotension is a late and often sudden sign of decompensation and, if not reversed, will be rapidly followed by death. Serial measurements of blood pressure should be performed frequently.

Effects of circulatory failure on other organs

Respiratory system: tachypnoea and hyperventilation occur as a result of the acidosis caused by poor tissue perfusion.

Skin: pale or mottled skin indicates poor perfusion.

Mental status: circulatory failure causes initial agitation, then drowsiness, followed by unconsciousness.

Urine output: a reduction in urine output to < 2 mL/kg/hour in infants, < 1 mL/kg/hour in children or < 30 mL/hour in pregnant mothers indicates inadequate renal perfusion.

In pregnancy: fetal compromise can be the first sign of shock in the mother.

The **WHO definition of shock** is cold hands, *plus* CRT of > 3 seconds, *plus* a weak and rapid pulse.

Life-threatening shock is usually associated with:

- severe tachycardia
- a weak-volume pulse (ideally assess centrally: brachial, femoral or carotid)
- low blood pressure (this is a late sign, and very difficult to measure in young children)
- extreme central pallor (if due to severe anaemia)
- raised respiratory rate (due to acidosis)
- poor skin circulation, with a CRT of > 3 seconds
- reduced conscious level.

Remember that anaphylaxis is one cause of shock, and typically there is a relevant history and other signs such as angio-oedema and urticaria.

Remember that if shock is due to heart failure, fluid overload will be fatal (for information on how to recognise and manage shock caused by heart failure, *see* Section 2.7.A).

Resuscitation in shock

For cardiac arrest or near arrest, **chest compressions** should be undertaken (for information on basic and advanced life support, *see* Sections 1.12 and 1.13).

Ensure that there is an open and secure airway.

Give **high-flow oxygen** to any patient who has an inadequate circulation (whether due to shock or to heart failure). This should be administered via a face mask with a reservoir bag (or an endotracheal tube if intubation has been necessary).

Venous or intra-osseous access should be obtained and blood for essential tests taken (haemoglobin, cross-matching, blood clotting factors, and urea and electrolytes if possible).

Lateral tilt

In pregnancy and after 20 weeks' gestation (whenever the uterus can be palpated abdominally), place the patient in the left lateral tilt position to prevent uterine pressure on the abdominal and pelvic veins stopping blood return to the heart.

In all patients with shock, lie them flat (or tilted) and **elevate the legs**.

Fluids in shock

In most cases of shock, if obvious bleeding is the cause then

the first priority must be to stop this. IV or IO fluids are then required as the immediate resuscitation treatment, once the airway has been opened and secured and oxygen is being given. However, different causes of shock require different approaches to treatment, as described below.

- If loss of fluid causing **hypovolaemia** is the cause of shock: for infants and children give an immediate **IV/IO bolus of 10–20 mL/kg of crystalloid (usually Ringer-lactate or Hartmann's solution)** as appropriate for weight (see below), provided that heart failure is not present (see above). For pregnant women and girls, give an IV bolus **of 500–1000 mL of crystalloid**.

  For a child, weight can be estimated on the basis that birth weight doubles by 5 months, triples by 1 year, and quadruples by 2 years.

  After 12 months of age, the following formula can be applied, but it needs to be modified according to whether the child is small or large compared with the average:

$$\text{weight (kg)} = 2 \times (\text{age in years} + 4)$$

- If the loss of fluid causing shock is due to **severe gastroenteritis**, there will usually be evidence of severe dehydration and a history of profound or long-standing diarrhoea. Give **20 mL/kg of Ringer-lactate or Hartmann's solution as an initial IV or IO bolus** as rapidly as possible, reassess, and then repeat if necessary. In cases of cholera, up to 60 mL/kg might be required in children, and 3 litres in pregnant mothers. Additional potassium will usually be required (*see* Section 5.12.A).
- If the loss of fluid causing shock is due to **bleeding**, which is **one of the commonest causes in pregnancy**, give crystalloid immediately and then try to obtain blood for transfusion as rapidly as possible, ideally fresh blood. Give O-negative blood if this is available.

  The concept of **targeted crystalloid fluid resuscitation** is important and requires urgent research into management if the cause of hypovolaemic shock is haemorrhage due to penetrating injury in trauma or to obstetric haemorrhage such as ruptured ectopic pregnancy. 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 surgery and/or specific medical treatments to stop the bleeding have started to take effect. Fresh blood is particularly useful to combat the coagulopathy that occurs in major blood loss if specific coagulation components such as platelets are unavailable.

  Giving too much IV crystalloid can increase the blood pressure and theoretically increase bleeding by disrupting early clot formation. IV crystalloid also dilutes the red cells (and coagulation factors) in the circulation, but whether or not this could reduce oxygen-carrying capacity requires further research.

  We suggest that when giving boluses of crystalloid in **shock due to bleeding (before blood is available and before procedures undertaken to stop haemorrhage are effective)** in patients with penetrating major trauma or obstetric haemorrhage, only the amount needed to maintain 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 pregnant women or in children who are in shock due to haemorrhage. **Adequate perfusion of vital organs may best be indicated by a radial pulse that can be palpated and a conscious level of A or V on the AVPU scale (i.e. the woman or child is either awake or will respond by opening their eyes when spoken to). During pregnancy, the adequacy of the fetal heart rate may also be helpful.**

  In children under 2–3 years of age, the radial pulse may be difficult to feel and the presence of a palpable brachial pulse may be the best available indicator at present.

  In this situation, therefore, and to maintain a palpable radial pulse in pregnancy, start with IV boluses of 500 mL of crystalloid or ideally blood, and reassess after each bolus.

  In children, in order to maintain a radial or brachial pulse give 10 mL/kg IV boluses of crystalloid or ideally blood, and reassess after each bolus.

  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.
- If shock is due to **septicaemia with purpura** (meningococcus or dengue), give IV or IO boluses of Ringer-lactate or Hartmann's or 0.9% saline as fast as possible, 20 mL/kg in children and 1 litre in pregnant mothers, and then reassess. Usually at least 40 mL/kg in children and 2–3 litres in pregnant mothers will be required to overcome shock (*see* Section 2.5.A). In this situation, **inotropes** may be valuable if they are available and safe to use (*see* Section 2.5.A).
- If shock is due to **anaphylaxis**, give **adrenaline**, 10 micrograms/kg (0.1 mL/kg of 1 in 10 000) IM in children and 1 mg (1 mL of 1 in 1000) IM in pregnant mothers, in addition to IV or IO fluid.
- If shock is due to **diabetic ketoacidosis**, there will usually be evidence of severe dehydration and coma. Give **10 mL/kg of 0.9% saline (or Ringer-lactate or Hartmann's solution) as an initial IV bolus** as rapidly as possible, reassess, and then repeat if necessary. Once shock has been initially managed, give fluid more cautiously, as overloading can cause cerebral oedema and death in patients with this condition.
- If shock is due to **severe anaemia**, IV crystalloid boluses such as Ringer-lactate or Hartmann's solution must be given with extreme care (due to the risk of heart failure). As soon as possible, give blood carefully (10 mL/kg in children and 50 mL in pregnant mothers, over 15 minutes) and then reassess and repeat if it is safe to do so.

  Partial exchange transfusion may be helpful in this situation, especially if it is possible to access a large superficial vein in the antecubital fossa. Successively remove 20-mL aliquots of the patient's blood and replace each 20 mL with 40 mL of packed donor red blood cells until shock has resolved.

Heart failure

This life-threatening situation can be seen in severe anaemia, after fluid overload, in the presence of structural heart disease and with severe hypertension (usually in pregnancy). It is important to distinguish heart failure from

shock, as the resuscitation required is different. Some of the following signs will be present in heart failure:

- tachycardia out of proportion to respiratory difficulty
- severe palmar pallor (if anaemia is the cause)
- raised jugular venous pressure
- gallop rhythm on auscultation of the heart
- some heart murmurs (if structural heart defect is responsible)
- an enlarged, sometimes tender, liver
- crepitations on listening to the lung bases
- cyanosis that does not respond to oxygen in the case of infants with cyanotic congenital heart disease.

In pregnancy, **severe hypertension** can cause heart failure (check the blood pressure; patients with values above 170/110 mmHg can present with heart failure).

Resuscitation for heart failure

1 **Sit the patient up.**
2 Give **oxygen**.
3 Give **furosemide** 1–2 mg/kg by IV/IO injection in children and 40 mg IV in pregnant mothers.
4 Consider giving **morphine** (50 micrograms/kg in children and 3 mg in pregnant mothers), and reassess. Morphine should be used with caution, especially in patients with altered mental status and impaired respiratory drive.
5 If the patient has severe anaemia, consider **exchange transfusion**.

Situations where emergency treatment is given in heart failure with shock

1 **Supraventricular tachycardia (usually in a child)** can cause both shock and heart failure. The heart rate will be > 180 beats/minute, and in infants can reach > 220 beats/minute. If available, ECG will confirm tachycardia. Treat by **vagal manoeuvres**, defibrillation if available, or adenosine if rapid IV access is available (*see* Section 5.4.C).
2 In **ventricular tachycardia**, defibrillation is needed if shock is present (*see* Section 1.13).
3 If **congenital** or **rheumatic heart disease** or **cardiomyopathy** is the cause of heart failure, inotropes or digoxin may be appropriate, but specialist advice will be needed.
4 If cyanotic congenital heart disease in the newborn is the cause of shock, give prostaglandin E2, but specialist paediatric advice will be necessary (*see* Section 5.4.A).

Primary assessment and resuscitation of neurological failure (disability)

Always assess and treat Airway, Breathing and Circulation problems before undertaking neurological assessment.

Primary assessment

Conscious level: AVPU

Alert is the normal state for an awake person. If the patient does not respond to **Voice** (i.e. being spoken to and asked 'Are you all right?'), it is important that assessment of the response to **Pain** is undertaken next. A painful central stimulus can be delivered by sternal pressure, by supraorbital ridge pressure or by pulling frontal hair. A patient who is **Unresponsive** or who only responds to pain has a significant degree of coma which can seriously interfere with vital Airway and Breathing functions.

Fits

Generalised convulsions, also known as 'fits' or 'seizures', can seriously interfere with vital Airway and Breathing functions, both during the fit itself and immediately afterwards, when lowered levels of consciousness may be present.

Posture

Many patients who have a serious illness in any system are hypotonic. Stiff posturing, such as that shown by decorticate (flexed arms, extended legs) or decerebrate (extended arms, extended legs) posturing, is a sign of serious brain dysfunction. **These postures can be mistaken for the tonic phase of a convulsion.** Alternatively, a painful stimulus may be necessary to elicit these postures.

Severe extension of the neck due to upper airway obstruction can mimic the opisthotonus that occurs with meningeal irritation. In infants, a stiff neck and full fontanelle are signs that suggest meningitis.

Pupils

Many drugs and cerebral lesions have effects on pupil size and reactions. However, the most important pupillary signs to seek are dilatation, unreactivity and inequality, which suggest possible serious brain disorders.

Always check blood glucose levels or suspect hypoglycaemia in any unwell infant or young child, especially if they have impaired consciousness.

Hypoglycaemia with a blood glucose level of less than 2.5 mmol/L (45 mg/dL) can cause impaired consciousness, coma or fits.

Respiratory effects of central neurological failure

The presence of any abnormal respiratory pattern in a patient with coma suggests mid- or hindbrain dysfunction.

Circulatory effects of central neurological failure

Systemic hypertension with sinus bradycardia (Cushing's response) indicates compression of the medulla oblongata caused by herniation of the cerebellar tonsils through the foramen magnum. **This is a late and pre-terminal sign.**

Raised intracranial pressure (ICP) may cause:

- hyperventilation
- slow sighing respirations
- apnoea
- hypertension
- bradycardia.

Resuscitation

1 If the patient is unconscious (P or U on the AVPU scale) but their airway and breathing are adequate, place them in the **recovery position**, so that if they vomit there is less likelihood of aspiration because when unconscious, the gag reflex may not be operative.
2 If the patient is unconscious or fitting, **always give oxygen**.
3 If **hypoglycaemia** is a cause of reduced consciousness (or a suspected cause, but immediate blood glucose measurements are not possible), treatment with glucose is urgently required. Give 2–5 mL/kg of 10% glucose IV or IO in children (*see* Section 5.8.B) and 100 mL of 25% glucose IV or IO in pregnant mothers. (Make 100 mL of 25% glucose by adding 50 mL of 50% glucose to 50 mL of Ringer-lactate or Hartmann's solution).

If IV or IO access is not immediately available in a

child, give sublingual sugar, 1 teaspoonful moistened with 1 to 2 drops of water. **Children should be monitored for early swallowing which leads to delayed absorption, and in this case another dose of sugar should be given.** Continue to attempt IV or IO access, as parenteral glucose is a more reliable method of treating hypoglycaemia.

If sublingual sugar is given, repeat the doses at 20-minute intervals.

Recheck the blood glucose level after 20 minutes, and if the level is low (< 2.5 mmol/litre or < 45 mg/dL), repeat the IV/IO glucose (5 mL/kg) or repeat the sublingual sugar.

4 If fitting occurs in pregnancy, give **magnesium sulphate** (*see* Section 2.5.E).

5 If fitting occurs in an infant or child and continues in your presence for more than 5 minutes and there is no hypoglycaemia, give **IV or rectal anticonvulsants**. Always make sure that a bag and mask are available in case the patient stops breathing, which is a possibility. Commonly used anticonvulsants in this situation are diazepam or, if there is no IV access, rectal diazepam, rectal paraldehyde or buccal midazolam (*see* Section 5.16.E).
   - IV or IO diazepam: 250 micrograms/kg IV over 5 minutes
   - rectal diazepam: 500 micrograms/kg
   - rectal paraldehyde: 0.4 mL/kg
   - buccal midazolam: 300 micrograms/kg.

6 To gain time in **acutely raised intracranial pressure** (e.g. in cases of head injury), consider the use of IV **mannitol**, 250 –500 mg/kg, which will draw fluid out of the brain for a short while, thereby temporarily reducing the ICP. Because the effect of mannitol is only short-lived (a matter of hours), it is used to gain time while definitive care is being set up (e.g. surgical intervention to drain an extradural or subdural haematoma).

7 In any case where **meningitis** or **encephalitis** is suspected, it is vital that suitable antibiotics and/or antiviral drugs are started IV or IO as soon as the condition is suspected (*see* Sections 2.7.E, 3.4, 5.16.B and 5.16.C). Antibiotic choices might include **cefotaxime** or **chloramphenicol**, **penicillin**, **amoxicillin** and **gentamicin** in the newborn. Consider adjunctive treatment with dexamethasone 150 micrograms/kg every 6 hours for 4 days starting before or with the first antibiotic dose. Do not use dexamethasone in cases where there is also septic shock (e.g. in meningococcal disease).

Secondary assessment and emergency treatments

The secondary assessment takes place once vital functions have been assessed and the initial resuscitation of those vital functions has been started. Primary assessment and resuscitation can usually be undertaken in less than 1 minute if the patient does not have a life-threatening airway, breathing, circulation or neurological problem.

Secondary assessment includes a focused medical history, a focused clinical examination and specific investigations. It differs from a standard medical history and examination in that it is designed to establish which emergency treatments might benefit the patient. Time is limited, and a focused approach is essential. At the end of secondary assessment, the practitioner should have a better understanding of the illness or component of injury likely to be affecting the patient, and may have formulated a differential diagnosis. Emergency treatments will be appropriate at this stage – to treat either specific disorders (e.g. asthma) or conditions (e.g. raised intracranial pressure). Emergency treatments will be undertaken at this stage in addition to those given as part of resuscitation/life-saving treatments, in order to manage specific components of serious illnesses or injuries (e.g. steroids for asthma, Caesarean section for antepartum haemorrhage). The establishment of a definite diagnosis is part of definitive care.

The history often provides the vital clues. In the case of infants and children, the history is often obtained from an accompanying parent, although a history should be sought from the child if possible. Do not forget to ask any health worker who has seen the patient about the initial condition and about treatments and the response to treatments that have already been given.

Some patients will present with an **acute exacerbation/complication of a known condition**, such as pregnancy, asthma or epilepsy. Such information is helpful in focusing attention on the appropriate system, but the practitioner should be wary of dismissing new pathologies in such patients. The structured approach avoids this problem. Unlike trauma (*see* Section 7), illness affects systems rather than anatomical areas. The secondary assessment must reflect this, and the history of the complaint should be sought with special attention to the presenting system or systems involved. After the presenting system has been dealt with, all of the other systems should be assessed and any additional emergency treatments commenced as appropriate.

The secondary assessment is not intended to complete the diagnostic process, but rather it aims to identify any problems that require emergency treatment.

An outline of a structured approach in the first hour of emergency management is given below. It is not exhaustive, but addresses the majority of emergency conditions that are amenable to specific emergency treatments in this time period.

The symptoms, signs and treatments relevant to each emergency condition are elaborated further in the relevant sections of the textbook.

Secondary assessment of airway and breathing

TABLE 1.11.4 Airway and breathing: signs and symptoms

Common symptoms	Clinical signs	Emergency investigations
Breathlessness Coryza Tachypnoea Choking Cough Abdominal pain Chest pain Apnoea Feeding difficulties	Bubbly noises in throat Cyanosis Recession Noisy breathing – stridor Drooling and inability to drink Wheeze Tracheal shift Abnormal percussion note	Oxygen saturation Blood culture (if infection is suspected) Chest X-ray (selective)

(*continued*)

Common symptoms	Clinical signs	Emergency investigations
Hoarseness Chest pain	Crepitations on auscultation Acidotic breathing Grunting	ECG (if pulmonary embolus is suspected) (selected and if available)

Examples of emergency treatment for airway and breathing

- If in a young child there is a harsh stridor associated with a barking cough and severe respiratory distress, upper airway obstruction due to **severe croup** should be suspected. **Nebulised adrenaline** will already have been given as resuscitation, but now give **oral prednisolone** as emergency treatment (*see* Section 5.1.A).
- If there is a quiet stridor and drooling in a sick-looking child, consider **epiglottitis** or **bacterial tracheitis**. **Intubation** is likely to be urgently required, preferably by an anaesthetist, and is initial resuscitation if the airway is completely closed. Do not put the airway at risk by performing unpleasant or frightening interventions. **Give intravenous antibiotics as emergency treatment, but only after the airway has been secured** (*see* Section 5.1.A). A surgical airway may also be needed as emergency treatment or as resuscitation if intubation is not possible, so contact a surgeon.
- With a sudden onset and significant history of inhalation, consider a laryngeal foreign body. If the 'choking' protocol has been unsuccessful, the patient may require laryngoscopy (*see* Section 1.12). Do not put the airway at risk by performing unpleasant or frightening interventions, but contact an anaesthetist/ENT surgeon urgently. However, in extreme, life-threatening cases, immediate direct laryngoscopy as part of resuscitation to remove a visible foreign body with Magill's forceps may be necessary.
- Stridor following ingestion or injection of a known allergen suggests **anaphylaxis** (*see* Section 5.1.B). Patients in whom this is likely should have received IM and nebulised adrenaline (**10 micrograms/kg for a child** and 1 mg for an adult) as resuscitation treatment. IV or oral **steroids** would then be part of emergency treatment.
- Patients with a history of asthma or with wheeze, significant respiratory distress and/or hypoxia should receive inhaled salbutamol and oxygen as resuscitation, but then need **oral steroids and further inhaled bronchodilators** as emergency treatment (*see* Section 5.2.B).
- Infants with wheeze and respiratory distress are likely to have bronchiolitis, and require oxygen, as well as clearing of nasal secretions as resuscitation, and **IV or NG fluids** as emergency treatment (*see* Section 5.2.A).
- In acidotic breathing, measure blood glucose levels to confirm diabetic ketoacidosis. A bolus of IV Ringer-lactate or Hartmann's solution will already have been given as resuscitation for any shock due to dehydration, and **insulin** can now be given as emergency treatment (*see* Section 5.8.A).
- In clinically suspected pulmonary embolus in pregnancy, IV **unfractionated heparin** should be given as resuscitation, and subcutaneous **low-molecular-weight heparin** should be given as emergency treatment (*see* Section 2.5.H).

Secondary assessment of circulation

TABLE 1.11.5 Circulation: signs and symptoms

Common symptoms	Signs	Emergency investigations
Haemorrhage Breathlessness Palpitations Feeding difficulties Abdominal pain Chest pain Apnoea Feeding difficulties Hoarseness Drowsiness	Tachycardia or bradycardia Abnormal pulse volume or rhythm Abnormal skin perfusion or colour Haemorrhage or hidden haemorrhage Severe malnutrition Fever Hypotension or hypertension Cyanosis Pallor Enlarged liver Lung crepitations Reduced urine output Cardiac murmur Peripheral oedema Raised jugular venous pressure Gallop rhythm on auscultation of the heart Dehydration Purpuric rash	Oxygen saturation Blood culture (if infection is suspected) Chest X-ray (selective) ECG (selective and if available) Haemoglobin Urea and electrolytes (if available) Clotting studies (if available) Malarial parasites

Examples of emergency treatment for circulation

- Further IV/IO **boluses of fluid** should be considered in shocked patients with hypovolaemia from gastroenteritis or with sepsis who have not shown a sustained improvement in response to the first bolus given at resuscitation (*see* Sections 2.5.A, 5.5.B and 5.5.C).
- However, in trauma, if there is uncontrolled internal bleeding, **early surgical intervention** has priority, and too much IV fluid may be harmful. **Continued blood transfusion** is an emergency treatment after the initial resuscitation (*see* Section 7.3.A).
- Consider **inotropes, intubation and central venous pressure monitoring**, if available, as emergency treatment for shock (*see* Section 2.5.A).
- Consider **IV broad-spectrum antibiotics** as emergency treatment for shock in patients with no obvious fluid loss, as sepsis is likely. Antibiotics are essential if purpura is present, as a diagnosis of meningococcal infection is likely (*see* Section 6.1.G).
- If a patient has a cardiac arrhythmia, the appropriate protocol should be followed after initial resuscitation (*see* Section 5.4.C).
- If anaphylaxis is suspected, IM adrenaline 10 micrograms/kg in children, or 1 mg in pregnant mothers, in addition to fluid boluses, should be given as resuscitation treatment, and **steroids and antihistamines** should be given as emergency treatment (*see* Sections 5.1.B and 2.7.C).
- Targeted treatment is needed for obstetric emergencies

that are known to cause shock. These include sepsis (for which **antibiotics** are needed), and antepartum or postpartum haemorrhage (for which specific treatment including **medication** and **urgent surgery** is needed together with **replacement of lost blood** (*see* Sections 2.5.D.i, iii and iv).

- Surgical advice and interventions for certain gastrointestinal emergencies such as volvulus would constitute emergency treatment. The following symptoms and signs may suggest intra-abdominal emergencies: vomiting, abdominal pain, abdominal tenderness and/or rigidity, lack of bowel sounds, rectal bleeding, abdominal mass (*see* Section 5.19).

Secondary assessment of neurological failure (disability)

TABLE 1.11.6 Neurological failure: signs and symptoms

Common symptoms	Signs	Emergency investigations
Headache Drowsiness Vomiting Behavioural changes Visual disturbance	Altered conscious level Convulsions Bradycardia Altered pupil size and reactivity Abnormal postures Meningism Fever Papilloedema or retinal haemorrhage Altered deep tendon reflexes Hypertension	Blood glucose Oxygen saturation Blood culture (if infection is suspected) Haemoglobin Urea and electrolytes (if available) Malarial parasites

Examples of emergency treatment for neurological failure

- If hypoglycaemia with a blood glucose level of less than 2.5 mmol/L (45 mg/dL) is a possible diagnosis, it will have been treated as part of resuscitation, but the prevention of further hypoglycaemia by IV glucose infusion represents emergency treatment. Remember that there will be a reason for the hypoglycaemia, so further monitoring and treatment are needed until the child is drinking appropriate fluids or has an IV infusion in place through which dextrose can be given.
- If convulsions persist after initial anticonvulsant drugs, treatment with further doses of anticonvulsants (*see* Sections 2.5.E, 2.7.E and 5.16.E) represents emergency treatment.
- If there is evidence of raised intracranial pressure (i.e. decreased conscious level, abnormal posturing and/or abnormal ocular motor reflexes), the patient should receive oxygen and bag-valve-mask ventilation as resuscitation, if they have apnoea or slow or poor breathing. Emergency treatment could include:
  - nursing with head in-line and 20–30 degrees head-up position (to aid cerebral venous drainage)
  - repeat IV infusion with mannitol 250–500 mg/kg over 15 minutes; however, the treatment becomes less effective with each dose (*see* Section 7.3.C)
  - in more long-standing raised ICP, caused by tumours in the brain, dexamethasone will help to reduce raised ICP for a few days while specialist neurosurgical intervention is sought, or as palliation (*see* Section 5.14). The initial dose is 25 mg for patients over 35 kg and 20 mg for patients less than 35 kg, followed by a sliding scale of 4 mg every 3 hours for 3 days, then every 6 hours for 1 day, and continuing to decrease by 1–2 mg per day.
- In patients with a depressed conscious level or convulsions, antibiotics are urgently required, but then consider encephalitis and give acyclovir as appropriate, as emergency treatment (*see* Sections 2.7.E and 5.16.C).
- In unconscious patients with pinpoint pupils, consider the possibility of opiate poisoning. After supporting breathing if necessary, a trial of naloxone should be given as emergency treatment (*see* Section 1.15).

Developmental and family history

Particularly in a small child or infant, knowledge of the child's developmental progress and immunisation status may be useful. The family circumstances may also be helpful, and asking about these may sometimes prompt parents to remember other details of the family's medical history.

Drugs and allergies

Any medication that the patient is currently taking, or has taken, should be recorded. In addition, if poisoning is a possibility, ask about any medication in the home that a child might have had access to. A history of allergies should be sought.

1.12 Basic life support for children and pregnant mothers

Introduction

Basic life support (BLS) is a technique that can be employed by one or more rescuers to support the respiratory and circulatory functions of a collapsed patient using no or minimum equipment.

Resuscitation from cardiac arrest in pregnant women and in children

The international guidelines for resuscitation from cardiac arrest (European Resuscitation Council, 2010) detail two approaches to basic life support. One is for adults and the other for children.

The 'adult' programme is predicated on resuscitation from a sudden cardiac event (e.g. ventricular fibrillation from a coronary occlusion) in a patient who was ventilating before the event and therefore has oxygen in their blood. In this group, chest compressions to move the oxygenated blood into the coronary and cerebral arteries are of prime importance, and therefore the rescuer's sequence of actions after assessment starts with chest compressions, not rescue breaths.

The sequence of actions in the 'child' programme is predicated on a hypoxic event (including any respiratory failure or obstruction, or hypoxia at a cellular level as seen in shock). In this type, re-establishing oxygenation is of prime importance, and moving the oxygenated blood to the coronary and cerebral arteries is the second step. Therefore the rescuer's sequence of actions after assessment starts with rescue breaths and then moves on to chest compressions.

The 'child'-type cardiac arrest is seen in almost all children (excluding those rare arrhythmic events in children with congenital or acquired heart disease and those in whom sudden, unexpected collapse is preceded by apparent normal respiratory and circulatory function), and in adults who have a terminal acute illness involving respiratory or circulatory pathology. This includes patients who have had convulsions, trauma (including drowning), poisoning, bleeding, sepsis, etc.

In addition, international guidelines on resuscitation from cardiac arrest agree that, where possible, guidelines should be simplified as there is evidence that complex guidelines cause 'provider paralysis', resulting in no or poor life-saving effort being made.

In view of the above, the Advanced Life Support Group (ALSG)/Maternal Childhealth Advocacy International (MCAI) programme for resource-limited countries teaches a programme of basic life support for infants, children and pregnant mothers which reflects the known pathologies in these groups (i.e. respiratory and circulatory causes of cardiac arrest) and recognises that the clinicians who provide resuscitation attend patients of all ages.

The sequence taught therefore includes five preliminary rescue breaths and a subsequent ratio of 15:2.

Because of minor differences in technique based on anatomical differences between the groups, children are classified into two groups:

- infants (< 1 year of age)
- children between 1 year of age and puberty.

Basic life support for infants, children and pregnant mothers (*see* Figures 1.12.1 and 1.12.2)

The initial approach: the three S's

Safety: it is essential that the rescuer does not become a second victim. Therefore they should approach the patient with care, and remove the patient from any continuing source of danger if necessary.

Stimulate: ask the question 'Are you all right?' in order to establish the state of consciousness of the patient.

Shout: this is essential because help will be needed.

If more than one rescuer is present, one person should start basic life support. The second person should activate the Emergency Medical Services (EMS) system and then returns to assist in the basic life support effort.

If the patient is an infant or pre-pubertal child, and there

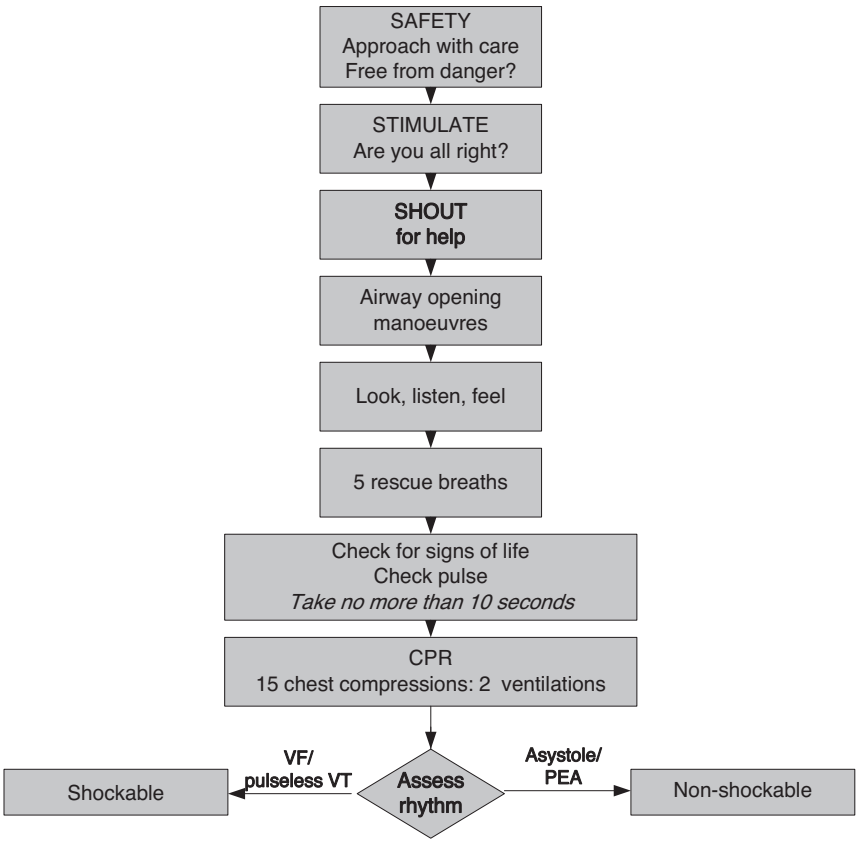


FIGURE 1.12.1 Algorithm for basic life support in infants and children. CPR, cardiopulmonary resuscitation; VF, ventricular fibrillation; VT, ventricular tachycardia; PEA, pulseless electrical activity.

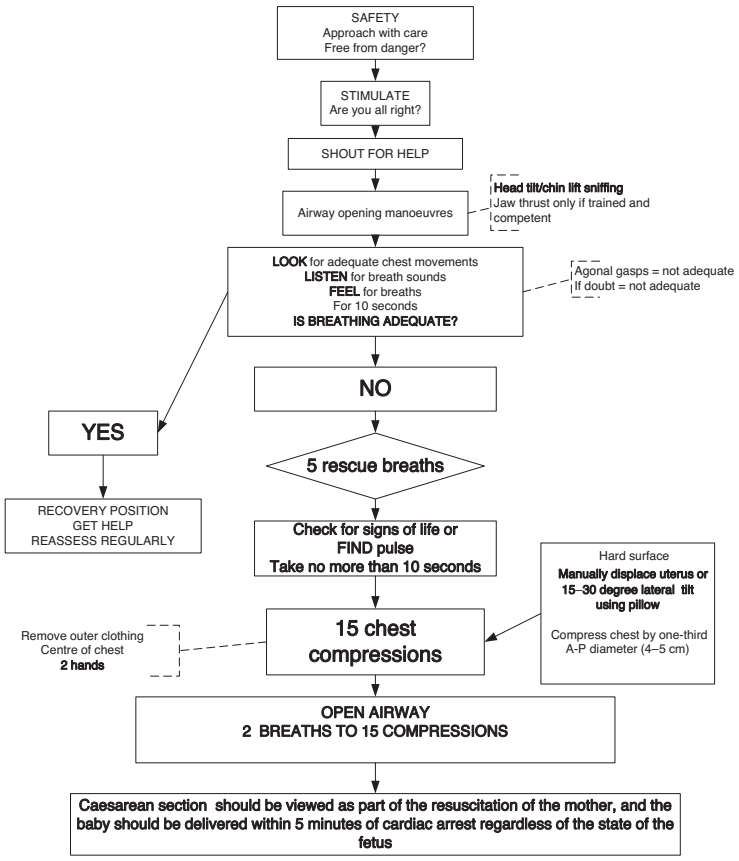


FIGURE 1.12.2 Algorithm for basic life support in pregnant women.

is only one rescuer and no help has arrived, the rescuer should open the airway, deliver the five rescue breaths and give 1 minute of cardiopulmonary resuscitation (CPR), and then activate the EMS system (if one is available) using a mobile phone if available so as to continue CPR. If a mobile is not available and the patient is a baby, the rescuer will probably be able to carry them to a telephone while continuing CPR.

Similarly, if the patient is a pregnant mother, and there is only one rescuer, they should activate the EMS system, where one is available, if no help has arrived in response to the initial shout for help after opening the airway, delivering the five rescue breaths and giving 1 minute of CPR.

'Are you all right?'

An initial simple assessment of responsiveness consists of asking the patient 'Are you all right?' and gently shaking them by the shoulder. Infants may make some noise or open their eyes.

In cases associated with trauma, or possible trauma, the cervical spine should be immobilised during this procedure by placing one hand firmly on the forehead while one of the patient's shoulders is shaken.

Airway-opening actions

An obstructed airway may be the primary problem, and correction of the obstruction can result in recovery without the need for further intervention. If the patient is unconscious but breathing, the recovery position should be used. For pregnant mothers the left lateral position must be adopted (*see* Section 2.5).

FIGURE 1.12.3 Head tilt with chin lift in neutral position for the infant.

FIGURE 1.12.4 Head tilt with chin lift in 'sniffing' position for the child and mother.

If the patient is not breathing, this may be because the airway is blocked by the tongue falling back and obstructing the pharynx. Attempt to open the airway using the **head tilt/chin lift manoeuvre**. The rescuer places their nearest hand on the patient's forehead, and applies pressure to tilt the head back gently. The correct positions are **'neutral' in the infant (0–1 year of age)** (*see* Figure 1.12.3) or **'sniffing' (nose up in the air) in the child or pregnant mother** (*see* Figure 1.12.4).

The fingers of the other hand should then be placed under the chin, and the chin of the supine patient should be lifted upwards. As this action may close the patient's mouth, it may be necessary to use the thumb of the same hand to part the lips slightly.

As an alternative to the head tilt/chin lift, the **jaw thrust manoeuvre** can be very effective, but requires more training and experience.

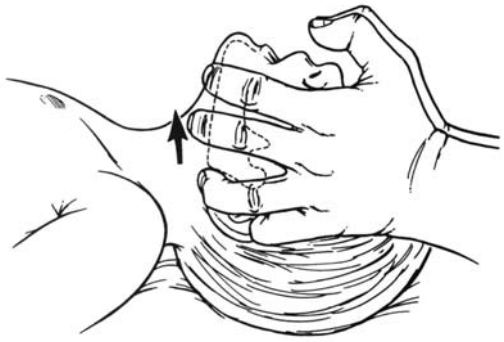


FIGURE 1.12.5 Jaw thrust to open airway.

Jaw thrust is achieved by placing two or three fingers under the angle of the mandible bilaterally, and lifting the jaw upward (*see* Figure 1.12.5). This is potentially safer than the head tilt/chin lift if there is a history of major trauma, as the latter manoeuvre may exacerbate a cervical spine injury.

BUT airway opening is always the most important action which must be achieved, and should always take precedence over concerns about a possible cervical spine injury.

Patency of the airway should then be assessed by:

- **looking** for adequate chest movements
- **listening** for breath sounds
- **feeling** for breaths.

This is best achieved by the rescuer placing their face above that of the patient, with the ear over the nose, the cheek over the mouth, and the eyes looking along the line of the chest. They should take no longer than 10 seconds to assess breathing.

If there is anything obvious in the mouth and it is easy to reach, remove it.

Do not perform a blind finger sweep in the mouth. A blind finger sweep can damage the soft palate, and foreign bodies may be forced further down the airway and become lodged below the vocal cords.

Breathing actions

If airway-opening techniques do not result in the resumption of adequate breathing within 10 seconds, and a self-inflating bag–mask system is not available, then the rescuer should commence mouth-to-mouth or mouth-to-mouth-and-nose exhaled air resuscitation.

Definition of adequate breathing

A patient may have very slow or shallow breathing, or take infrequent, noisy, agonal gasps. Do not confuse this with normal breathing.

Rescue breaths

If in doubt about the adequacy of breathing, five initial rescue breaths should be given. While the airway is held open, the rescuer breathes in and seals their mouth around the patient's mouth or mouth and nose (in the case of infants) (*see* Figures 1.12.6 and 1.12.7). If the mouth alone is used, the nose should be pinched using the thumb and index finger of the hand maintaining head tilt. Slow exhalation, 1–2 seconds, by the rescuer should result in the patient's chest rising. The rescuer should take a further breath him- or herself before the next rescue breath.

FIGURE 1.12.6 Mouth-to-mouth and nose breaths in neutral position for an infant.

FIGURE 1.12.7 Mouth-to-mouth breaths with pinched nose in sniffing position for a child or mother.

As children and mothers vary in size, only general guidance can be given regarding the volume and pressure of inflation (*see* Box 1.12.1).

BOX 1.12.1 General guidance for exhaled air resuscitation

- The chest should be seen to rise.
- Slow breaths at the lowest pressure reduce gastric distension.
- Firm gentle pressure on the cricoid cartilage may reduce gastric distension with air.

If the chest does not rise, the airway is not clear. The usual cause is failure to correctly apply the airway-opening techniques discussed earlier. The first step is to readjust the head tilt/chin lift position and try again. If this is not successful, jaw thrust should be tried. If two rescuers are present, one should maintain the airway while the other breathes for the patient.

Failure of both head tilt/chin lift and jaw thrust should lead to suspicion that a foreign body is causing the obstruction (see below).

While performing rescue breaths, the presence of a gag reflex or coughing is a positive sign of life (see below).

Circulation actions

Once the initial five breaths have been given successfully, circulation should be assessed and managed.

Check signs of life and/or pulse (take no more than 10 seconds)

Even experienced health professionals can find it difficult to be certain that the pulse is absent within 10 seconds, so the absence of **'signs of life'** is the best indication for starting chest compressions. 'Signs of life' include movement, coughing, gagging or normal breathing (but not agonal gasps, which are irregular, infrequent breaths). Thus the absence of evidence of normal breathing, coughing or gagging (which may be noticed during rescue breaths) or any spontaneous movement is an indication for chest compressions.

Inadequacy of circulation is also indicated by the absence of a central pulse for up to 10 seconds, but it can be difficult and therefore time wasting to be certain about this – hence the current emphasis on assessing the presence of 'signs of life'.

In babies and young children, if a slow pulse (less than 60 beats/minute) is felt, this is still an indication for chest compressions. In children and pregnant mothers, the carotid pulse in the neck can be palpated. However, infants generally have a short fat neck, so the carotid pulse may be difficult to identify. The brachial artery in the medial aspect of the antecubital fossa or the femoral artery in the groin should be felt in infants. If there are no signs of life and/or a pulse is absent for up to 10 seconds, **start chest compressions**. Compressions should also be started if in an infant or young child there is an inadequate heart rate (less than 60 beats/minute), **but only if this is accompanied by signs of poor perfusion**, which include pallor, lack of responsiveness and poor muscle tone.

Start chest compressions if:

- there are no signs of life *or*
- there is no pulse *or*
- there is a slow pulse (less than 60 beats/minute in an unconscious infant or young child with poor perfusion).

'Unnecessary' chest compressions are almost never damaging. It is important not to waste vital seconds before starting chest compressions after oxygenating the patient with the rescue breaths. If there are signs of life and the pulse is present (and has an adequate rate, with good perfusion), but apnoea persists, exhaled air resuscitation must be continued until spontaneous breathing resumes.

Chest compressions

For the best output, the patient must be placed on their back, on a hard surface. The chest should be compressed by a third of its depth. Children vary in size, and the exact nature of the compressions given should reflect this. In general, infants (less than 1 year of age) require a different technique from pre-pubertal children, in whom the method used in adults can be applied with appropriate modifications for their size.

FIGURE 1.12.8 Two-thumb method for chest compressions in an infant (two rescuers).

FIGURE 1.12.9 Two-finger method for chest compressions in an infant (one rescuer).

Position for chest compressions

Chest compressions should compress the lower half of the sternum.

Infants: Infant chest compression can be more effectively achieved using the hand-encircling technique: the infant is held with both the rescuer's hands encircling or

FIGURE 1.12.10 Chest compressions using one hand in a child.

partially encircling the chest. The thumbs are placed over the lower half of the sternum and compression is carried out as shown in Figure 1.12.8. This method is only possible when there are two rescuers, as the time needed to reposition the airway precludes the use of the technique by a single rescuer if the recommended rates of compression and ventilation are to be achieved. The single rescuer should use the two-finger method as shown in Figure 1.12.9, employing the other hand to maintain the airway position.

Small children: Place the heel of one hand over the lower half of the sternum. Lift the fingers to ensure that pressure is not applied over the child's ribs. Position yourself vertically above the child's chest and, with your arm straight, compress the sternum to depress it by approximately one third of the depth of the chest (Figure 1.12.10).

For ***larger children or pregnant mothers***, or for small rescuers, compressions may be achieved most easily by using both hands with the fingers interlocked (Figure 1.12.11). The rescuer may choose one or two hands to achieve the desired compression of one third of the depth of the chest.

Once the correct technique has been chosen and the area for compression identified, **15 compressions should be given to 2 ventilations.**

Technique for giving chest compressions in larger children and pregnant mothers

- Kneel by the side of the patient, who must be positioned on a firm surface, the uterus having been displaced if appropriate (see below).
- Place the heel of one hand in the centre of the patient's chest.
- Place the heel of your other hand on top of the first hand.
- Interlock the fingers of your hands and ensure that pressure is not applied over the patient's ribs. Do not apply any pressure over the upper abdomen or the bottom end of the bony sternum (breastbone).
- Position yourself vertically above the patient's chest and, with your arms straight, press down on the sternum to a depth of 5–6 cm.
- After each compression, release all the pressure on the chest without losing contact between your hands and the sternum.
- Repeat at a rate of about 100–120 times a minute (a little less than 2 compressions a second).
- Compression and release should take an equal amount of time.

FIGURE 1.12.11 Chest compressions using two hands in a larger child or mother.

Technique for giving breaths in larger children and pregnant mothers (*see* Figure 1.12.12)

- After 15 compressions, open the airway again using the head tilt and chin lift (use the jaw thrust if you are experienced and capable of doing it properly and there are two rescuers).
- Pinch the soft part of the patient's nose closed, using the index finger and thumb of your hand on their forehead.
- Allow the patient's mouth to open, but maintain chin lift.
- Take a normal breath and place your lips around the patient's mouth, making sure that you have a good seal. If you have a bag-valve-mask, this can be used instead of mouth-to-mouth basic life support in all age groups.
- Blow steadily into the patient's mouth while watching for their chest to rise; take about 1 second to make their chest rise, as in normal breathing; this is an effective rescue breath.
- Maintaining the head tilt and chin lift, take your mouth away from the patient and watch for their chest to fall as air is exhaled.
- Take another normal breath and blow into the patient's mouth once more to give a total of two effective rescue breaths. Then return your hands without delay to the correct position on the sternum and give a further 15 chest compressions.
- Continue with chest compressions and rescue breaths in a ratio of 15:2.
- Stop to recheck the patient only if they start breathing **normally**; otherwise **do not interrupt resuscitation**.
- If your rescue breaths do not make the chest rise as in normal breathing, then before your next attempt:
  - check the patient's mouth and remove any visible obstruction
  - recheck that there is adequate head tilt and chin lift
  - try the jaw thrust if you are able to do this effectively.

FIGURE 1.12.12 Giving breaths for a larger child or a mother.

- Do not attempt more than two breaths each time before returning to chest compressions.
- **If there is more than one rescuer present, a different person should take over CPR about every 2 minutes to prevent fatigue. Ensure that there is minimal delay during the changeover between rescuers.**

Continuing cardiopulmonary resuscitation

The compression rate for all age groups is 100–120 compressions per minute. A ratio of 15 compressions to 2 ventilations is maintained irrespective of the number of rescuers. With pauses for ventilation there will be less than 100–120 compressions per minute, although the **rate** is 100–120 per minute. Compressions can be recommenced at the end of inspiration and may augment exhalation.

If no help has arrived, the emergency services must be contacted after 1 minute of cardiopulmonary resuscitation. **Apart from this interruption to summon help, basic life support must not be interrupted unless the patient moves or takes a breath.**

Effective chest compressions are tiring for the rescuer. Continually check that the compressions and ventilations are satisfactory (they should be performed 'hard and fast') and, if possible, alternate the rescuers involved in this task.

Any time spent readjusting the airway or re-establishing the correct position for compressions will seriously decrease the number of cycles given per minute. This can be a real problem for the solo rescuer, and there is no easy solution. In infants and small children, the free hand can maintain the head position. The correct position for compressions does not need to be measured after each set of ventilations.

The cardiopulmonary resuscitation manoeuvres recommended for infants and children are summarised in Table 1.12.1.

TABLE 1.12.1 Summary of basic life support techniques in infants and children

	Infants (< 1 year)	Children (1 year to puberty) and pregnant mothers
Airway		
Head-tilt position	Neutral	Sniffing
Breathing		
Initial slow breaths	Five	Five
Circulation		
Pulse check	Brachial or femoral	Carotid
Landmark	Lower half of sternum	Lower half of sternum
Technique	Two fingers or two thumbs	One or two hands
CPR ratio	15:2	15:2

Call emergency services (if available)

If no help has arrived, the emergency services must be contacted after 1 minute of resuscitation has been delivered. A mobile phone can be used or an infant or small child may be carried to a static telephone or to get help while attempts are continued. Apart from any necessary interruption to summon help, basic life support must not be interrupted unless the patient moves or takes a breath, or you are exhausted.

If recovery occurs and signs of life return, place the patient in the recovery position and continue to reassess them and ensure that specialist help arrives.

Special circulation actions in the pregnant mother (*see* Figures 1.12.13 and 1.12.14)

Place the patient on a hard surface in the left lateral tilt position to overcome vena caval compression. This can be achieved with a wedge placed under the right hip to displace the gravid uterus to the left, or it is possible to improvise with a pillow or coat. If an assistant is available, they can displace the uterus to the left side of the vena cava. Effective chest compressions can be accomplished at a 15–30-degree tilt to the left, but displacement of the uterus is the more effective method.

Chest-compression-only CPR.

- If you either unable or unwilling to give rescue breaths, give chest compressions only. This is particularly relevant in countries where there is a high prevalence of HIV, hepatitis or TB (see below).
- If chest compressions only are given, these should be continuous at a rate of 100 compressions per minute.
- Stop to recheck the patient only if they start to breathe **normally**; otherwise do not interrupt resuscitation.

Continue resuscitation until:

- qualified help arrives and takes over *or*
- the patient starts breathing normally *or*
- you become exhausted.

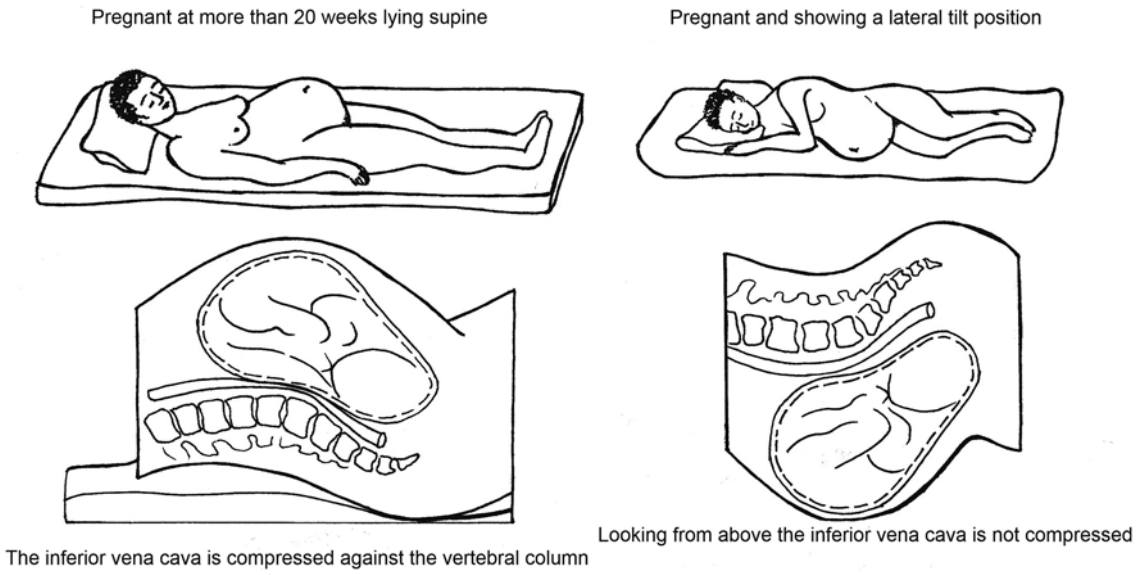


FIGURE 1.12.13 The supine hypotensive syndrome. On the left the mother is lying on her back, her uterus is occluding her inferior vena cava. On the right the mother is lying in a lateral position (the recovery position here) and the inferior vena cava is no longer compressed.

FIGURE 1.12.14 Displacing the gravid uterus manually.

Basic life support and infection risk

Few cases have been reported. The most serious concerns are meningococcus and TB. In the case of meningococcus, rescuers involved in the resuscitation of the airway in such patients should take standard prophylactic antibiotics.

There have been no reported cases of transmission of either hepatitis B or human immunodeficiency virus (HIV) through mouth-to-mouth ventilation. Blood-to-blood contact is the single most important route of transmission of these viruses, and in non-trauma resuscitation the risks are negligible. Sputum, saliva, sweat, tears, urine and vomit are low-risk fluids. Precautions should be taken, if possible, in cases where there might be contact with blood, semen, vaginal secretions, cerebrospinal fluid, pleural and peritoneal fluids, or amniotic fluid. Precautions are also recommended if any bodily secretion contains visible blood. Devices that prevent direct contact between the rescuer and the patient (such as resuscitation masks) can be used to lower the risk. Gauze swabs or any other porous material placed over the patient's mouth is of no benefit in this regard.

Infection rates vary from country to country, and rescuers must be aware of the local risk. In countries where HIV/AIDS is more prevalent, the risk to the rescuer will be greater.

If available, bag-valve-mask ventilation is preferable to mouth-to-mouth ventilation.

The recovery position

The patient should be placed in a stable, lateral position that ensures maintenance of an open airway with free drainage of fluid from the mouth, ability to monitor and gain access to the patient, security of the cervical spine and attention to pressure points (*see* Figure 1.12.15). The Resuscitation Council (UK) recommends the following sequence of actions when placing a patient in the recovery position:

- Remove the patient's spectacles (if present).
- Kneel beside the patient and make sure that both of their legs are straight.
- Place the arm nearest to you out at right angles to their body, elbow bent with the hand palm uppermost.
- Bring the far arm across the chest, and hold the back of the hand against the patient's cheek nearest to you.
- With your other hand, grasp the far leg just above the knee and pull it up, keeping the foot on the ground.
- Keeping their hand pressed against their cheek, pull on the far leg to roll the patient towards you on to their side.
- Adjust the upper leg so that both the hip and knee are bent at right angles.
- Tilt the head back to make sure the airway remains open.
- Adjust the hand under the cheek, if necessary, to keep the head tilted.
- Check the patient's breathing regularly.

If the patient has to be kept in the recovery position for **more than 30 minutes**, turn them to the opposite side in order to relieve the pressure on the lower arm.

FIGURE 1.12.15 The semi-prone or recovery position.

Automatic external defibrillators (AEDs)

The use of the AED is now included in basic life support teaching for adults because early defibrillation is the most effective intervention for the large majority of unpredicted cardiac arrests in adults. As has already been stated, in children and young people and in pregnant and puerperal women, circulatory or respiratory causes of cardiac arrest predominate. However, in certain circumstances, in children and pregnant mothers there may be a primary cardiac cause of cardiac arrest, and the use of an AED may be life-saving.

An algorithm for AED use is shown in Figure 1.12.16. The standard AED can be used in children over the age of 8 years and in adults. For children aged 1–8 years, an AED can be used, but paediatric paddles are essential. An AED cannot currently be used for infants under 1 year old, as the devices are not accurate enough in this age group.

These devices are becoming much more widely available and are relatively inexpensive. They are life-saving in cases where there is a shockable rhythm, and are included in the training for basic rather than advanced life support, as they were designed for community use. If defibrillation is to be successful, it must be performed within 15 minutes of the onset of fibrillation (and the earlier it is performed, the greater the likelihood of success), so for cases of collapse that might produce fibrillation in the community, waiting until arrival at hospital would be too late.

However, AEDs are also now widely used in treatment of hospital cardiac arrests by first responders, and are therefore included here.

Attach AED pads

Expose the chest and place one adhesive defibrillator pad on the patient's chest to the right of the sternum below the right clavicle, and one in the mid-axillary line, taking care to avoid breast tissue. Keep the axillary electrode vertical to maximise efficiency.

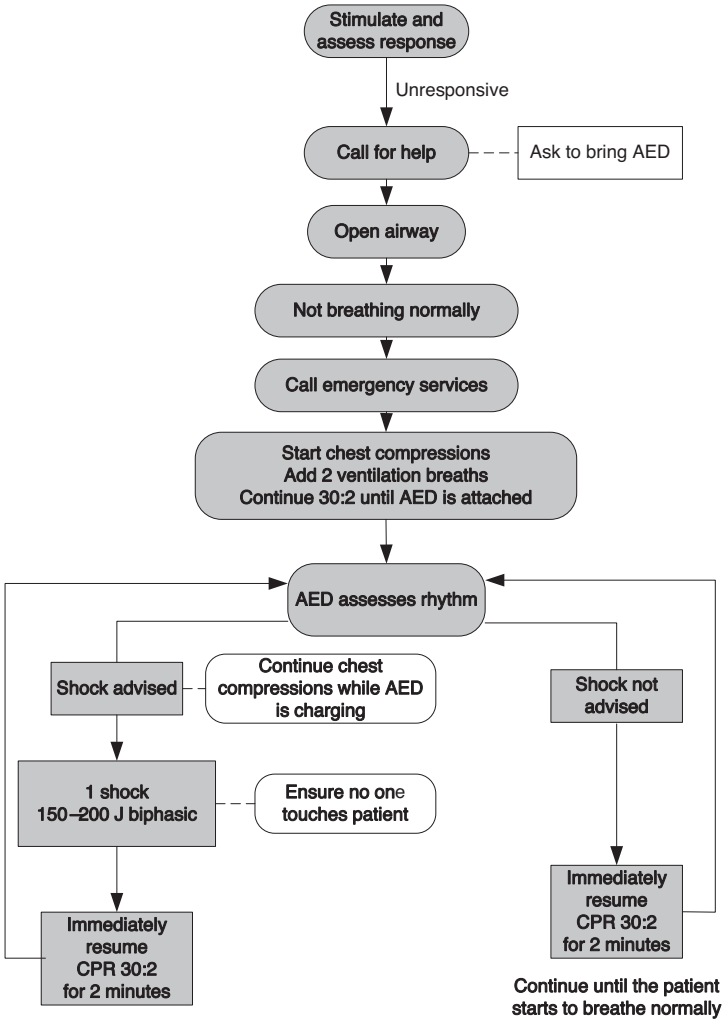


FIGURE 1.12.16 Algorithm for automatic external defibrillator (AED) use.

If a shock is indicated, most AED devices will do this automatically, but some will ask the operator to deliver the shock by pressing a button. Immediately after the shock, resume compressions for 2 minutes, after which there will be a further prompt for a rhythm analysis.

If defibrillation is **not** indicated, CPR should be continued for 2 minutes, at which stage the AED will prompt further analysis of the rhythm.

Perimortem Caesarean section

The UK Resuscitation Council considers that prompt Caesarean delivery should be seen as part of resuscitation in cardiac arrest in advanced pregnancy. Delivery of the fetus will obviate the effects of aortocaval compression and significantly increase the likelihood of successful resuscitation. It will reduce maternal oxygen consumption, increase venous return, make ventilation easier and allow CPR in the supine position.

When to perform it

All the evidence suggests that a Caesarean delivery should begin within 4 minutes of cardiac arrest and be accomplished by 5 minutes. In practice this means that preparations for surgical evacuation of the uterus should begin almost at the same time as CPR following cardiac arrest. Pregnant women develop anoxia faster than non-pregnant women, and can suffer irreversible brain damage within 4–6 minutes of cardiac arrest. CPR should be continued throughout the Caesarean section and afterwards, as this increases the likelihood of a successful neonatal and maternal outcome.

Where to perform it

The woman should **not** be transferred to an operating theatre as this will merely waste time. She should be delivered at the site of collapse unless this is physically impossible. Diathermy will not be needed, as blood loss is minimal in patients with no cardiac output. If the mother is successfully resuscitated, she can be moved to theatre to be anaesthetised and to complete the operation.

How to perform it

A minimal amount of equipment is required in this situation. Sterile preparation and drapes are unlikely to improve survival. A surgical knife is sufficient.

No one surgical approach in particular is recommended, and the choice of approach should be based on operator preference. The classical midline abdominal approach is aided by the natural diastasis of recti abdomini that occurs in late pregnancy and the relatively bloodless field in this situation. However, many obstetricians are more familiar with a lower transverse abdominal incision and can deliver a baby in less than 1 minute.

Open cardiac massage during surgery is a possibility when the abdomen is already open and the heart can be reached relatively easily through the diaphragm (if a midline approach has been used).

An anaesthetist should attend at the earliest opportunity to provide a protected airway, ensure continuity of effective chest compressions and adequate ventilation breaths, and help to determine and treat any underlying cause (4 Hs and 4 Ts, *see* Section 1.13).

If resuscitation is successful and the mother regains a cardiac output, appropriate anaesthesia and pain relief will be required and the woman should be moved to a theatre to complete the operation.

Fetal outcome

It must be emphasised that Caesarean section is part of resuscitation and is performed to improve maternal survival, and it is worthwhile performing this procedure once the uterus has reached the level of the umbilicus (i.e. around 20 weeks' gestation). If done promptly, it can also improve fetal survival, although gestational age at the time of delivery also clearly influences the fetal outcome. In the UK, the 2006–2008 National Audit Report on maternal mortality (*'Saving Mothers' Lives': The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom*) there were no neonatal survivors among those delivered at less than 28 weeks. However, 47% of those delivered at more than 36 weeks did survive; all but one of the cases in this group involved CPR commenced in hospital, demonstrating the advantage of early evacuation of the uterus for the neonate as well as the mother.

Although uterine evacuation is a well-validated step in maternal resuscitation, there is still reluctance among some obstetricians to perform peri-arrest Caesarean section, due to concerns about neonatal neurological damage. However, in a comprehensive review of postmortem Caesarean deliveries between 1900 and 1985 by Katz and colleagues, 70% (42/61) of infants delivered within 5 minutes survived, and all of them developed normally. Only 13% (8/61) of those delivered at 10 minutes and 12% (7/61) of those delivered at 15 minutes survived. One infant in each of the groups of later survivors had neurological damage. Later series confirm the advantage of early delivery for intact fetal survival, although there are a few case reports of intact infant survival more than 20 minutes after maternal cardiac arrest.

The evidence suggests that if the fetus survives the neonatal period, the probability of normal development is high.

The decision to abandon CPR if it is unsuccessful

CPR should be continued if the rhythm continues as ventricular fibrillation (VF)/ventricular tachycardia (VT). The decision to abandon CPR should only be made after discussion with senior clinicians.

Medico-legal issues

No doctor has been found liable for performing a postmortem Caesarean section in the UK jurisdiction.

Choking

Introduction

The vast majority of deaths from foreign body airway obstruction (FBAO) occur in preschool children. Virtually anything may be inhaled, but foodstuffs predominate. The diagnosis may not be clear-cut, but should be suspected if the onset of respiratory compromise is sudden and associated with coughing, gagging and stridor.

Airway obstruction also occurs with infections such as acute epiglottitis and croup. In these cases, attempts to relieve the obstruction using the methods described below are dangerous. Children with known or suspected infectious causes of obstruction, and those who are still breathing and in whom the cause of obstruction is unclear, should be

taken to hospital urgently. The treatment of these children is dealt with in Section 4.

If a foreign body is easily visible and accessible in the mouth, remove it, but while attempting this take great care not to push it further into the airway. Do not perform blind finger sweeps of the mouth or upper airway, as these may further impact a foreign body and damage tissues without removing the object.

The physical methods of clearing the airway, described below, should therefore only be performed if:

1 the diagnosis of FBAO is clear-cut (witnessed or strongly suspected) and ineffective coughing and increasing dyspnoea, loss of consciousness or apnoea have occurred.
2 head tilt/chin lift and jaw thrust manoeuvres have failed to open the airway of an apnoeic child.

If the child is coughing, this should be encouraged. A spontaneous cough is more effective in relieving an obstruction than any externally imposed manoeuvre. An effective cough is recognised by the patient's ability to speak or cry and to take a breath between coughs. The child should be continually assessed and not left alone at this stage. No intervention should be made unless the cough becomes ineffective (i.e. quieter or silent), and the patient cannot cry, speak or take a breath, or becomes cyanosed or starts to lose consciousness. Then call for help and start the intervention.

These manoeuvres are then alternated with each other, and with examination of the mouth and attempted breaths as shown in Figure 1.12.17.

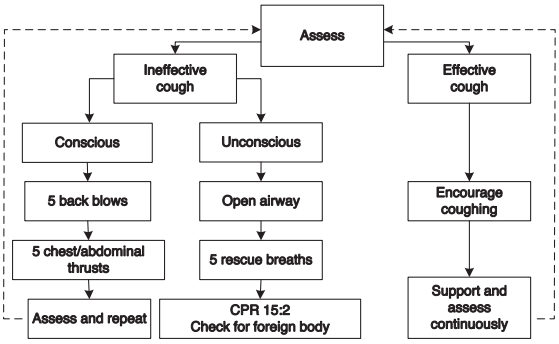


FIGURE 1.12.17 Algorithm for the management of choking.

Infants

Abdominal thrusts may cause intra-abdominal injury in infants. Therefore a combination of back blows and chest thrusts is recommended for the relief of foreign body obstruction in this age group (*see* Figures 1.12.18 and 1.12.19).

The baby is placed along one of the rescuer's arms in a head-down position, with the rescuer's hand supporting the infant's jaw in such a way as to keep it open, in the neutral position. The rescuer then rests his or her arm along the thigh, and delivers five back blows with the heel of the free hand.

If the obstruction is not relieved, the baby is turned over and laid along the rescuer's thigh, still in a head-down position. Five chest thrusts are given using the same landmarks as for cardiac compression, but at a rate of one per second. If an infant is too large to allow use of the single-arm technique described above, then the same manoeuvres can be performed by lying the baby across the rescuer's lap.

FIGURE 1.12.18 Back blows in an infant.

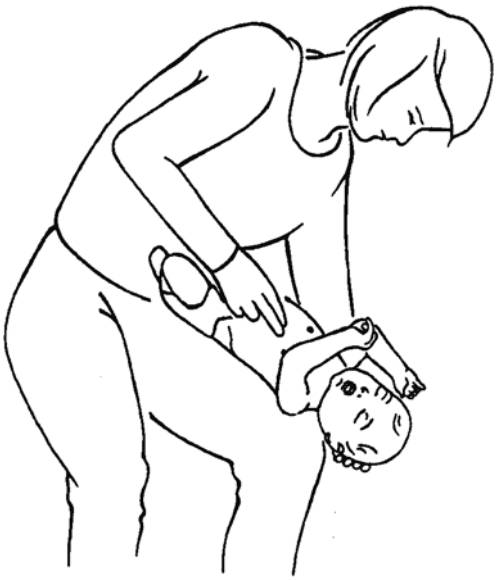


FIGURE 1.12.19 Chest thrusts in an infant.

Children

Back blows can be used as described for infants or, in the case of a larger child, with the child supported in a forward-leaning position (*see* Figure 1.12.20). In children the abdominal thrust (Heimlich manoeuvre) can also be used (*see* Figures 1.12.21 and 1.12.22). This can be performed with the patient either standing or lying down, but the former is usually more appropriate.

If this manoeuvre is to be attempted with the child standing, the rescuer moves behind the patient and passes his or her arms around the patient's body. Owing to the short height of children, it may be necessary for an adult to raise the child or kneel behind them to carry out the standing manoeuvre effectively. One hand is formed into a fist and placed against the child's abdomen above the umbilicus and below the xiphisternum. The other hand is placed

over the fist, and both hands are thrust sharply upwards into the abdomen. This procedure is repeated five times unless the object that is causing the obstruction is expelled before then.

To perform the Heimlich manoeuvre in a supine child, the rescuer kneels at the child's feet. If the child is large, it may be necessary to kneel astride him or her. The heel of one hand is placed against the child's abdomen above the umbilicus and below the xiphisternum. The other hand is placed on top of the first, and both hands are thrust sharply upwards into the abdomen, with care being taken to direct the thrust in the midline. This procedure is repeated five times unless the object that is causing the obstruction is expelled before then.

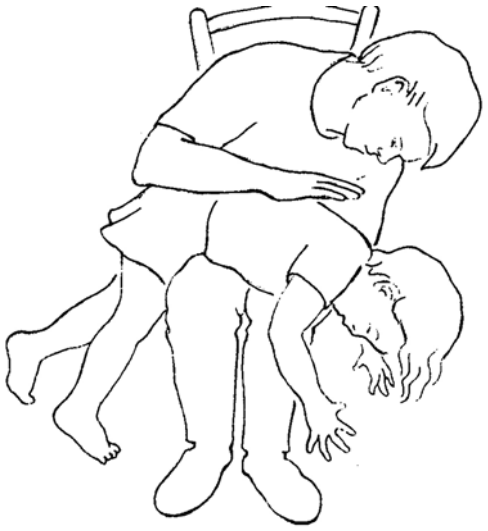


FIGURE 1.12.20 Back blows in a small child.

Following successful relief of the obstructed airway, the child should be assessed clinically. There may still be some foreign material present in the respiratory tract. If abdominal thrusts have been performed, the child should be assessed for possible abdominal injuries.

Each time breaths are attempted, look in the mouth for the foreign body and remove it if it is visible. Take care not to push the object further down, and avoid damaging the tissues. If the obstruction is relieved the patient may still require either continued ventilations if they are not breathing, or chest compressions if there are no signs of a circulation. Advanced life support may also be needed.

FIGURE 1.12.21 Heimlich manoeuvre in a standing child.

FIGURE 1.12.22 Heimlich manoeuvre using a chair.

If the child is breathing effectively, place them in the recovery position and continue to monitor them.

Unconscious infant or child with foreign body airway obstruction

- Call for help.
- Place the child in a supine position on a flat surface.
- Open the mouth and attempt to remove any visible object.
- Open the airway and attempt five rescue breaths, repositioning the airway with each breath if the chest does not rise.
- Start chest compressions even if the rescue breaths were ineffective.
- Continue the sequence for single-rescuer CPR for about 1 minute, then summon help again if none is forthcoming.
- Each time breaths are attempted, look in the mouth for the foreign body and remove it if it is visible. Take care not to push the object further down, and avoid damaging the tissues.
- If the obstruction is relieved, the patient may still require either continued ventilations if they are not breathing but are moving or gagging, or both ventilations and chest compressions if there are no signs of a circulation. Advanced life support may also be needed.
- If the child is breathing effectively, place them in the recovery position and continue to reassess them.

1.13 Advanced life support for children and pregnant mothers

Introduction

As described in Section 1.12 on basic life support, the pregnant mother in cardiac arrest has usually suffered from the same deranged pathophysiology as the arrested child (i.e. respiratory or circulatory collapse rather than a primarily cardiac event).

The 'child' type of cardiac arrest is seen in almost all children (excluding those rare arrhythmic events in children with congenital or acquired heart disease, and those in whom sudden, unexpected collapse is preceded by apparent normal respiratory and circulatory function), and in adults who have a terminal acute illness involving respiratory or circulatory pathology. This includes patients who have had convulsions, trauma (including drowning), poisoning, bleeding, sepsis, etc.

In addition, there is international agreement that, where possible, guidelines on resuscitation of patients with cardiac arrest should be simplified, as there is evidence that complex guidelines cause 'provider paralysis', resulting in no or poor life-saving effort being made.

In view of this, the Advanced Life Support Group (ALSG)/Maternal Childhealth Advocacy International (MCAI) programme for resource-limited countries teaches a programme of basic life support (BLS) and advanced life support (ALS) for infants, children and pregnant mothers which reflects the known pathologies in these groups (i.e. respiratory and circulatory causes of cardiac arrest) and recognises that the clinicians who provide resuscitation attend patients of all ages.

Airway and breathing

Management of the airway (A) and breathing (B) components of the ABC must take priority in all situations. Resuscitation will fail if effective ventilation does not occur.

Before effective resuscitation techniques can be applied, it is essential that the operator is able to:

1 understand the airway equipment available and how to use it
2 recognise respiratory failure and when it may occur
3 perform a systematic and prioritised approach (the structured ABC approach) to the management of the infant, child or mother who has a problem of the airway or breathing (*see* Section 1.11).

Airway: equipment and skills for opening and maintaining the airway

Essential airway and breathing equipment includes the following:

- face masks (ideally with reservoirs)
- airways, including laryngeal mask airways (LMAs) if anaesthetic skills are available
- self-inflating bag-valve-mask devices
- tracheal tubes, introducers and connectors
- laryngoscopes
- Magill's forceps
- suction devices
- surgical airway packs for performing an emergency surgical airway.

This equipment should be available in all resuscitation areas, ideally on a resuscitation trolley. It is crucial to gain familiarity with it before an emergency situation occurs.

Pharyngeal airways

There are two main types of pharyngeal airway, namely **oropharyngeal** (*see* Figures 1.13.1 and 1.13.2) and **nasopharyngeal**.

FIGURE 1.13.1 Oropharyngeal airway, showing position when inserted.

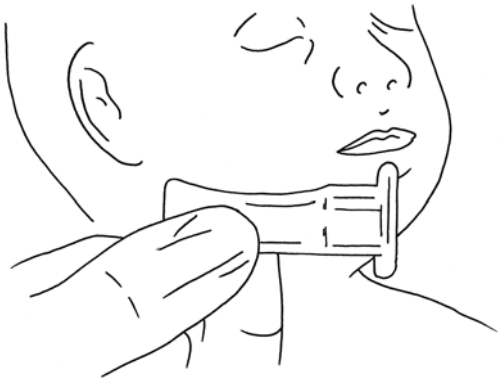


FIGURE 1.13.2 Oropharyngeal airway, showing sizing technique.

Oropharyngeal airways

The oropharyngeal or Guedel airway is used in the unconscious or obtunded patient to provide an open airway channel between the tongue and the posterior pharyngeal wall.

In the awake patient with an intact gag reflex, it may not be tolerated and may induce vomiting.

The oropharyngeal airway is available in a variety of sizes. A correctly sized airway when placed with its flange at the centre of the incisors, then curved around the face, will reach the angle of the mandible. Too small an airway may be ineffective, and too large an airway may cause laryngospasm. Either may cause mucosal trauma or may worsen airway obstruction. Reassessment following placement is therefore a vital part of safe insertion of an airway device.

There are two methods for inserting an oropharyngeal airway in children, depending on whether the child is small or large. However, there is no specific age of transition from one to the other – the choice of method depends on practicality and the skills of the operator. The important point is not to push the tongue back by inserting the airway carelessly.

The twist technique is used for larger children and in pregnant mothers. With this technique the convex side of the airway is used to depress the tongue as the airway is pushed into the mouth. The airway should be inserted upside down until the tip has passed the soft palate, and then rotated through 180 degrees so that the natural curve of the Guedel airway follows the curve of the tongue and pharynx (*see* Figure 1.13.3).

FIGURE 1.13.3 Oropharyngeal airway shown being inserted concave side up, then in place concave side down.

However, in infants and small children, as the tongue is larger relative to the size of the mouth, the airway cannot be rotated in the mouth without causing trauma. Therefore the tongue is depressed with a spatula and not by the convex side of the airway (*see* Figure 1.13.4).

FIGURE 1.13.4 When inserting the airway without rotation, a tongue depressor can be helpful (not shown).

Nasopharyngeal airways

The nasopharyngeal airway is often better tolerated than the Guedel airway. **It is contraindicated in fractures of the base of the skull.** It may also cause significant haemorrhage from the vascular nasal mucosa if it is not inserted with care, preferably with lubrication. A suitable length can be estimated by measuring from the lateral edge of the nostril to the tragus of the ear. An appropriate diameter is one that just fits into the nostril without causing sustained blanching of the alae nasi. If small-sized nasopharyngeal airways are not available, shortened endotracheal tubes may be used.

Ensure that insertion of one or other of these devices results in an improvement in the patient's airway and breathing. It if does not improve the airway as shown by improved breathing, then a reappraisal of the choice or size of airway is urgently required.

In pregnant mothers, the nasopharyngeal tube is not commonly used, because of the tendency for nasal mucosal bleeding to occur in pregnancy.

Laryngoscopes

There are two principal designs of laryngoscope, namely **straight bladed** and **curved bladed**.

The straight-bladed laryngoscope is usually employed to directly lift the epiglottis, thereby uncovering the vocal folds. The advantage of this approach is that the epiglottis is moved sufficiently so that it does not obscure the cords. The potential disadvantage is that vagal stimulation may cause laryngospasm or bradycardia.

The curved-bladed laryngoscope is designed to move the epiglottis forward by lifting it from in front. The tip of the blade is inserted into the mucosal pocket, known as the vallecula, anterior to the epiglottis, and the epiglottis is then moved forward by pressure in the vallecula. This may be equally effective for obtaining a view of the cords, and it has the advantage that less vagal stimulation ensues, as the mucosa of the vallecula is innervated by the glossopharyngeal nerve instead.

A laryngoscope blade appropriate for the age of the patient should be chosen. It is possible to intubate with a blade that is too long, but not with one that is too short.

Laryngoscopes are notoriously unreliable pieces of equipment which may develop flat batteries and unserviceable bulbs very quickly between uses. Therefore it is vital that a spare is available at all times, and equipment must be regularly checked to ensure that it is in good working order.

Tracheal tubes

Uncuffed tubes should be used during resuscitation, by operators who do not have paediatric anaesthetic experience, for children up to approximately 10 years of age. If the operator is familiar with cuffed tube placement, both cuffed and uncuffed tubes are acceptable for infants and children undergoing emergency intubation, but not for neonates. Up until the age of around 10 years, the larynx is circular in cross section and the narrowest part of it is at the cricoid ring, rather than the vocal cords. An appropriately sized tube should give a relatively gas-tight fit in the larynx, but the fit should not be so tight that no leak is audible when the bag is compressed. Failure to observe this condition may lead to damage to the mucosa at the level of the cricoid ring, and to subsequent oedema following extubation.

The appropriate size of an uncuffed tracheal tube is estimated as follows:

internal diameter (mm) = (age in years/4) + 4
length (cm) = (age in years/2) + 12 for an oral tube
length (cm) = (age in years/2) + 15 for nasal tube.

These formulae are appropriate for ages over 1 year. Neonates usually require a tube of internal diameter 3–3.5 mm, although preterm infants may need one of diameter 2.5 mm. Cuffed tubes should not be used in neonates.

For cuffed tracheal tubes, the appropriate internal diameter for children aged 2 years or older is estimated as follows:

$$\text{internal diameter (mm)} = (\text{age in years}/4) + 3.5.$$

For infants of weight over 3 kg and up to 1 year in age a size 3 cuffed tube is usually acceptable, and for those aged 1–2 years a size 3.5 cuffed tube can generally be used.

The size of tracheal tubes is measured in terms of their internal diameter in millimetres. They are available in whole- and half-millimetre sizes. The clinician should select a tube of appropriate size, but also prepare one a size smaller and one a size larger.

In the case of resuscitation in a young child where the lungs are very 'stiff' (e.g. in a cardiac arrest from severe bronchiolitis), a cuffed tube rather than an uncuffed tube may be used by a non-expert, but the risk of airway damage from the cuff must be balanced against the risk of failure to inflate the lungs.

In pregnant mothers, cuffed tubes must be used because of the high risk of gastric reflux in the pregnant patient causing aspiration of acidic gastric material and severe respiratory problems.

Tracheal tube introducers

Intubation can be facilitated by the use of a stylet or introducer, which is placed through the lumen of the tracheal tube. There are two types – either **soft and flexible** or **firm and malleable**.

The soft and flexible type can be allowed to project beyond the tip of the tube, so long as it is handled very gently. The firm and malleable type is used to alter the shape of the tube, but can easily damage the tissues if allowed to protrude from the end of the tracheal tube. Tracheal tube introducers should not be used to force a tracheal tube into position.

Bougies, which are flexible, deformable, blunt-ended gum elastic rods of different sizes, can be used to help to introduce a tracheal tube when access is difficult. A Seldinger-type technique is used. The bougie is introduced into the trachea using the laryngoscope, the endotracheal tube is then passed over it into the trachea, and finally the bougie is removed.

In pregnant mothers:

1 A 15 French bougie should be used for endotracheal tube sizes 6.0–11.0.
2 Lubricate the bougie with KY jelly.
3 Perform laryngoscopy. If the cords are not visible, identify landmarks to aid intubation.
4 Place the bougie into the pharynx and direct it into the larynx. If necessary, bend the bougie to negotiate the corner. Correct placement may be confirmed by detection of tracheal 'clicks' and 'hold-up' of the bougie (the absence of hold-up indicates oesophageal placement).
5 Hold the tube firmly in place and gently withdraw the bougie.
6 Remove the laryngoscope and confirm tube placement as usual.

Tracheal tube connectors

In pregnant mothers, the proximal end of the tube connectors is of standard size, based on the 15-mm/22-mm system, which means that they can be connected to a standard self-inflating bag.

The same standard system exists for children, including neonates.

Magill's forceps

Magill's forceps (*see* Figure 1.13.5) are angled to allow a view around the forceps when they are in the mouth. They may be useful to help to position a tube through the cords by lifting it anteriorly, or to remove pharyngeal or supraglottic foreign bodies.

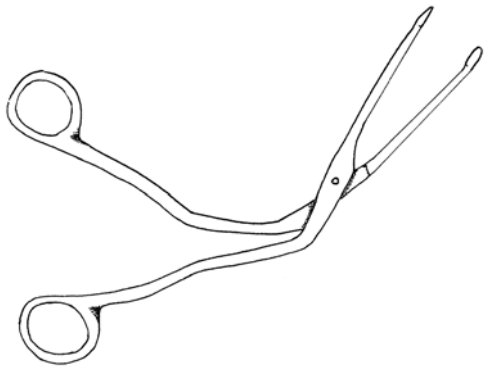


FIGURE 1.13.5 Magill's forceps.

Suction devices

These are used to remove blood, vomit and secretions from the mouth and throat, usually with a rigid suction tube (Yankauer suction tube; see below). In resuscitation areas, ideally the suction device should be connected to a central vacuum unit. This consists of a suction hose inserted into a wall terminal outlet, a controller (to adjust the vacuum pressure), a reservoir jar, suction tubing and a suitable sucker nozzle or catheter. In order to aspirate vomit effectively, it should be capable of producing a high negative pressure and a high flow rate, although these can be reduced in non-urgent situations, so as not to cause mucosal injury.

Portable suction devices are required for resuscitation when central suction is not available (as is the case in most resource-limited hospitals), and for transport to and from the resuscitation room. These are either manual, mains electrical or battery powered. A manual or battery-operated suction system must be available at all sites where resuscitation may be needed.

To clear the oropharynx of debris (e.g. vomit), a rigid sucker (e.g. Yankauer sucker) should be used with care not to damage delicate tissue or induce vomiting. The Yankauer sucker is available in both adult and paediatric sizes. It may have a side hole, which can be occluded by a finger, allowing greater control over vacuum pressure.

Tracheal suction catheters (see Figure 1.13.6)

These may be required after intubation to remove bronchial secretions or aspirated fluids. In general, the appropriate size in French gauge is numerically twice the internal diameter in millimetres (e.g. for a 3-mm tube the correct suction catheter is a French gauge 6).

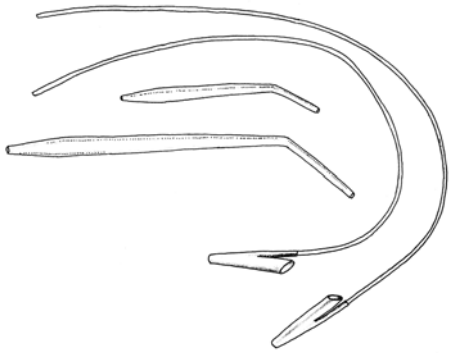


FIGURE 1.13.6 Tracheal and oral or nasal suction catheters.

Advanced airway techniques

Advanced airway techniques are used when the above techniques fail to maintain and protect an airway over the longer term, particularly if there is potential for it to become obstructed and thus prevent accurate control of oxygenation and ventilation. Advanced airway techniques (tracheal intubation, surgical cricothyroidotomy and surgical tracheostomy) are described in Section 8.2.

Breathing: equipment and skills for helping the patient to breathe

The following equipment for oxygenation and ventilation should be readily available:

- an oxygen source
- masks for those who are spontaneously breathing
- close-fitting face masks (for artificial ventilation)
- self-inflating bag-valve systems to be used with close-fitting face masks
- T-piece and open-ended bag systems (only to be used by those with anaesthetic skills)
- mechanical ventilators
- chest tubes
- gastric tubes.

Oxygen treatment

Indications

Give oxygen to patients:

- with respiratory distress (severe indrawing of the lower chest wall, also known as recessions, raised respiratory rate, gasping, grunting with each breath, nasal flaring, head bobbing, etc.)
- with cyanosis (blueness) that is central (around the lips and tongue, or inside the mouth in children with dark skin)
- who are shocked
- who are fitting
- who are unconscious, with abnormal oxygen saturation (SaO_2) on a pulse oximeter.

Ideally, where the resources for this are available, oxygen therapy should be guided by pulse oximetry (see below). Give oxygen to children with an SaO_2 of < 94%, and aim to keep SaO_2 at 94–98% (except at high altitude, where normal oxygen saturation levels are lower). If pulse oximeters are not available, the need for oxygen therapy has to be guided by clinical signs, which are less reliable.

Provision of oxygen

Oxygen must be available at all times. The two main sources of oxygen are cylinders and oxygen concentrators.

Oxygen cylinders contain compressed gas. A flow meter needs to be fitted to regulate flow. A hissing noise can be heard if gas is being delivered.

Flow meters are used to ascertain how much oxygen is being delivered. Take the reading of flow rate from the middle of the ball. Always switch off the flow when the source is not in use (ensure that the indicator ball is at the bottom of the flow meter and not moving).

Do not leave anything inflammable near to the oxygen supply. Do not allow smoking near to the oxygen supply.

At least once a day, check that an adequate oxygen supply is available (use a signed logbook). If a gauge indicating the amount left in the cylinder is not available, switch on the flow and listen for a hissing noise. Replace empty cylinders promptly. Ensure that cylinders are stored and secured in an upright position in suitable containers so that they cannot fall over and cause injury. Cylinder keys to permit changes of regulator should be tied to each cylinder.

Oxygen concentrators may be available. They produce more than 95% oxygen with a flow of 1–8 litres/minute but, unlike cylinders, they require a continuous electricity supply. For this reason, all areas where patients might need oxygen must have both cylinders and concentrators.

There are now small oxygen plants available that can provide oxygen for a defined area or even for the whole of a hospital or health facility. Some of them can be used to fill oxygen cylinders as well, thus providing a constant back-up (www.ogsi.com).

Oxygen delivery

A mask with a reservoir bag (*see* Figure 1.13.7) allows up to 100% oxygen to be delivered. Without a reservoir, it is only possible to deliver around 40% oxygen. If only low flow rates of oxygen are available, do not use a reservoir bag.

If an oxygen mask is being used, ensure that the mask is large enough to cover the mouth and nose. Both low- and high-flow oxygen (with a delivery rate of up to 15 litres/minute) can be given. Hold the mask in place using the

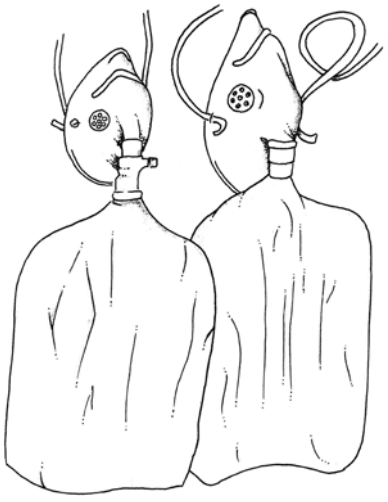


FIGURE 1.13.7 Reservoir bags.

elastic strap around the back of the head or, in the case of a young child, ask the mother to hold it as close as possible to the child's face.

Nasal cannulae (also known as nasal prongs) (*see* Figure 1.13.8) are the preferred method of delivery in most circumstances, as they are safe, non-invasive, reliable and do **not** obstruct the nasal airway. Head boxes are not recommended, as they use up too much oxygen and deliver a low concentration. Face masks can be used for resuscitation purposes, ideally with a reservoir attached to deliver 100% oxygen.

FIGURE 1.13.8 Nasal cannulae delivering oxygen and taped in place.

Monitoring

Nursing staff must know how to place and secure the nasal cannulae correctly. Check regularly that the equipment is working properly, and remove and clean the cannulae at least twice a day.

Monitor the patient at least every 3 hours to identify and correct any problems, including:

- SaO_2 values measured by pulse oximeter
- nasal cannulae out of position
- leaks in the oxygen delivery system
- incorrect oxygen flow rate
- airway obstructed by mucus (clear the nose with a moist wick or by gentle suction).

Pulse oximetry

Normal oxygen saturation at sea level in a child is 95–100%. Oxygen is ideally given to maintain oxygen saturation at 94–98%. Different cut-off values might be used at high altitude or if oxygen is scarce. The response to oxygen therapy in lung disease can be measured with the pulse oximeter, as the patient's SaO_2 should increase (in patients with cyanotic heart disease, SaO_2 does not change when oxygen is given). The oxygen flow can be titrated using the pulse oximeter as a monitor to obtain a stable SaO_2 of 94–98% without giving too much oxygen. This is especially important in pre-term babies with respiratory disease (*see* Section 3.4).

Assessment of oxygenation at and above sea level

A systematic review in 2009 found an SpO_2 of 90% is the 2.5th centile for a population of healthy children living at an altitude of approximately 2500 m above sea level. This decreases to 85% at an altitude of approximately 3200 m.

TABLE 1.13.1 SpO_2 levels at different altitudes[a]

Altitude	Location	n	Age	SpO_2 (%)	Author	Year
Sea level	UK	70	2–16 (mean, 8) years	Range, 95.8–100 Median, 99.5	Poets *et al.*	1993
Sea level	Peru	189	2 months to 5 years	Range, 96–100 Mean, 98.7	Reuland *et al.*	1991
1610 m	Colorado	150	< 48 hours 3 months	95% CI, 88–97 Mean, 93 95% CI, 86–97 Mean, 92.2	Thilo *et al.*	1991
1670 m	Nairobi	87	7 days to 3 years	Range, 89.3–99.3 Mean, 95.7	Onyango *et al.*	1993
2640	Bogota	189	5 days to 2 years	Range, 84–100 Mean, 93.3	Lozano *et al.*	1992
2800	Colorado	72	3–670 days	Range, 88–97 Mean, 91.7	Nicholas *et al.*	1993
3100	Colorado	14	6 hours to 4 months 1 week to 4 months	Range, 81–91 Mean, 80.6±5.3 Mean, 86.1±4.6	Niemeyer *et al.*	1993
3658	Tibet[b]	15	6 hours to 4 months	Immigrant, 76–90 Indigenous, 86–94	Niemeyer *et al.*	1995
3750	Peru	153	2 –60 months	Range, 81–97 Mean, 88.9	Reuland *et al.*	1991

[a]Values given are those in quiet sleep.

[b]Ranges refer to those born to immigrant Chinese mothers and to those indigenous babies whose families have lived at that altitude for innumerable generations.

Duration of oxygen therapy

Continue giving oxygen continuously until the patient is able to maintain an SaO_2 of 94% or higher in room air. When the patient is stable and improving, take them off oxygen for a few minutes. If the SaO_2 remains in the range 94–98%, discontinue oxygen, but check again 30 minutes later, and 3-hourly thereafter on the first day off oxygen to ensure that the patient is stable. Where pulse oximetry is not available, the duration of oxygen therapy has to be guided by clinical signs, which are less sensitive.

Breathing for the patient

Face masks with seal over nose and mouth for positive pressure ventilation (see Figure 1.13.9)

These face masks are used for either mouth-to-mask or, more commonly, bag–mask ventilation. Masks are available in various sizes, and the appropriate size to cover the mouth and nose should be chosen.

Face masks for mouth-to-mouth or bag-valve-mask ventilation in infants are of two main designs. Some masks conform to the anatomy of the patient's face and have a low dead space. Circular soft plastic masks give an excellent seal and are often preferred. Children's masks should be clear so that the child's colour or the presence of vomit can be seen.

A pocket mask is a single-size clear plastic mask with an air-filled cushion rim designed for mouth-to-mask resuscitation. It can be supplied with a port for attaching it to an oxygen supply, and can be used in adults and children. It can be used upside down to ventilate infants.

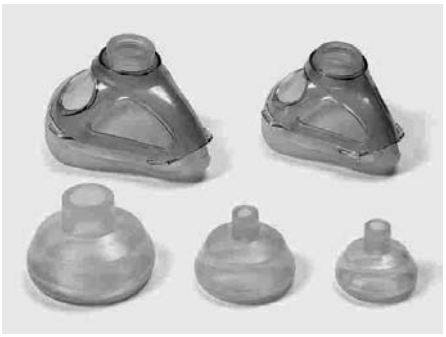


FIGURE 1.13.9 Face masks with cushioned rim for a leak-proof fit, and round shape for infants.

Self-inflating bags (see Figure 1.13.10)

This is one of the most important pieces of equipment, allowing hand ventilation by face mask without a supply of gas. The two appropriate sizes are **500 mL** and **1600 mL (the smaller size for infants under 1 year of age, and the larger size for children and mothers)**. There is also a 250-mL version for small premature babies. These bags have pressure-limiting valves that operate at 30–45 cm H_2O. Test the valve by placing the mask on a surface and pressing the bag and ensuring that the valve opens. It can be overridden if necessary for stiff, poorly compliant lungs by loosening the screw at the top.

The bag connects to the patient through a one-way valve to direct exhaled air to the atmosphere. The other end connects to the oxygen supply and can attach to a reservoir bag which allows high concentrations (up to 98%) of oxygen to be delivered. Without the reservoir bag, only concentrations of up to 40% can be delivered. The bag itself is easily dismantled and reassembled. It is important to realise that this system **will operate without an attached oxygen supply**, allowing resuscitation to be initiated before oxygen is available. However, if resuscitation is failing, check that oxygen is being delivered into the bag and to the patient and that the oxygen supply has not been disconnected.

Always use high-flow oxygen (if available) and a reservoir bag during resuscitation apart from at birth where room air is satisfactory for almost all babies (*see* Section 3.2).

It is also important to clean the system after each patient.

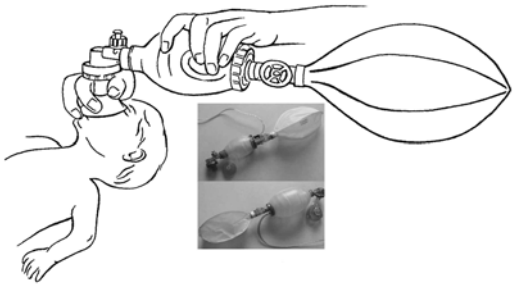


FIGURE 1.13.10 Two sizes of self-inflating bags and masks.

It is essential that the mask is properly sized and correctly placed over the mouth and nose of the patient (*see* Figures 1.13.11 and 1.13.12).

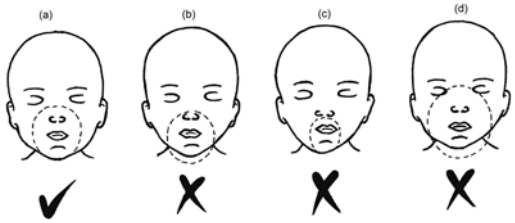


FIGURE 1.13.11 (a) Correct placement of infant mask. (b), (c) and (d) Incorrect placement of infant mask.

FIGURE 1.13.12 Two views of single-handed grip on mask.

FIGURE 1.13.13 Two-handed grip on mask incorporating jaw thrust.

If the chest does not rise, the airway is not clear. The usual cause is failure to correctly apply the airway-opening techniques discussed previously. The first step to try is to readjust the head-tilt/chin-lift position and try again. If this is not successful, the jaw-thrust manoeuvre should be tried (*see* Figure 1.13.13). Failure of both the head-tilt/chin-lift and jaw-thrust manoeuvres should lead to suspicion that a foreign body is causing the obstruction.

Once breathing has restarted, replace the bag-valve-mask system with a simple face mask and reservoir. Because of the internal valves it is not possible to spontaneously breathe through the bag-valve-mask system.

Chest tubes

In cases with a significant haemothorax or pneumothorax (particularly tension pneumothorax), ventilation may be compromised and insertion of a chest drain is mandatory (*see* Section 8.3).

Gastric tubes

Insertion of a gastric tube is essential after intubation, and may also relieve respiratory distress in spontaneously breathing patients with abdominal emergencies or gastric stasis. It allows decompression of a stomach full of air from both bag and mask ventilation as well as air swallowed by a distressed patient. Without a gastric tube, the patient may vomit or there may be aspiration of stomach contents. In addition, venting of stomach gas will avoid diaphragmatic splinting. A nasogastric tube will increase airway resistance through the nose, which in a spontaneously breathing infant with respiratory failure can be significant. An orogastric tube has less effect on ventilation, but is less readily tolerated and less easily fixed in position.

Further information

Additional breathing procedures are described in Section 5.2.B (on spacers and nebulisers), Section 8.3

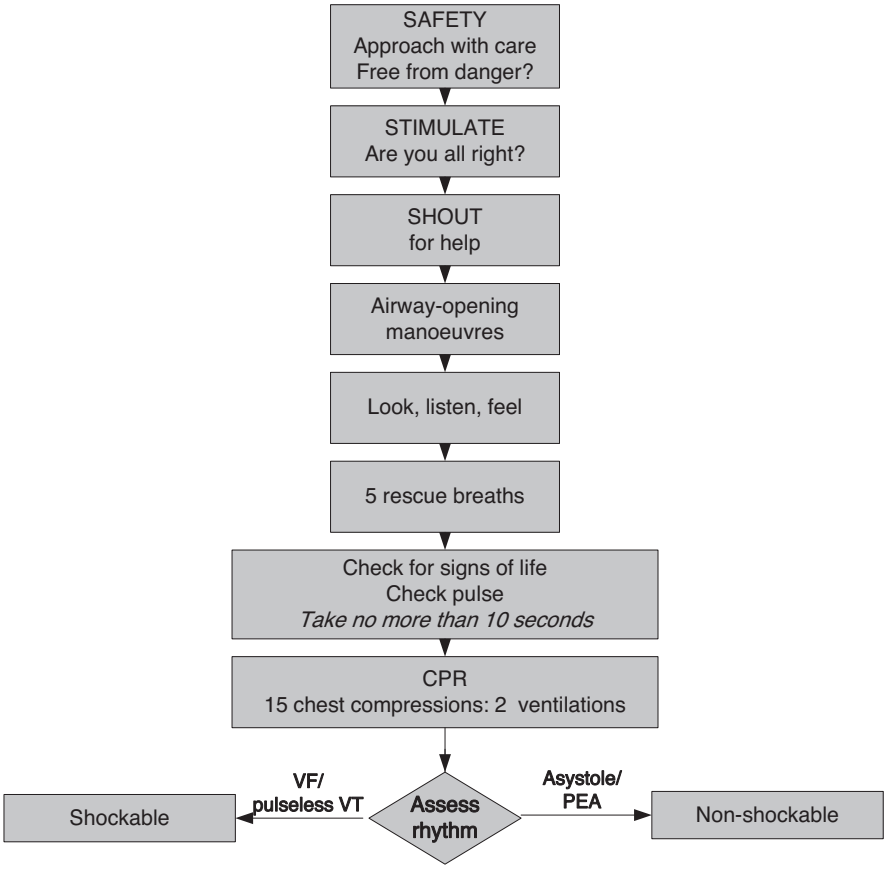


FIGURE 1.13.14 Initial approach to cardiac arrest. CPR, cardiopulmonary resuscitation; VF, ventricular fibrillation; VT, ventricular tachycardia; PEA, pulseless electrical activity.

(on needle thoracocentesis) and Section 8.3 (on chest drain insertion).

Circulation: equipment and skills for maintaining the circulation

Details of how to undertake the following procedures are covered in Section 8.4:

- peripheral venous cannulation
- blood sampling from an IV cannula
- intraosseous cannulation and infusion
- cutdown long saphenous venous cannulation
- insertion of central venous catheters
- needle pericardiocentesis.

Management of cardiac arrest

Cardiac arrest occurs when there is no effective cardiac output. Before any specific therapy is started, effective basic life support must be established (*see* Figure 1.13.14).

Four cardiac arrest rhythms can occur:

1 asystole
2 pulseless electrical activity (including electromechanical dissociation)
3 ventricular fibrillation
4 pulseless ventricular tachycardia.

These are divided into two groups. Asystole and pulseless electrical activity, which do not require defibrillation, are called 'non-shockable' rhythms. Ventricular fibrillation and pulseless ventricular tachycardia, which do require defibrillation, are called 'shockable' rhythms.

Non-shockable cardiac arrest

Asystole

This is the most common cardiac arrest rhythm in infants and children, and in pregnant mothers. The response of the heart to prolonged severe hypoxia and shock (which are the usual pathologies in these groups) is progressive bradycardia leading to asystole.

The ECG will distinguish asystole from ventricular fibrillation, ventricular tachycardia and pulseless electrical activity. The ECG appearance of ventricular asystole is an almost straight line; occasionally P-waves are seen (*see* Figure 1.13.15). Check that the appearance is not caused by an artefact (e.g. a loose wire or disconnected electrode). Turn up the gain on the ECG monitor.

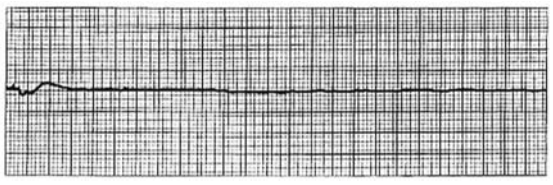


FIGURE 1.13.15 ECG appearance of asystole.

Pulseless electrical activity (PEA)

This is the absence of a palpable pulse or other signs of life despite the presence on the ECG monitor of recognisable complexes that normally produce a pulse (*see* Figure 1.13.16). PEA is treated in the same way as asystole, and is often a pre-asystolic state.

PEA in children and pregnant mothers is often due to major trauma, often with an identifiable and reversible cause such as severe hypovolaemia, tension pneumothorax or pericardial tamponade. PEA is also seen in hypothermic patients and in those with electrolyte abnormalities. It may be seen after massive pulmonary thromboembolus.

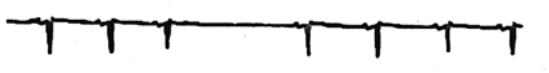


FIGURE 1.13.16 Pulseless electrical activity (PEA) in a child with no pulse or signs of life.

Management of asystole/PEA in children and pregnant mothers

The first essential step is to establish ventilations and chest compressions effectively. Ensure a patent airway, initially using an airway manoeuvre to open the airway and stabilising it with an airway adjunct. Ventilations are provided initially by bag and mask with high-concentration oxygen.

Provide effective chest compressions at a rate of 100–120 per minute with a compression:ventilation ratio of 15:2. The depth of compression should be at least one-third of the antero-posterior diameter of the chest, and compressions should be given in the middle of the lower half of the sternum. Ideally a cardiac monitor is attached. Properly performed basic life support is key to any chance of successful resuscitation from cardiac arrest. Ensure that the person performing chest compressions is keeping the correct rate and depth of compression, and if possible change operator every 2 to 3 minutes, to avoid fatigue causing poor performance.

If asystole or PEA is identified, give **adrenaline 10 micrograms/kilogram** (0.1 mL of 1:10 000 solution/kg) **intravenously or intra-osseously in children and 1 mg IV in pregnant mothers**. Adrenaline increases coronary artery perfusion, enhances the contractile state of the heart and stimulates spontaneous contractions. The drug is best given through a central line, but if one is not in place it may be given through a peripheral line. Where there is no existing IV access, the IO route is recommended as the route of choice, as it is rapid and effective. In each case, the adrenaline is followed by a normal crystalloid flush (2–5 mL).

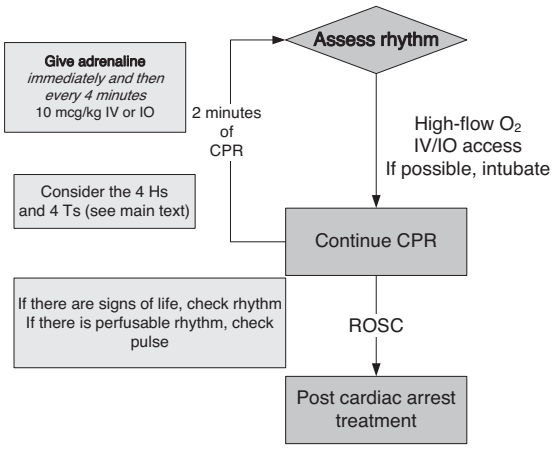


FIGURE 1.13.17 Algorithm for the treatment of non-shockable (asystole and PEA) rhythms in children. Doses of drugs used in pregnancy are given in the text above. CPR, cardiopulmonary resuscitation; IV, intravenous; IO, intra-osseous; ROSC, return of spontaneous circulation.

If available, and as soon as is feasible, a skilled and experienced operator should **intubate the patient's airway**. This will both control and protect the airway and enable chest compressions to be given continuously, thus improving coronary perfusion. Once the patient has been intubated and compressions are uninterrupted, the ventilation rate should be 10–12 breaths per minute. It is important for the team leader to check that the ventilations remain adequate when chest compressions are continuous. An algorithm for non-shockable rhythms is shown in Figure 1.13.17.

During and following adrenaline treatment, chest compressions and ventilation should continue. It is vital that chest compressions and ventilations continue uninterrupted during advanced life support, as they form the basis of the resuscitative effort. The only reason for interrupting compressions and ventilation is to shock the patient if necessary (see below), and to check the rhythm. A brief interruption may be necessary during difficult intubation. Giving chest compressions is tiring for the operator, so if enough personnel are available, change the operator frequently and ensure that they are achieving the recommended rate of 100–120 compressions per minute together with a depression of the chest wall by at least one-third of the antero-posterior diameter of the chest.

At intervals of about 2 minutes during the delivery of chest compressions, pause briefly to assess the rhythm on the monitor. If asystole persists, continue CPR while again checking the electrode position and contact.

- If there is an organised rhythm, check for a pulse and signs of life.
- If there is a return of spontaneous circulation (ROSC), continue post-resuscitation care, increasing the ventilation rate to 12–20 breaths per minute.
- If there is no pulse and no signs of life, continue the protocol.
- Give adrenaline about every 4 minutes at a dose of 10 micrograms/kg IV/IO in children and 1 mg IV in pregnant mothers.

In pregnant mothers, if there is asystole or a slow heart rate (< 60 beats/minute), give atropine 3 mg IV just once to counteract any excessive vagal tone.

Reversible causes of cardiac arrest

The causes of cardiac arrest in childhood and pregnancy are multifactorial, but the two commonest final pathways are through hypoxia and hypovolaemia.

All reversible factors are conveniently remembered as the **4Hs and 4Ts** (see below). Sometimes cardiac arrest is due to an identifiable and reversible cause, such as shock due to massive haemorrhage. In the trauma setting, cardiac arrest may be caused by severe hypovolaemia, tension pneumothorax or pericardial tamponade.

It is often appropriate to give an early IV bolus of Ringer-lactate or Hartmann's solution (10 mL/kg in a child and 500 mL to 1 litre in a mother, depending on her weight), as this will be supportive in cases related to severe hypovolaemia. In addition, however, a tension pneumothorax and/or pericardial tamponade require definitive treatment. Continuing blood replacement and the prevention of haemorrhage may also be required.

Rapid identification and treatment of reversible causes such as hypovolaemic shock, hypothermia, electrolyte and acid–base disturbance, tension pneumothorax and pericardial tamponade are vital.

During CPR it is important to continually consider and correct reversible causes of the cardiac arrest based on the history of the event and any clues that are found during resuscitation.

The 4Hs and 4Ts

1. **Hypoxia** is a prime cause of cardiac arrest in childhood, and its reversal is key to successful resuscitation.
2. **Hypovolaemia** may be significant in arrests associated with trauma, gastroenteritis, pregnancy-related haemorrhage, anaphylaxis and sepsis. It requires infusion of crystalloid, and in the case of haemorrhage, blood should be given.
3. **Hyperkalaemia, hypokalaemia, hypocalcaemia, acidaemia, hypermagnesaemia** (following excess magnesium sulphate in eclampsia) and other metabolic abnormalities may be suggested by the patient's underlying condition (e.g. renal failure, eclampsia), tests taken during the resuscitation or clues from the ECG. Intravenous calcium (0.2 mL/kg of 10% calcium gluconate in children and 10 mL of 10% calcium gluconate in pregnant mothers) is indicated in cases of magnesium overdose, hyperkalaemia and hypocalcaemia.
4. **Hypothermia** is associated with drowning incidents and requires particular care. A low-reading thermometer must be used to detect it (*see* Section 7.3.E).
5. **Tension pneumothorax** and **cardiac Tamponade** are especially associated with PEA and are often found in trauma cases.
6. **Toxic** substances, resulting either from accidental or deliberate overdose or from an iatrogenic mistake, may require specific antidotes.
7. **Thromboembolic** phenomena (pulmonary or amniotic fluid) in pregnancy.

Shockable cardiac arrest

These arrhythmias are less common in children and in pregnant mothers, but either of them may be expected in patients with sudden collapse, hypothermia, poisoning by tricyclic antidepressants, or cardiac disease. The protocol for ventricular fibrillation (VF) (*see* Figure 1.13.18) and pulseless ventricular tachycardia (pVT) (*see* Figure 1.13.19) is the same, and is shown in Figure 1.13.20.

A sudden witnessed collapse is also suggestive of a VF/pVT episode.

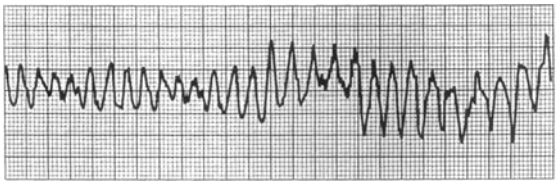


FIGURE 1.13.18 An episode of ventricular fibrillation.

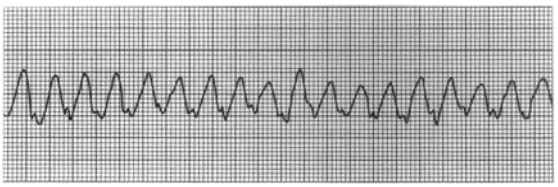


FIGURE 1.13.19 Ventricular tachycardia.

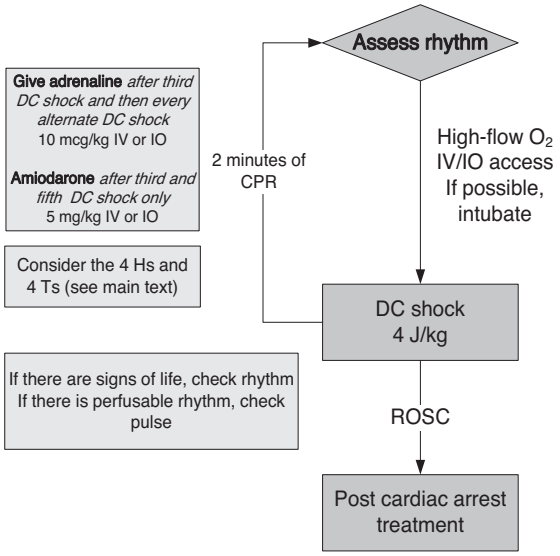


FIGURE 1.13.20 Algorithm for the treatment of shockable (VF and pVT) rhythms in children. Doses of drugs and size of shock used in pregnancy are given in the text below. CPR, cardiopulmonary resuscitation; IV, intravenous; IO, intra-osseous; ROSC, return of spontaneous circulation.

If the patient is being monitored, the rhythm can be identified before significant deterioration occurs. With immediate identification of VF/pVT, asynchronous electrical defibrillation of 4 joules/kg in children and 200 joules in pregnant mothers should be undertaken immediately and the protocol continued as described below.

In unmonitored patients, basic life support will have been started in response to the collapse, and VF/pVT will be identified when the cardiac monitor is put in place.

An **asynchronous shock of 4 joules/kg in children and 200 joules in pregnant mothers** should be given immediately and **CPR immediately resumed** without reassessing the rhythm or feeling for a pulse. Immediate resumption of CPR is vital because there is a pause between successful defibrillation and the appearance of a rhythm on the monitor. Cessation of chest compressions will reduce the likelihood of a successful outcome if a further shock is needed. However, no harm accrues from 'unnecessary' compressions.

Paediatric paddles (4.5 cm) should be used for children under 10 kg.

One electrode is placed over the apex in the mid-axillary line, while the other is placed immediately below the clavicle just to the right of the sternum. If the paddles are too large, one should be placed on the upper back, below the left scapula, and the other should be placed on the front, to the left of the sternum.

Automated external defibrillators (AEDs) are now commonplace in well-resourced countries. The standard adult shock is used for children over 8 years of age. For children under 8 years, attenuated paediatric paddles should be used with the AED (if available).

For infants under 1 year of age, a manual defibrillator which can be adjusted to give the correct shock is recommended. However, if an AED is the only defibrillator available, its use should be considered, preferably with paediatric attenuation pads. The choice of defibrillation for infants in decreasing order of preference is as follows:

1 manual defibrillator
2 AED with dose attenuator
3 AED without dose attenuator.

Many AEDs can detect VF/VT in children of all ages, and differentiate between 'shockable' and 'non-shockable' rhythms with a high degree of sensitivity and specificity.

If the shock fails to defibrillate, attention must revert to supporting coronary and cerebral perfusion as in asystole. Although the procedures for stabilising the airway and obtaining circulatory access are now described sequentially, they should be undertaken simultaneously under the direction of a resuscitation team leader.

The airway should be secured, the patient **ventilated** with high-flow oxygen, and **effective chest compressions** continued at a rate of 100–120 per minute, with a compression depth of at least one-third of the antero-posterior diameter of the chest, and a ratio of 15 compressions to 2 ventilations. As soon as is feasible, a skilled and experienced operator should **intubate the child's airway**. This will both control and protect the airway and enable chest compressions to be given continuously, thus improving coronary perfusion. Once the patient has been intubated and compressions are uninterrupted, the ventilation rate should be 10–12 breaths per minute. It is important for the team leader to check that the ventilations remain adequate when chest compressions are continuous. **Obtain circulatory access.** Whenever venous access is not readily obtainable, intra-osseous access should be considered early on in children, as it is rapid and effective. Central venous lines provide more secure long-term access, but they offer no advantages compared with IO or peripheral IV access. In each case any drug is followed by a crystalloid flush (2–5 mL).

Two minutes after the first shock, pause the chest compressions briefly to check the monitor. If VF/VT is still present, give a **second shock of 4 joules/kg** and **immediately resume CPR**, commencing with chest compressions.

Consider and correct reversible causes (the 4Hs and 4Ts) while continuing CPR for a further 2 minutes.

Pause briefly to check the monitor.

If the rhythm is still VF/VT, give a **third shock of 4 joules/kg**.

Once chest compressions have resumed, give **adrenaline 10 micrograms/kg in children and 1 mg in pregnant mothers IV** and **amiodarone 5 mg/kg in children** and **300 mg in pregnant mothers** intravenously or intra-osseously, flushing after each drug.

After completion of the 2 minutes of CPR, pause briefly to check the monitor, and if the rhythm is still VF/VT give an immediate **fourth shock of 4 joules/kg** and **resume CPR**.

After a further 2 minutes of CPR, pause briefly to check the monitor and if the rhythm is still shockable, give an immediate **fifth shock of 4 joules/kg**.

Once chest compressions have resumed, give a second dose of **adrenaline 10 micrograms/kg** and a second dose of **amiodarone 5 mg/kg** intravenously or intra-osseously in children and **1 mg of adrenaline IV** and **150 mg amiodarone in pregnant mothers**. An amiodarone infusion can be continued if there is refractory VF/pVT of 900 mg over 24 hours in adults and 15 mg/kg over 24 hours in children.

After completion of the 2 minutes of CPR, pause briefly before the next shock to check the monitor. Continue giving shocks every 2 minutes, minimising the pauses in CPR as

much as possible. Give adrenaline after every **alternate** shock (i.e. every 4 minutes) and continue to seek and treat reversible causes.

Note: After each 2 minutes of uninterrupted CPR, pause briefly to assess the rhythm on the monitor.

In addition, if at any stage there are signs of life, such as regular respiratory effort, coughing or eye opening, stop CPR and check the monitor.

- If the rhythm is still VF/VT, continue with the sequence as described above.
- If the rhythm is asystole, change to the asystole/PEA sequence.
- If organised electrical activity is seen, check for signs of life and a pulse. If there is ROSC, continue post-resuscitation care. If there is no pulse (or a pulse of < 60 beats/minute) and no other signs of life, continue the asystole/PEA sequence.

In VT or VF that does not respond to the above sequence, and where there is no evidence of previous administration of magnesium for eclampsia, consider giving magnesium sulphate 25–50 mg/kg up to a maximum of 2 grams in children and an **8 mmol IV bolus (4 mL of 50% magnesium sulphate) in pregnant mothers**.

Sodium bicarbonate

If VF/VT is due to tricyclic antidepressant overdose or hyperkalaemia, sodium bicarbonate may be helpful. Give 1 mmol/kg (1 mL/kg of an 8.4% solution or 2 mL/kg of a 4.2% solution) in children, and give 50 mmol in pregnant mothers.

Amiodarone

Amiodarone is the treatment of choice in shock-resistant ventricular fibrillation and pulseless ventricular tachycardia. The dose of amiodarone for VF/pulseless VT is 5 mg/kg via rapid IV/IO bolus in children, and **300 mg IV in pregnant mothers**.

Lidocaine is an alternative to amiodarone if the latter is unavailable. The dose is 1 mg/kg IV or IO in children and **100 mg** as an IV bolus **in pregnant mothers**.

It is DC shock that converts the heart back to a perfusing rhythm, not the drug. The purpose of the anti-arrhythmic drug is to stabilise the converted rhythm, and the purpose of adrenaline is to improve myocardial oxygenation by increasing coronary perfusion pressure. Adrenaline also increases the vigour and intensity of ventricular fibrillation, which increases the success rate of defibrillation.

Precordial thump

A precordial thump may be given in monitored patients in whom the onset of VT or VF is witnessed, if there are several clinicians present and if the defibrillator is not immediately to hand. However, it is rarely effective, and early activation of emergency services and obtaining an AED are more appropriate. Start CPR as soon as possible.

Drugs used in non-shockable and shockable cardiac arrest

Oxygen

Although 100% oxygen must be used during the resuscitation process, once there is return of spontaneous circulation (ROSC) this can be detrimental to tissues that are recovering from hyperoxia. Pulse oximetry should be used to monitor and adjust for oxygen requirement after a successful resuscitation. Saturations should be maintained in the range 94–98%. **Always ensure that oxygen delivery is discontinued during defibrillation shocks, to avoid the risks of explosions and fire.**

Adrenaline

Adrenaline is the first-line drug for treatment of cardiac arrest. Its effect is to increase blood flow to the brain and myocardium by constricting alternative arterioles. It renders the myocardium more susceptible to defibrillation.

The initial IV or IO dose is 10 micrograms/kg (0.1 mL/kg of 1 in 10 000 solution) in children and 1 mg (1 mL of 1 in 1000 solution) in pregnant mothers. In children with no existing IV access, the intra-osseous route is recommended as the route of choice, as it is rapid and effective. In each case, adrenaline is followed by a 0.9% saline flush (2–5 mL).

Sodium bicarbonate

Good basic life support is more effective than alkalising agents, which may be considered if spontaneous circulation has not returned after the first or second dose of adrenaline. Sodium bicarbonate is recommended in the treatment of patients with VT/VF due to hyperkalaemia and tricyclic antidepressant overdose (see above).

The dose is 1 mmol/kg in children (1 mL/kg of an 8.4% solution or 2 mL/kg of 4.2% solution), and 50 mmol in pregnant mothers.

- Sodium bicarbonate must not be given in the same intravenous line as calcium, otherwise precipitation will occur.
- Sodium bicarbonate inactivates adrenaline and dopamine, so the line must be flushed with Ringer-lactate or Hartmann's solution if these drugs are subsequently given.
- **Sodium bicarbonate must not be given via the intratracheal route.**

Glucose

Hypoglycaemia is defined as a glucose concentration of less than 2.5 mmol/litre (45 mg/dL).

All patients, but especially infants and preschool children, can become hypoglycaemic when seriously ill. Blood glucose levels should therefore be checked frequently, and **hypoglycaemia must be corrected**. If it is suspected and blood glucose levels cannot be measured, always give 2–5 mL/kg of 10% glucose in children or 100 mL of 25% glucose in pregnant mothers, preferably IV if not enterally (via a gastric tube). Make 100 mL of 25% glucose by adding 50 mL of 50% glucose to 50 mL of Ringer-lactate or Hartmann's solution. If blood glucose levels can be measured, avoid hyperglycaemia (maintain blood glucose concentration below 12 mmol/litre).

Cardiac arrest and cardiopulmonary resuscitation in the obstetric patient

Background

Cardiac arrest in late pregnancy or during delivery is rare, and maternal survival rates are very low (3–33% in published series). The cause of the arrest is not often reversed, and the physiological changes present in late pregnancy hinder effective CPR.

Cardiac arrest in the mother results in absent uterine

perfusion, and the fetus will also die. Even when CPR is ideal, it is not possible to generate a cardiac output of more than 30%.

Causes

These include the following:

- massive haemorrhage
- pulmonary embolism
- trauma
- amniotic fluid embolism
- severe infection
- local anaesthetic toxicity.

Physiological changes of pregnancy that relate to cardiopulmonary resuscitation

- Pregnant mothers more easily develop hypoxaemia.
- The enlarged uterus along with the resultant upward displacement of the abdominal viscera decreases lung compliance.
- The most serious physiological change is aorto-caval compression in the supine position. **It is essential that CPR is performed in the left lateral position in any pregnant woman where the uterus is a significant intra-abdominal mass (usually after 20 weeks' gestation).** During closed-chest cardiac compression the best cardiac output that can be achieved is between one-fourth and one-third of normal. Although many factors contribute to this, poor venous return to the heart is of paramount importance. At term the vena cava is completely occluded in 90% of supine pregnant patients. This results in a decrease in cardiac stroke volume of as much as 70%. **It is helpful to manually displace the uterus to the left in advanced pregnancy** (*see* Figure 1.13.21).
- Caesarean section performed early in resuscitation greatly improves the effectiveness of maternal resuscitation.

Perimortem Caesarean section

- Caesarean section should be performed as soon as possible, as described in Section 1.12 on basic life support. This will immediately relieve the vena caval obstruction and increase the likelihood of survival for both infant and mother. CPR must be continued throughout the procedure until spontaneous and effective cardiac activity occurs.
- Assisted ventilation may have to be continued for a longer period of time. Some infants have survived when delivered after 20 minutes of maternal resuscitation.
- Without Caesarean section, less than 10% of mothers who arrest in hospital will survive to discharge. Removal of the infant improves maternal circulation during resuscitation, and cardiac output immediately increases by 20–25%.

Perform the Caesarean section with a midline vertical incision, or whatever method the operator is most familiar with, and remove the baby as fast as possible. Remove lateral tilt when the baby is delivered.

FIGURE 1.13.21 Displacing the gravid uterus to the left.

When to stop resuscitation

Local guidelines should be in place. Resuscitation efforts are unlikely to be successful, and cessation can be considered, if there is no return of spontaneous circulation at any time after 20 minutes of life support and in the absence of recurring or refractory VF/VT. The exceptions are patients with a history of poisoning or a primary hypothermic insult, in whom prolonged attempts may occasionally be successful. Prolonged external cardiac compressions during which central (femoral or arterial) pulses were felt have successfully resuscitated patients with tricyclic antidepressant overdose.

The presence of the parents at the child's side during resuscitation enables them to gain a realistic understanding of the efforts made to save their child's life. In general, family members should be offered the opportunity to be present during the resuscitation of their child.

The most important points can be summarised as follows:

- A staff member (if available) must be designated as the parents' support and interpreter of events at all times.
- The team leader, not the parents, decides when it is appropriate to stop the resuscitation.
- If the presence of the parents is impeding the progress of the resuscitation, they should be sensitively asked to leave.
- The team needs a debriefing session to support staff and reflect on practice.

1.14 High-dependency care in pregnancy and childhood

High-dependency care is a service provided for patients with potentially recoverable pathological processes who can benefit from more detailed observation and treatment than is generally available on the standard hospital ward.

High-dependency care is usually provided for patients with threatened or established organ failure, which may have arisen as a result of:

- an acute illness
- a complication of pregnancy or delivery
- trauma
- a predictable phase in a planned treatment programme (e.g. after major surgery).

Introduction

Health needs are best met through an integrated approach involving several agencies, including primary and secondary healthcare, education and social services. **Together such services may help to prevent some of the conditions that lead to patients requiring intensive care.** For example, vaccination programmes will decrease the number of children who develop respiratory failure due to preventable diseases such as pertussis and measles. Education and legislation are important for reducing the number of individuals who are seriously injured in road traffic accidents and in accidents in the home.

High-dependency care is a low-volume, high-demand specialty. Women and girls with complications of pregnancy and children under 2 years of age account for most of those who require high-dependency care. There also may be seasonal variation, with a peak in the winter months associated with respiratory-related illness, or a peak in the rainy season associated with malaria.

Dedicated intensive care units in large tertiary care centres have been shown to have the best outcomes. Ideally, every country in the world should have units that provide this service. **However, the majority of patients who require high-dependency or intensive care will present to smaller peripheral hospitals rather than to large tertiary centres.** Therefore it is absolutely essential that staff in smaller district hospitals are able to recognise and appropriately treat sick children and pregnant women in the early stages of their illness (*see* EESS-EMNCH programme – Essential and Emergency Surgical Skills – *Emergency Maternal, Neonatal and Child Healthcare Manual and Pocket Book*, which can be found on the MCAI website: www.mcai.org.uk).

All medical and nursing staff who undertake high-dependency care should be well trained in emergency care so as to be able to stabilise critically ill or injured patients, and initiate appropriate medical therapy, which may involve intubation and ventilation. A proportion of such patients may then be safely transferred to an intensive care unit if this is still appropriate and a bed is available. Often, with good initial resuscitation and early diagnosis and treatment, the need for intensive care can be avoided. In a patient who requires intensive care, there should be early consultation with the regional/national intensive-care unit, usually by telephone or radio, so that further management can be jointly decided until a retrieval team, if available, arrives to collect the patient.

Transportation of critically ill patients (*see* Section 1.19), particularly those receiving assisted ventilation, requires appropriately trained staff and equipment. Transportation is best thought of as 'a high-dependency care bed on wheels', and the aim should be that the patient does not deteriorate during transport. Before the patient is moved, proper resuscitation and stabilisation are essential.

Children and pregnant mothers exhibit fundamental differences that influence the training of staff and the type and size of equipment available. These differences extend across anatomy, physiology, pharmacology and behaviour. However, both of these patient groups have less reserve and tend to decompensate early and quickly. They also have a greater capacity to make a full recovery.

Provision of high-dependency care is not just about equipment and facilities. The surrounding environment and contact with their family is crucial to the promotion of a patient's recovery.

Levels of high-dependency/intensive care

There are three levels of care that are designed to make the most appropriate use of staff and equipment resources (*see* Table 1.14.1). In most resource-limited countries, only Level 1 care is likely to be available, and then only in the most well-funded hospitals, such as those in the capital cities or where medical students are trained.

The majority of patients can be managed at Level 1 with close monitoring, good nursing care and appropriate medical therapy. By providing optimal therapy it is often possible to prevent the deterioration of the patient (e.g. through good fluid management, early but appropriate treatment with antibiotics, and the use of oxygen).

Many hospitals will have poor outcomes if patients have to be ventilated in sites where there is a lack of maintained ventilators, and no reliable oxygen source or blood gas analyser. As far as possible in countries with limited resources, intubation and ventilation should be avoided until they are absolutely necessary. Many patients can tolerate high pCO_2 levels with a compensated pH – it is hypoxia that is potentially fatal. It may be appropriate to develop and have available non-invasive modes of ventilatory support, such as nasal mask or cannula **continuous positive airways pressure (CPAP)**, nasal or face mask **intermittent positive pressure ventilation (IPPV)**, **bilevel positive airways pressure (BiPAP)**, or **negative pressure ventilation (CNEP or INPV)**. Similarly, the more invasive a procedure or monitoring process is, the greater the risk of complications.

Finally, it is essential that hospitals which provide high-dependency care have an on-site biomedical engineer to keep all of the equipment serviced and safe.

TABLE 1.14.1 Levels of high dependency and intensive care

Level 3 (intensive care)		
Multi-organ failure		
Ideally one or more nurses per patient		
Invasive monitoring		
Examples: ventilation, haemofiltration		
Optimise medical therapy		
Level 2 (intensive care)		
Single-organ failure		
Ideally one nurse per patient		
Non-invasive or invasive monitoring		
Example: ventilation		
Intubate ↑		Extubate ↓
Optimise medical therapy		
Level 1 (high-dependency care)		
Requirement for closer observation and monitoring than is available on the standard ward		
Ideally one nurse for every two patients		
Non-invasive monitoring		
Examples: after major surgery, non-intubated child with severe croup, pregnant woman with severe pre-eclampsia or eclampsia		

Minimum standards for a lead centre providing intensive care

Medical staff

- Senior doctors or physician assistants with appropriate training in high-dependency care medicine.
- Training programme for junior medical staff specialising in high-dependency care.
- Provision of 24-hour cover at both senior and junior level.
- Resident junior cover for 24 hours by staff with skills in emergency care and resuscitation, whose only clinical responsibility is to the high-dependency care unit.
- Access on site to other specialist consultants (e.g. obstetrician, paediatrician, ENT surgeon, anaesthetist).

Nursing staff

- Nursing staff with training in high-dependency care and resuscitation.
- Ongoing training and support for nursing staff.
- Continuous 24-hour observation of each patient at all times by a nurse qualified in high-dependency care, with observations documented.

Support staff

- Availability of a physiotherapist.
- Availability of a pharmacist 24 hours a day.
- Availability of a dietitian.
- Availability of a biomedical engineer 24 hours a day.

Equipment and drugs

- Medical staff and nursing staff with training in how to use all equipment.
- Equipment maintained on a regular basis and according to manufacturer's guidelines by a biomedical engineer.
- Controlled drugs, especially morphine, available immediately and for 24 hours a day.

Retrieval service

- Available 24 hours a day from the community or other health facilities without high-dependency care (e.g. via an emergency ambulance service; *see* www.reproductive-health-journal.com/content/pdf/1742-4755-7-21.pdf).
- Does not take staff from the high-dependency unit, leaving it uncovered.
- Usually an experienced doctor, midwife or nurse.
- Able to provide phone or radio advice.
- Equipped with portable battery-operated monitors (ECG, heart rate, respiratory rate, oxygen saturation) and suction. Possible to provide hand bag ventilation by face mask or endotracheal tube rather than have a transport ventilator.

Clinical effectiveness and management

- Protocols for admissions, discharges, retrievals, resuscitation and stabilisation, and for treating major conditions.
- Data collection and regular audit of deaths and near-miss cases to improve care provided.

Facilities for families

- Access for carers of children and partners of pregnant mothers at all times.
- Accommodation and food for families.
- Maternal and Child Health Initiative (MCHI) environment (*see* MCHI manual).

Essential equipment for the high-dependency care of children and pregnant mothers

1 Beds that are manually operated to tilt the head up or feet down.
2 Wedges for lateral tilt for pregnant mothers.

3 Suction systems and suction catheters, both electrical and manual (ideally wall suction).
4 Pulse oximeters and ECG monitors (one for each bed).
5 Resuscitation trolley containing drugs and equipment (particularly oropharyngeal airways, laryngoscopes with spare bulbs, endotracheal tubes and introducers, bag-valve-masks (child and adult), masks with reservoir bags.
6 Mobile screens.
7 Mobile oxygen cylinders and one oxygen concentrator for each bed, with face masks and nasal cannulae (infant, child and adult).
8 Wall sockets (six per bed).
9 One basic infant ventilator and one child/adult ventilator.
10 Nasal or mask CPAP systems (neonatal, child and adult).
11 Two automatic external defibrillators (AEDs).
12 Infusion pumps (if there are sufficient staff).
13 IV drip stands.
14 Basic CVP monitoring system.
15 Blood warmer (ideally).
16 Fridge for pharmacy drugs.
17 Fridge for blood for transfusion.
18 Lockable cupboard for drugs not needing refrigeration.
19 Metal lockable cupboard for controlled drugs.
20 Cupboard for storing IV fluids.
21 End-of-bed chart tables and specially designed high-dependency care charts.
22 One portable ultrasound scanner.
23 One portable fetal heart monitor.
24 Burette giving sets.
25 Portable examination light.
26 Portable fans.
27 Suitable storage boxes (preferably easy to clean and label).
28 Blackboard for documenting priority issues for each patient.
29 Wall-mounted pathways of care.
30 Hand wash facilities × 3/4.
31 Separate sluice and patient and staff toilet and washing facilities.
32 Steriliser.

For details of procedures that are likely to be used in high-dependency care, *see* Section 2.13 (on obstetrics) and Section 7 (on children and all-age trauma).

1.15 Pain control in pregnancy and childhood

Introduction

It is ethically wrong and a failure of professional duties for any patient to suffer uncontrolled pain.

- Uncontrolled pain has adverse cardiovascular, respiratory, immunological and metabolic consequences, as well as long-term psychological effects.
- Both pharmacological and non-pharmacological approaches are valuable in both acute and chronic pain.
- **Attempts should be made to anticipate and prevent pain rather than trying to relieve it when it is established.** This method usually results in less analgesia being needed. 'As-required' regimens should be avoided. Analgesics should be used in regular and adequate doses.
- There is little place for IM pain relief, particularly as a repeated treatment. Many patients would rather suffer and hide their pain than receive IM analgesia.
- If a **conscious** child has to be restrained for a procedure, this must be done kindly but firmly by a person or persons (ideally a parent or caregiver) and not by contraptions such as straitjackets or the tying down of limbs.
- It is vital to ask for and value the patient's own judgement concerning the adequacy of pain relief provided.
- When beginning a course of treatment for pain it is important to realise that such treatment may continue for a long time. **Pain must be controlled quickly from the onset to ensure confidence in treatment, with an emphasis on preventative measures.**

Assessment of pain

- Establish the severity of pain that is being experienced.
- Help to select the right amount and type of pain relief.
- Indicate the success of pain management.

Methods for assessing pain

- Description by the patient (self-reporting), possibly involving the use of a self-report scale (*see* Figures 1.15.1 and 1.15.2)
- Observation of behavioural changes (e.g. crying, guarding of the injured part, facial grimacing). This method is best for children in collaboration with carers. The Alder Hey Triage Pain Score may be useful in this context (*see* Appendix on p. 80).
- Physiological changes (e.g. vasoconstriction, tachycardia, tachypnoea). However, these can also be due to serious medical causes.
- Expectation of pain because of the pathophysiology involved (e.g. obstructed labour, placental abruption, fracture, burn or other significant trauma).
- Keeping a diary of long-term pain.

FIGURE 1.15.1 Visual scale for assessing the severity of pain.

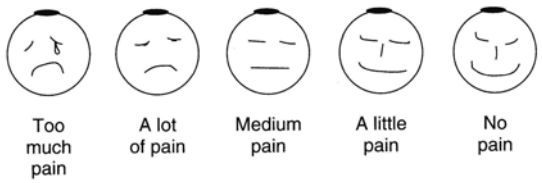


FIGURE 1.15.2 A commonly used faces pain scale for assessing the severity of pain in children.

Problems with assessing pain

- Suffering being hidden by a frightened patient, especially a child.
- Difficulty in differentiating anxiety from pain.
- Family members (and healthcare professionals) may underestimate or overestimate pain.
- Pre-verbal and non-verbal children (and any older patient with learning difficulties or with sensory handicap) may not be able to adequately express their need for pain control.
- Cultural factors (beliefs, perceptions and behaviour).

Treatment of pain

Many patients, particularly babies and children, are undertreated for pain because of:

- fear of the harmful side effects of medications
- failure to accept that children feel pain in the same way that adults do
- fear of receiving IM injections
- limited availability of the required spectrum of pain medications.

Methods for reducing pain without drugs

Environmental factors

Negative aspects of the environment should be minimised or removed. These include an overly 'clinical' appearance, and evidence of invasive instrumentation. Needles should be kept out of sight. An attractive, decorated environment with toys, mobiles and pictures may help the child to feel more relaxed.

- Privacy is important.
- Pain caused by fractures can be reduced by splinting to immobilise them.
- Pain from burns can be reduced by applying a light covering.
- Parents should be present with their child during invasive procedures, unless there are very good medical reasons why they should be excluded, or they choose not to be present.

Supportive and distractive techniques for children

Age-appropriate distraction strategies include:

- the presence of familiar objects (comforters) (e.g. pillow, soft cuddly toy)
- singing, concentrating on nice things, jokes, games and puzzles
- imaginary journeys
- blowing soap bubbles
- breathing out (but not hyperventilation, which may increase anxiety)
- a mirror that allows the child to see the view through a nearby window
- listening to stories or music.

Drug treatment for pain using local anaesthetic drugs

Infiltration (the most widely used method)

Lidocaine 0.5–2%

- Used for rapid and intense sensory nerve block.
- Onset of action is within 2 minutes; the procedure must not be started until an anaesthetic effect is evident.
- Effective for up to 2 hours.
- Doses:
  - neonates to 12 years: maximum dose given locally 3 mg/kg – 0.3 mL/kg of 1% solution or 0.6 mL/kg of 0.5% solution (7 mg/kg with 1 in 200 000 adrenaline)
  - children over 12 years and pregnant mothers: up to a maximum of 200 mg (500 mg if used with adrenaline) not more than 4-hourly.
- Adrenaline is rarely added in children and never for digits.
- Strength: 1% or 0.5%.
- Preparation of lidocaine 0.5% solution. Combine:
  - lidocaine 1%, 1 part
  - Ringer-lactate or Hartmann's solution or sterile distilled water, 1 part.

Do not use local anaesthetic containing adrenaline in areas served by an end artery or with a poor blood supply (e.g. finger, toe, penis), as tissue necrosis will occur.

Advantages of adding adrenaline include the following:

- less blood loss
- longer effect of anaesthetic (usually 1–2 hours)
- lower risk of toxicity because of slower absorption into the general circulation.

The concentration of adrenaline to use is 1:200 000 (5 micrograms/mL). In children, the maximum dose of adrenaline is 5 micrograms/kg.

Note: It is critical to measure adrenaline carefully and accurately using a 1-mL or, at the most, 2-mL syringe. (An insulin syringe may be used if a regular 1-mL syringe is not available.) Mixtures must be prepared observing strict infection prevention practices.

TABLE 1.15.1 Formulas for preparing 0.5% lidocaine solutions containing 1:200 000 adrenaline

Desired amount of local anaesthetic needed (mL)	Ringer-lactate or Hartmann's solution (mL)	Lidocaine 1% (mL)	Adrenaline 1:1000 (mL)
20	10	10	0.1
40	20	20	0.2
100	50	50	0.5
200	100	100	1.0

Local infiltration into an abscess is not recommended, because local anaesthetics are ineffective in inflamed tissues.

Complications of local anaesthesia

Prevention of complications

- If more than 40 mL of 0.5% lidocaine are to be used, add adrenaline as described above. Procedures that may require more than 40 mL of 0.5% lidocaine are Caesarean section and repair of extensive perineal tears.
- Use the lowest effective dose.
- Inject slowly.
- Avoid accidental injection into a vessel. There are three ways of doing this:
  - the **moving needle technique** (preferred for tissue infiltration): the needle is constantly in motion while injecting, which makes it impossible for a substantial amount of solution to enter a vessel
  - the **plunger withdrawal technique** (preferred when considerable amounts are injected into one site): the syringe plunger is withdrawn before injecting, and if blood appears the needle is repositioned and another attempt is made
  - the **syringe withdrawal technique**: the needle is inserted and the anaesthetic is injected as the syringe is being withdrawn.

Symptoms and signs of lidocaine allergy and toxicity

Lidocaine can be absorbed through mucous membranes in a large enough dose to be toxic.

Symptoms of allergy: shock, redness of skin, skin rash/hives, bronchospasm, vomiting, serum sickness (*see* Sections 2.7.C and 5.1.B on anaphylaxis in mothers and children, respectively).

TABLE 1.15.2 Lidocaine toxicity

Mild toxicity	Severe toxicity	Life-threatening toxicity (very rare)
Numbness of lips and tongue	Sleepiness	Tonic–clonic convulsions
Metallic taste in mouth	Disorientation	Respiratory depression or arrest
Dizziness/lightheadedness	Muscle twitching and shivering	Cardiac depression or arrest
Ringing in ears	Slurred speech	
Difficulty in focusing eyes		

- Direct intra-arterial or IV injection of even a small amount may result in cardiac arrhythmias and convulsions (see above).
- Resuscitative facilities and healthcare professionals with resuscitative skills should be present.
- Lidocaine can be absorbed through mucous membranes in sufficient concentration to be toxic.

Immediately stop injecting and prepare to treat severe and life-threatening side effects.

If symptoms and signs of mild toxicity are observed wait a few minutes to see if the symptoms subside. Check vital signs and talk to the patient. Delay the procedure for at least 4 hours if possible.

Adrenaline toxicity

This is caused by excessive amounts or inadvertent IV administration, and results in:

- restlessness
- sweating
- hypertension
- cerebral haemorrhage
- rapid heart rate
- cardiac arrest.

Bupivacaine 0.25%

- This is used to provide longer-lasting local anaesthesia.
- Onset of action is up to 30 minutes.
- It is effective for up to 8 hours.
- Maximum dosage is 2 mg/kg (in mothers the pre-pregnant weight is used for calculations).

For uses of other preparations of bupivacaine, *see* Section 1.24.

Local anaesthetics given through the surface of the skin or mucous membranes

1 **Lidocaine:** apply on gauze to painful mouth ulcers before feeds (apply with gloves, unless both the family member and the patient are HIV-positive, in which case the family member does not need protection from infection). It acts within 2–5 minutes.

2 **TAC (tetracaine–adrenaline–cocaine):** apply to a gauze pad and place over open wounds; it is particularly useful when suturing. Care needs to be taken close to mucous membranes to avoid toxicity from absorption of cocaine. If available, other topical anaesthetic agents such as lidocaine–adrenaline–tetracaine seem to be equally effective and avoid the potential toxicity associated with cocaine.

Systemic drug treatment for pain

The World Health Organization (WHO) has altered the previous three-step approach to the treatment of pain, removing the use of codeine between Step 1 and Step 2 (*see* Figure 1.15.3). Although widely available, codeine is unpredictable in its effects, due to its very variable metabolism between individuals, with the potential for both toxicity and inadequate analgesia. It is now recommended that if Step 1 drugs do not control pain, morphine should be used next.

Non-opiate analgesics

Paracetamol

- This is the most widely used analgesic and anti-pyretic.
- It does not cause respiratory depression.
- It is dangerous in overdose but a very safe and effective drug if used in recommended doses.
- It is given by mouth, rectally or intravenously.
  - The maximum daily dose should not be given for more than 3 days.
  - Caution is needed in patients with liver impairment.
  - There are no anti-inflammatory effects.
  - Paracetamol can be combined with NSAIDs and both have a morphine-sparing effect, lowering the dose, and therefore severity of side effects of morphine.

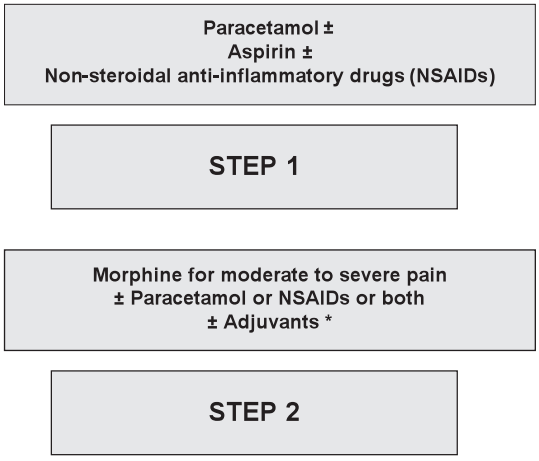


FIGURE 1.15.3 WHO two-step analgesic ladder.

Non-steroidal anti-inflammatory drugs (NSAIDs) (e.g. ibuprofen, diclofenac)

- These are anti-inflammatory, anti-pyretic drugs with moderate analgesic properties.
- They are less well tolerated than paracetamol, causing gastric irritation, platelet disorders and bronchospasm.
- They should be avoided in patients with gastric ulceration, platelet abnormalities or significant asthma.
- NSAIDs are especially useful for post-traumatic and bone pain because of their anti-inflammatory effect.
- They are given by the oral or rectal route (e.g. diclofenac).

Caution: do not give NSAIDs in the third trimester of pregnancy, as they may close the ductus arteriosus and predispose to pulmonary hypertension of the newborn. They may also delay the onset and progress of labour.

There is a risk of gastric haemorrhage through whichever route the NSAIDs are given.

Opiate analgesics

For a discussion of the importance of properly storing, handling and monitoring the use of morphine, *see* Section 1.6.

Morphine

- Morphine is the most important drug in the world for pain control, and the WHO recommends that it should be universally available.
- **In resource-limited countries it is mostly administered orally, which is useful for chronic or anticipated pain but less effective for acute pain. The latter requires IV administration of morphine.**
- At an appropriate dose, analgesia occurs without impaired consciousness.
- Nausea and vomiting are rare with oral treatment, but when morphine is given intravenously for the first time it may produce this side effect.

Intravenous use of morphine

- In single doses it has minimal haemodynamic effects in a supine patient with normal circulating blood volume.
- In hypovolaemic patients it can contribute to hypotension. Therefore:
  - monitor the patient's cardiovascular status
  - have an IV fluid bolus of Ringer-lactate or Hartmann's solution ready (20 mL/kg for a child and 500 mL to 1 litre for pregnant mothers).
- In excessive dosage it can produce a dose-dependent depression of ventilation and decreased respiratory rate, leading to apnoea.
- Patients who are receiving morphine in hospital (where it is often intravenously administered) need observation and/or monitoring of respiratory rate and sedation.
- Morphine is better controlled by the IV than the IM route. If using the IV route, give a small dose initially and repeat every 3–5 minutes until the patient is comfortable. Individuals vary widely with regard to the dose needed to provide pain relief. **It is rarely appropriate to give morphine intramuscularly**, and **for patients who are in shock, giving morphine IM is dangerous, as it can be initially poorly absorbed, and then quickly absorbed when perfusion improves, potentially leading to too high a blood level of the drug.**
- Morphine can also be given by subcutaneous infusion in hospital (e.g. as a post-operative analgesic), especially if small battery-operated syringe drivers are available.
- Intravenous morphine can be dangerous in situations of raised intracranial pressure without the means to provide respiratory support.
- During late pregnancy or delivery, morphine can cause respiratory depression in the neonate.

TABLE 1.15.3 Orally administered drugs for mild or moderate pain

Medicine	Neonate 0–29 days	Infant 30 days to 3 months	3 months to 12 years	Maximum daily dose	In pregnancy
Paracetamol	10 mg/kg every 6–8 hours Maximum 4 doses in 24 hours 5 mg/kg if jaundiced	10 mg/kg every 4–6 hours	15 mg/kg up to 1 g every 4–6 hours Maximum 4 doses/4 g in 24 hours	4 doses in 24 hours	500 mg to 1 g 6-hourly
Ibuprofen	Not recommended	Not recommended	5–10 mg/kg every 6 hours	40 mg/kg/day	Do not use in pregnancy
Diclofenac	Not recommended	Not recommended	**Over 6 months**, 0.3–1 mg/kg 3 times daily	3 mg/kg/day	Do not use in pregnancy

Naloxone

Naloxone is an opiate antagonist that reverses the sedative, respiratory-depressive and analgesic effects of morphine, and so should be given to treat morphine overdose.

Preparations of non-opioid drugs:

Doses can be obtained from the *British National Formulary* and the newly published *PCF4 Palliative Care Formulary*, available at www.palliativedrugs.com/palliative-care-formulary.html (accessed July 2014).

Paracetamol: oral suspension, 120 mg/5 mL, 250 mg/5 mL; tablets, 500 mg.

Ibuprofen: oral suspension, 100 mg/5 mL; tablets, 200 mg, 400 mg.

Diclofenac: tablets, 25 mg, 50 mg; dispersible tablets, 10 mg.

Notes on ibuprofen and diclofenac

- Do not use in patients less than 1 year old, or in pregnancy.
- Caution is needed in patients with asthma, liver or renal failure.
- Contraindications include dehydration, shock, bleeding disorders and hypersensitivity to aspirin.
- NSAIDs and paracetamol can be used in combination.

If rectal drugs are available, the doses are similar to oral doses.

TABLE 1.15.4 Intravenous paracetamol for mild or moderate pain

Age/weight	Dose	Maximum dose in 24 hours
Preterm over 32 weeks	7.5 mg/kg every 8 hours	25 mg/kg
Term neonate	10 mg/kg every 4–6 hours	30 mg/kg
Pregnant woman or child less than 50 kg body weight	15 mg/kg every 4–6 hours	60 mg/kg
Pregnant woman or child more than 50 kg body weight	1 g every 4–6 hours	4 g

Intravenous paracetamol

- Paracetamol IV is formulated as a 10 mg/mL aqueous solution (in ready-to-use 50-mL and 100-mL vials for infusion over 15 minutes).
- It is useful, effective and safe.
- The peak analgesic effect of IV paracetamol occurs within 1 hour, with a duration of approximately 4–6 hours.
- Ensure that the correct dose is given, as serious liver toxicity can occur in overdose.
- Side effects are rare. They include rashes, blood disorders and hypotension on infusion.
- Caution is needed in patients with severe renal impairment, severe malnutrition (and thus low reserves of hepatic glutathione) or dehydration.
- Paracetamol helps to reduce the amount of narcotics required when used in combination with them.

TABLE 1.15.5 WHO advice: oral and rectal morphine for severe pain in hospital

Age	Dose	Interval
1 month to 1 year	80–200 micrograms/kg	Every 4 hours
1–2 years	200–400 micrograms/kg	Every 4 hours
2–12 years	200–500 micrograms/kg	Every 4 hours
Over 12 years and in pregnancy	5–10 mg	Every 4 hours

Note: the upper doses seem quite high – if a child weighs 20 kg, they would be receiving 10 mg – the same as an adult.

We suggest that you start with the lower dose and give more frequently, e.g. every hour if needed, until the patient is comfortable, then increase the dose if morphine needs to be given every hour. The Table immediately below (Table 1.15.6) already has lower doses.

Almost all patients with chronic pain can be managed with oral morphine when this is given in the doses shown in Tables 1.15.6 and 1.15.7 in combination with non-opioid analgesics

These are starting doses and can be increased as necessary on an individual patient basis if pain is not controlled

TABLE 1.15.6 *British National Formulary (BNF)* and *BNF for Children (BNFc)* recommended doses for oral and rectal morphine

Age	Initial dose (adjust according to response)	Interval
1–3 months	50–100 micrograms/kg	Every 4 hours
3–6 months	100–150 micrograms/kg	Every 4 hours
6–12 months	200 micrograms/kg	Every 4 hours
1–2 years	200–300 micrograms/kg	Every 4 hours
2–12 years	200–300 micrograms/kg	Every 4 hours
12–18 years	5–10 mg	Every 4 hours
Adults/pregnant mothers	5–10 mg	Every 4 hours

Preparations of morphine

1 Prepared mixture:
   - 10 mg/5 mL
   - 30 mg/5 mL
   - 100 mg/5 mL.
2 Morphine oral solutions can be made by dissolving powder in clean water, and are available in Africa at concentrations of 5 mg/5 mL, 50 mg/5 mL and 100 mg/5 mL.
3 Tablets: 10 mg, 20 mg and 50 mg.
4 Suppositories: 15 mg and 30 mg.
5 Slow-release tablets: 10 mg, 30 mg, 60 mg and 100 mg.
6 Slow-release suspension sachets: 5 mg, 20 mg, 30 mg, 60 mg, 100 mg and 200 mg.

Note: *See* Section 1.16 on palliative care for use of morphine at home.

Parenteral morphine

IV morphine is only needed if oral or rectal preparations are not going to be absorbed (e.g. in shock) or where rapid emergency onset is needed. IV morphine is potentially less safe, especially if staff shortages mean that the correctly calculated dose is not given.

TABLE 1.15.7 Intermittent IV (bolus) morphine dosage*

Age	Dose	Interval	Maximum dose
Neonate	25–50 micrograms/kg	Every 6 hours	
1–6 months	100 micrograms/kg	Every 6 hours	2.5 mg/dose
6 months to 2 years	100 micrograms/kg	Every 4 hours	2.5 mg/dose
2–12 years	100–200 micrograms/kg	Every 4 hours	
Over 12 years and in pregnancy	10 mg	Every 4 hours	

* We suggest that the total dose recommended is drawn up in 10 mL 0.9% saline and that 2 mL boluses of this solution are given every 3–5 minutes until the patient is comfortable. Also, if pain returns despite regular paracetamol/nonsteroidal analgesia, further dose of oral/IV morphine can be given within 6 hours if the respiratory rate is normal and the patient is not sedated.

Intravenous infusion of morphine requires continuous monitoring including oxygen saturation and respiratory rate and sedation score every 5 minutes for the first 15 minutes after start of the infusion and every 15 minutes subsequently for one hour and at least every 30 minutes after that. It should only be undertaken in a high dependency care situation. In resource limited situations, intermittent IV boluses as in Table 1.15.7 are safer.

Monitoring during morphine administration:

Side effects occur only in overdose and should not be seen at the doses stated here. They include the following:

1 Respiratory depression. **If the respiratory rate is:**
   - < 20 breaths/minute in patients aged less than 6 months
   - < 16 breaths/minute in those aged less than 2 years
   - < 14 breaths/minute in those aged 2–10 years
   - < 12 breaths/minute in those aged 10–18 years and in pregnant mothers

   alert medical staff and ensure that bag-valve-mask and naloxone are available.

   Monitor SaO_2 as appropriate (it should be higher than 94% in air).
2 Constipation. Use prophylactic laxatives.
3 Monitor for urinary retention.
4 Patients with liver and renal impairment may need lower doses and longer time interval between doses.Caution in patients with head injuries

Always ventilate with bag-valve-mask first if patient is unresponsive before giving naloxone. This is because arrhythmias and pulmonary oedema can be caused if naloxone is given to a patient with high blood carbon dioxide concentrations.

Naloxone doses to reverse opioid induced respiratory depression

1 Neonate to 1 month of age: 5–10 microgram/kg repeated every 2–3 minutes until adequate response
2 1 month to 12 years of age: 5–10 microgram/kg, subsequently 100 mcg/kg
3 12 to 18 years and in pregnancy: – 0.2–2.0 mg/kg. Repeat at intervals of 2–3 minutes to a maximum of 10 mg.

If respiratory rate is low, but the patient's oxygen saturation is acceptable (>94%) with facemask oxygen, in order to avoid complete reversal of analgesia draw up 400 microgram naloxone into 20 mL and give 1–2 mLs every 2 minutes until the patient is rousable and the respiratory rate increased to an appropriate rate for age.

Preparations of naloxone: Ampoule 20 microgram/mL

Give IV or IM if IV is not possible. Repeat after 2–3 minutes if there is no response; the second dose may need to be much higher (up to 100 micrograms/kg). An IV infusion may be needed if protracted or recurrent depression of respiration occurs because naloxone is short acting compared with most opioids.

Starting dose for naloxone infusion: 60% of the dose that maintained adequate respiration for 15 minutes.

Alternatively: Neonate – 5 to 20 microgram/kg/hour, adjusted according to response; 1 month to 18 years and in pregnancy – 5 to 20 microgram/kg/hour.

(For the newborn, to treat respiratory depression due to maternal opioid administration during labour or delivery 200 microgram as a single IM dose is recommended or 60 microgram/kg.)

Prevention and treatment of nausea and vomiting due to initial high-dose morphine

1 Cyclizine. This covers the widest range of causes of nausea and vomiting with the least side effects. It is not recommended orally in children < 2 years and rectally < 6 years.
   The IV doses are:
   - 1 month to 6 years: 500 microgram to 1 mg/kg 8 hourly
   - 6 to 12 years: 25 mg 8 hourly
   - 12 to 18 years and in pregnancy: 50 mg 8 hourly
2 Domperidone – where gastric emptying is a problem, then as in Table 1.15.8 for doses.

TABLE 1.15.8 Domperidone for prevention and treatment of nausea and vomiting

Domperidone	
Oral	**Rectal**
From 1 month up to 35 kg in a child: 250–500 micrograms/kg 3–4 times daily, up to a maximum of 2.4 mg/kg in 24 hours Over 35 kg and in pregnant mothers: 10–20 mg 3–4 times daily, up to a maximum of 80 mg daily Tablets, 10 mg Suspension, 5 mg/5 mL	Not recommended for children weighing < 15 kg Children weighing 15–35 kg, 30 mg twice daily Children weighing > 35 kg or in pregnant mothers, 60 mg twice daily Suppositories, 30 mg

Both of the above can cause extrapyramidal side effects, including acute dystonia, which can be treated with diazepam IV 100 microgram/kg, or, if over 12 years and in pregnancy, 5–10 mg IV.

Specific clinical situations in which analgesia may be required

Invasive procedures

- These are often painful, undignified, or both. Ideally they should be undertaken in a treatment room so that other patients are not frightened by the procedures, and so that the patient's bed-space remains a safe place that is not associated with such events.
- Such procedures often have to be repeated. Therefore provide optimal treatment on the first occasion in order to reduce the likelihood of dread of future procedures.
- Fear is often the main emotion that needs to be addressed, so explain each step.
- Both pharmacological and non-pharmacological methods should be used.
- For major procedures that require powerful analgesia/sedation, two healthcare workers should be present – one to perform the procedure and the other to administer analgesia and sedation and ensure that the airway is maintained.
- Major procedures include chest drain insertion and repeated lumbar puncture. **Such procedures may be best undertaken under general anaesthesia or ketamine if this can be given safely (which may not be the case in resource-limited countries).**
- For venous cannulation, size-appropriate catheters must be available. For example, it is not appropriate to use an 18- or 20-gauge cannula in a neonate. Although the use of local anaesthetic creams (e.g. EMLA) prior to cannulation represents best practice, they are expensive. In some circumstances, the urgency of the situation will not allow use of local anaesthetic creams.
- Give analgesics at an appropriate time before the procedure (30 minutes beforehand for IM and 30–60 minutes beforehand for oral medication depending on the drug used) aiming for maximal effect during the procedure.
- Check the level of anaesthesia by pinching the area with forceps. If the patient feels the pinch, wait 2 minutes and then retest.
- Wait a few seconds after performing each step or task for the patient to prepare for the next one.
- Handle tissue gently and avoid undue retraction, pulling or pressure.
- Talk to the patient throughout the procedure.

Analgesia during labour

For severe pain, give morphine bolus 2.5–5 mg and repeat once after 5 minutes if the pain is not controlled. Then wait 2–4 hours before repeating.

Nitrous oxide plus oxygen can be effective in reducing pain during labour (*see* Section 2.3).

Barbiturates and sedatives should never be used to relieve anxiety in labour.

Severe pain

- Severe pain is likely to occur in obstetric emergencies, post-operatively, and in patients with major trauma, significant burns, or displaced or comminuted fractures.
- Give IV morphine as described in Table 1.15.6.
- A further dose can be given after 5–10 minutes if sufficient analgesia is not achieved.
- Monitor ABC (heart rate, respiratory rate, chest wall expansions, blood pressure, SaO_2).
- Have IV Ringer-lactate or Hartmann's solution available (20 mL/kg for children and 500 mL to 1 litre for pregnant mothers as a bolus if hypotension occurs following IV morphine injection: this is unusual).
- Ketamine could be used as an alternative.

Head injuries

- An analgesic dose does not necessarily cause sedation.
- If the patient is conscious and in pain, the presence of a potential deteriorating head injury is **not** a contraindication to giving morphine. Give IV up to a maximum dose of 100 micrograms/kg for a child or 5 mg for a pregnant mother.
- If the patient's conscious level does deteriorate, assess ABC. If hypoventilation occurs, ventilate with a bag-valve-mask.
- If necessary, a dose of naloxone will help to distinguish whether reduced conscious level is due to morphine or increasing intracranial pressure, as it will reverse the effects of the morphine, including the analgesic effect.

Pre-operative management

This should include patient assessment, including a history of previous painful experiences from the patient and family (the parents of a child). The following questions should be asked.

- What sort of painful things have happened in the past?

- How does the patient usually react to sudden pain? And to chronic pain?
- Does the patient tell you (or others) if he or she is in pain?
- What does the patient do to get relief from pain?
- Which actions appear to be most effective?

Pain management during surgery

- Morphine/NSAIDs can reduce post-operative pain (but do not give NSAIDs to pregnant patients).
- Consider wound infiltration with bupivacaine or lidocaine.
- Use local or regional anaesthetic as part of the overall strategy (*see* Section 1.24).

Prophylactic anti-emetics for children aged 4 years or older and in pregnancy when morphine is part of the post-operative pain control plan can be very effective (*see* Table 1.15.10).

Post-operative pain management

- Provide analgesia before the pain becomes established; the amount of pain can often be anticipated depending on procedure.
- Use safe and effective doses of morphine along with other analgesics to reduce the amount of morphine required.
- Avoid intramuscular injections.
- **Assess, give analgesia, and then reassess.**
- Those most at risk of poor pain control are children with limited or no verbal ability.
- If the pain seems to be out of proportion to surgical trauma, consider the possibility of surgical complications and arranged reassessment by surgeons.
- If the patient is asleep, assume that the pain level is acceptable. Don't wake them up to make an assessment, count the respiratory rate and check regularly whether they are still asleep. If they are awake and lying quietly do not assume that they are comfortable without asking them.

Special issues with regard to pain in the newborn infant

- Most studies (some of them controlled) have shown that neonates (both premature and full term) react to pain.
- Infants can easily be forced to put up with suffering.
- Small doses should be measured and given with an oral syringe.
- Adequate general anaesthesia, using morphine when needed, should be given for all surgical procedures on neonates.
- Local anaesthetics must be used when they would be used in an older child undergoing the same procedure.

Pain control during procedures in neonates

- A sugar-dipped dummy, coated with 2 mL of 25–50% sucrose 2 minutes before the procedure, can be helpful.
- Breastfeeding during procedures may be equally helpful.
- In all cases, comfort and containment (swaddling) should be provided by a parent or nurse.

Pain management in high-dependency care

- Where possible, all invasive procedures should be elective. Every effort should be made to avoid unexpected emergency procedures, such as intubation, by adequate monitoring of airway, oxygenation and chest movement.
- **Emergency procedures are frequently extremely painful, dangerous to the patient, and often can be avoided by early recognition of a deteriorating condition (*see* Section 1.11).**
- Muscle relaxants should be avoided if possible and **never** be used unless the patient is pain free, sedated and being ventilated.
- Provide a day/night cycle (uninterrupted natural sleep can reduce the need for analgesia/sedation).
- Ensure that there is minimal noise and low lighting from 8 pm to 8 am.
- Emergency admissions at night should take place away from sleeping patients.
- Monitors should be set to alarm audibly only when this is essential.
- Consider the use of ear plugs, especially when the patient is paralysed.
- Provide human input through voice, touch, music, cuddling, rocking, holding and pacifying.
- Consider the use of distraction, play therapy, relaxation, behavioural techniques, hypnosis and aromatherapy, particularly for patients who are undergoing long-term intensive/high-dependency care.
- Provide privacy whenever possible.
- Be alert for depression after prolonged intensive care.
- Consider the use of methadone and clonidine for the control of morphine and sedation withdrawal after prolonged treatment.

Sedation

Sedation is not recommended for use in pregnancy after the first trimester, because of the risks of re-gurgitation and aspiration if the airway is not protected.

A health worker skilled in anaesthesia should be asked for advice and help with managing conditions where sedation is being considered.

Sedation in children

- This may be useful when added to analgesics for lengthy or repeated procedures. The aim of sedation is to make the procedure more comfortable while allowing verbal contact with the patient to be maintained.
- Start with a small dose IV, wait for 2–3 minutes, observe the response, and repeat the dose if necessary.
- Sedation relieves anxiety but not pain.
- Sedation may reduce a patient's ability to communicate discomfort, and therefore should **not** be given without concomitant analgesia if there is pain.
- Side effects include hyper-excitability or prolonged sedation, delaying discharge after the procedure.

Sedation and anaesthesia form a spectrum. If you give enough 'sedation' you can induce anaesthesia (i.e. loss of consciousness and the inability to feel pain). This is why it is not recommended in pregnancy, because of the increased risk of aspiration of stomach contents into the lungs, causing life-threatening pneumonia.

The fine distinction lies in the ability of the patient to maintain vital functions without assistance, and to respond to being roused (*see* Table 1.15.9).

Any healthcare worker who is administering a sedative, especially a benzodiazepine, must stay with the patient and have available a bag-valve-mask of suitable size and be able to use it to ventilate the patient if they develop abnormally slow breathing.

TABLE 1.15.9 The differences between sedation and anaesthesia

Vital function	Sedation	General anaesthesia
Response to being roused	Present	Absent
Respiration	Rate and depth may be slightly reduced	Rate and depth are markedly reduced or absent
Swallowing reflex	Present	Absent
Gag reflex	Present	Absent
Cough reflex	May be reduced	Absent
Cardiovascular stability	Mild hypotension may occur	Hypotension should be anticipated

Loss of any of the above reflexes is routine in anaesthetic environments, but should **not** occur when sedation is being provided.

Minimum information required to prescribe sedation

Anyone who is giving intravenous sedation could inadvertently produce anaesthesia, and must therefore be able to deal with the possible consequences. This means that they must be able to:

- **support respiration**
- **manage and maintain the airway**
- **use suction appropriately**
- **intubate if necessary.**

High-dependency nursing (*see* Section 1.14) or perioperative nursing care in the recovery room after surgery is required.

A combination of drugs may give better effects with fewer side effects than continually repeating doses of the same drug (e.g. morphine or ketamine combined with benzodiazepine). Each of the drugs should be given separately and the doses adjusted.

Some patients are difficult to sedate for predictable reasons (e.g. treatment for epilepsy may make the dose required much higher than normal).

Some patients are very resistant to sedation, possibly due to excessive anxiety, so the first dose of sedation may not succeed, and a higher dose may be needed.

Patients who need sedation should have their oral intake restricted as for anaesthesia.

Some children are more vulnerable to the effects of sedation, particularly those with respiratory or upper airway problems, causing complete upper airway obstruction and should not be sedated unless a health worker skilled in anaesthesia/airway management is present.

Sedation in children is difficult and potentially dangerous, and this practice is increasingly being abandoned.

- Children may refuse to take sedatives.
- The effects of sedatives in children are unpredictable.
- The interval between taking the medicine and becoming sedated, and also the time taken to recover, are difficult to predict in children.
- Some children, especially those who are very young, can take large doses of sedatives with no apparent effect.
- Some children become paradoxically over-excited as a result of taking sedatives.
- There is a danger that the dose needed to sedate a child will compromise the reflexes that protect the airway.

Wherever possible, procedures in children should be done without sedation. Instead ensure that, if possible, a parent or other familiar caregiver can stay with the child to reassure and comfort them. Give good analgesia with ketamine, oral morphine and local anaesthesia, and use skilful restraint to keep the child still. Explain carefully to the child, if they are old enough to understand, what you are doing at each stage of the procedure, to reduce their anxiety and encourage their cooperation.

The minimum information required to prescribe sedation includes the following:

- age and weight if the patient is a child
- the procedure for which sedation is required
- the patient's previous sedation history
- any other drugs that are being taken
- **other major illnesses that affect respiratory function and upper airway competence**
- current health status, including coughs, colds and pyrexia
- oral intake status.

TABLE 1.15.10 Patients at risk of airway obstruction/respiratory depression from the effects of sedation

Risk factor	Underlying cause
Impaired upper airway Obstruction	Croup Foreign body Congenital stridor (e.g. Pierre–Robin syndrome, cleft palate) Baby with very blocked nose
Impaired reflexes	Pre-existing neuromuscular problems Swallowing difficulties Known bulbar problems, especially if combined with reflux
Impaired central respiratory drive	Head injury Drug effects (opiates) Raised intracranial pressure Impaired level of consciousness Encephalopathy (hypoxic, metabolic, infective)
Impaired respiratory muscle function	Neuropathy and myopathy Chronic illness and weakness Malnutrition Prematurity Infancy
Impaired lung function	Chest infection Pleural effusions Chronic lung disease
Impaired cardiovascular function	Haemorrhage Sepsis Drugs

Sedative drugs commonly used for children

Promethazine (Phenergan)

Give 0.5 mg/kg deep IM or IV or 1–2 mg/kg orally, up to a maximum of 50 mg.

Chloral hydrate

Chloral hydrate is more suitable for younger babies (less than 18 months of age or less than 15 kg), but may paradoxically worsen agitation (e.g. in Down's syndrome).

TABLE 1.15.11 Sedative drugs

Drug	Route	Onset	Duration	Dose
Promethazine Tablets: 10 mg	Oral	30 minutes to 1 hour	Up to 12 hours	Not recommended for patients under 2 years of age Children: 2–5 years, 15–20 mg 5–10 years, 20–25 mg 10–18 years, 25–50 mg
Promethazine Liquid injection: 25 mg/mL	Slow IV or deep IM injection	30 minutes to 1 hour	Up to 12 hours	I month to 12 years: 0.5–1 mg/kg (up to a maximum of 25 mg) 12–18 years: 25–50 mg
Chloral hydrate Liquid: 100 mg/mL Suppositories: 100 mg and 500 mg	Oral or rectal	30 minutes to 1 hour	1–2 hours	Neonates to 12 years old: 30–50 mg/kg 12–18 years: 45–60 mg Maximum dose 1 g

Management of long-term pain and pain during terminal care

This is discussed in Section 1.16.

Appendix: Alder Hey Triage Pain Score

Cry/voice

Score 0: Child is not crying and, although they may be quiet, they are vocalising appropriately with carer or taking notice of surroundings.

Score 1: Child is crying but consolable/distractible or is excessively quiet and responding negatively to carer. On direct questioning the child says it is painful.

Score 2: Child is inconsolable, crying and/or complaining persistently about pain.

Facial expression

Score 0: Normal expression and affect.

Score 1: Some transient expressions that suggest pain/distress are witnessed, but less than 50% of the time.

Score 2: Persistent facial expressions suggesting pain/distress more than 50% of the time.

Posture

This relates to the child's behaviour towards the affected body area.

Score 0: Normal.

Score 1: Exhibiting increased awareness of the affected area (e.g. by touching, rubbing, pointing, sparing or limping).

Score 2: Affected area is held tense and defended so that touching it is deterred; non-weight-bearing.

Movement

This relates to how the child moves their whole body.

Score 0: Normal.

Score 1: Movement is reduced or the child is noted to be restless/uncomfortable.

Score 2: Movement is abnormal, either very still/rigid or writhing in agony/shaking.

Colour (applicable only to children with paler skins)

Score 0: Normal.

Score 1: Pale.

Score 2: Very pale 'green', the colour that can sometimes be seen with nausea or fainting – extreme pallor.

Further reading

British National Formulary and British National Formulary for Children. www.bnf.org/bnf/index.htm (accessed 9 December 2012).

WHO Guidelines on the Pharmacological Management of Persisting Pain in Children with Medical Illnesses. http://whqlibdoc.who.int/publications/2012/9789241548120_Guidelines.pdf (accessed 9 December 2012).

Freedom from Pain. Pharmacists working with doctors and nurses to secure this human right in Africa. A publication of Hospice Africa Uganda, PO Box 7757, Kampala. Email: info@hospiceafrica.org.ug

1.16 Palliative care for children in resource-limited countries

Introduction

Most children who need palliative care in resource-limited countries will require identification and treatment in the community rather than in hospital. Moreover, in the presence of effective care and support networks, **home has frequently been demonstrated to be the best setting for palliative care for both the child and the family**.

A high proportion of children do not reach hospitals in Africa. This percentage ranges from approximately 57% in Uganda to 85% in Ethiopia. Also, hospitals need to be aware that most families would wish for their child to die at home, where they can look after them and they can be buried with their ancestors near to the home. The cost of transporting a body is very high, so economic factors also play a part.

Therefore any treatment that is given in the hospital must be of a kind that can be continued at home, otherwise the child will never be able to leave the hospital. Healthcare workers in hospital, with the support of Ministries of Health and community leaders, must set up systems to help community health workers to provide care in the community, including the safe management of morphine treatment when it is required.

Allowing the family and child to choose the setting for palliative care is of great importance. However, it is recognised that the necessary resources may be minimal or absent in many locations, and local conditions will determine what options are available.

This section describes the use of affordable medications that have been proven to work in resource poor settings. In resource limited situations, it is vital that government funds are spent carefully on measures which work and are not too expensive thus ensuring that the poorest families can also receive their right to palliative care for their children.

Although palliative care actually means relief of symptoms in all care, the term is usually associated with relieving symptoms when the emphasis is no longer on curative treatment. The decision to stop or withdraw curative treatment will never be easy for parents or healthcare professionals, and may evolve over a period of time. **It is important, however, to state that even when we cannot cure the body, it is never true that nothing more can be done.**

Like all of us, children have personal needs, and careful attention must be given to the physical, social, emotional and spiritual needs of the child and their family. Staff, too, should be receiving support through what can be a distressing time.

BOX 1.16.1 WHO definition of palliative care

Palliative care is an approach that improves the quality of life of patients and their families facing the problem associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual.

Palliative care:

- provides relief from pain and other distressing symptoms
- affirms life and regards dying as a normal process
- intends neither to hasten nor to postpone death
- integrates the psychological and spiritual aspects of patient care
- offers a support system to help patients live as actively as possible until death
- offers a support system to help the family cope during the patient's illness and in their own bereavement
- uses a team approach to address the needs of patients and their families, including bereavement counselling, if indicated
- will enhance quality of life, and may also positively influence the course of illness
- is applicable early in the course of illness, in conjunction with other therapies that are intended to prolong life, such as chemotherapy or radiation therapy, and includes those investigations needed to better understand and manage distressing clinical complications.

WHO definition of palliative care for children

- Palliative care for children is the active total care of the child's body, mind and spirit, and also involves giving support to the family.
- It begins when illness is diagnosed, and continues regardless of whether or not a child receives treatment directed at the disease.
- Health providers must evaluate and alleviate a child's physical, psychological, and social distress.
- Effective palliative care requires a broad multidisciplinary approach that includes the family and makes use of available community resources; it can be successfully implemented even if resources are limited.
- It can be provided in tertiary care facilities, in community health centres and even in children's homes.

Essential healthcare for the dying child

- Include parents or familiar caregivers.
  - This matters at all times.
  - Their familiar presence will comfort the child.
  - Even apparently unconscious children may still know their parents' or caregivers' voices.
  - Parents invariably want to be able to provide care for their child. This is a natural wish and can aid their own coping strategies.
- Set realistic goals.
  - The art of terminal care is to know when both goal and treatment must change.
  - The goal is to help the child to enjoy and cope with what is left of their life.
  - It should be clearly and well communicated that resuscitation measures are not to be a feature of terminal care.

  - Our aim is now not to cure, and never to kill, but always to comfort.
  - The social needs and goals of a dying child include access to siblings and friends to play with and talk to. They should be made welcome.
- Listen and explain.
  - It should be clear from the child's deteriorating condition that the goals are changing and death is imminent. This must be gently explained and the parents' and child's questions answered. It is wise, especially with children, to clarify the real question that is being asked. Replies must be honest, but the truth should be shared sensitively, a little at a time.
  - Explanations are very important for both parents and children, and appropriate, understandable terms should be used.
  - Forewarning of procedures, with hugs and praise afterwards, will reduce fears and fantasies.
  - Honesty results in greater trust and cooperation than saying something won't hurt when it will.
  - All of those involved, from a young child to an elderly grandparent, will harbour fears and anxieties. Active listening is a major part of caring for a dying child and their family. Great comfort can be derived from the acknowledgement and expression of anxiety, and this helps to dissipate the feelings of isolation that are frequently experienced.
  - Adolescents will also have particular concerns and worries, and often have spiritual needs as well. Spirituality is a major aspect of life even for younger children in Africa. All members of the team must be aware of this and ready to discuss it with them.
- List and treat the child's symptoms.
  - In palliative care, symptom intervention and practical care are paramount.
  - Even with limited resources, symptoms can often be helped. Problem lists are a useful key to active needs.
  - The availability of drugs does not guarantee their skilful use, but when medication is used effectively it will make both life and death more bearable. It can be helpful to give the family a treatment chart showing times or relationship to sunrise and sunset (*see* Figure 1.16.1).
  - The child and carer together should make a list of all the symptoms. This can guide palliation even when the cause is incurable.
  - Ask the carer to chart extra doses required and any medication-related problems that arise.

The duration and nature of palliative care will be unique to each child and their particular disease. **For those children who cannot be cured (sadly they are the majority in resource-limited settings), highly effective symptom control is paramount to enable a good quality of life for the time that is remaining.**

It is essential to approach the management of any symptom systematically.

For palliative care issues concerning HIV infection, *see* Section 6.2.D.

Common symptoms

Pain

For pain assessment, *see* Section 1.15.

Principles of pain control

Pain is probably the most common symptom in palliative care, and is frequently seen in both malignant and non-malignant disease. It is a complex sensation related to the physiological insult to the tissues, but is also influenced by psychological, social and cultural factors.

It is helpful to think of severe pain in terms of response to opioids.

- **Opioid-responsive** pain is relieved by opioids.
- **Opioid-semi-responsive** pain is relieved by the concurrent use of an opioid and an adjuvant drug.
- **Opioid-resistant** pain is not relieved by opioids.

Neuropathic or nerve pain is more likely to fall into the semi-responsive or unresponsive groups. Bone pain falls into the semi-responsive group.

Analgesic approaches to pain relief

The optimal approach to pain management in children includes drug therapy, with analgesics usually being the mainstay of treatment. Correct use of analgesic drugs

Medicine	Reason	Morning		Afternoon		Evening		Night
		On Waking	10 am	12 noon	2 pm	6 pm	10 pm	Bedtime
Morphine 5 mg in 5 mL	Pain	2.5 mL	2.5 mL		2.5 mL	2.5 mL		5 mL
Senna	Constipation						2	
Ibuprofen 200 mg	Pain	2		2		2		2

Medication chart for..... Date.....

FIGURE 1.16.1 Example of treatment chart for family use in the community.

will relieve pain in most children, and should be based on the four key concepts recommended by the WHO:

- by the **ladder**
- by the **clock** (or by the sun if there is no clock!)
- by **mouth**. Injections are not given at home because there are too few community health workers. Subcutaneous infusion pumps are not always acceptable, and also need close monitoring, which is often not possible
- by the **child or carer**.

By the ladder

Use the 'two-step' approach to analgesia, non-opioids and opioids. The second step in the three-step ladder that was proposed in 1986 by the WHO is now widely being omitted, and a two-step ladder is used instead (*see* Figure 1.16.2). This is because the middle step, namely codeine, is expensive and causes severe constipation, and if the child has cancer they will need morphine, so can commence with a small dose that can then be titrated to the pain. Pain is classified as mild, moderate or severe, and the analgesic choices are adjusted accordingly. The ladder approach is based on drugs that are widely available in most countries. The sequential use of analgesic drugs is based on the child's level of pain, with a non-opioid analgesic usually being the first step.

Importantly, however, assessment of a child's pain may indicate the need for immediate use of a strong opioid. Morphine is the safest and most effective opioid, and the only affordable one in resource-limited settings.

There should be no hesitation in moving on to Step 2 of the analgesic ladder if pain control is inadequate.

Only one drug from each pharmacological group should be used at the same time but remember that paracetamol plus a non-steroidal drug can be used together if there is no contraindication. Strong opioids can be increased until pain is relieved. Occasionally an alternative strong opioid (rarely affordable in resource-limited countries) may be substituted if side effects from the first opioid tried are intolerable.

The aim is for the child to be:

- pain free on movement
- pain free at rest
- pain free at night.

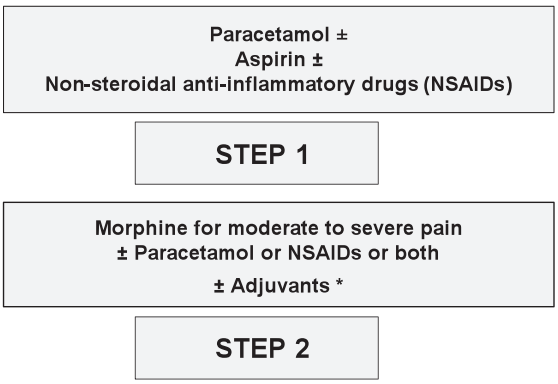


FIGURE 1.16.2 WHO two-step analgesic ladder. *An adjuvant is another drug (e.g. steroid or anxiolytic) or type of treatment (e.g. TENS or radiotherapy) that prevents but can also relieve pain.

By the clock (or by sunrise/sunset)

Analgesia should be given regularly (e.g. every 4 hours or according to the half-life).

There is no place for 'when-requested' prescribing of analgesics in palliative care. The dose must be titrated against that needed to control the pain of the individual patient.

Paracetamol and ibuprofen should be given at the recommended doses (*see* Section 1.15), but the dose of morphine needed must be titrated against that needed to control the pain.

The dosing interval should be determined according to the severity of the child's pain and the duration of action of the drug being used. Additional 'rescue' doses for intermittent and breakthrough pain should be prescribed and explained to the family, so that these can be given as soon as breakthrough pain occurs.

The effectiveness of analgesia should be regularly reviewed, so that it can be titrated effectively against pain.

By the appropriate route

Children should receive drugs by the simplest, most effective and least painful route. For this reason the oral route is the preferred route.

IM injections should not be used. They are painful, and there is a risk of abscess and/or haematoma formation, particularly in children who may have low platelet counts or other blood-clotting problems. Also, use of the parenteral route means that the patient must be in hospital or a clinic and cannot go home. Children who are afraid of injections may deny that they are in pain and therefore suffer unnecessarily.

When selecting the best route of analgesic administration it is important to consider the nature and severity of the pain, the potency of the drug, the required dosing interval and the compliance of the child.

By the child

The doses of any analgesic must be based on the individual child's symptoms and circumstances. There is no single dose that will be appropriate for all children.

Regular reassessment of the child's pain and of the effectiveness of the analgesia is essential, so that the drug doses can be adjusted accordingly to keep the child pain free.

For some children, particularly those with cancer-induced pain, very large doses of opioids may be required in order to achieve satisfactory pain control.

Therefore it should be noted that some of the suggested dosage recommendations included in this section differ from those specified elsewhere in the manual. This is appropriate in palliative care, and it reflects the differences in goals and priorities between the acute setting and the palliative setting.

CASE EXAMPLE: Haji, aged 3 years, presented with a clinical diagnosis of retinoblastoma. He was in severe pain. The lesion was too friable for a biopsy. Morphine was commenced immediately, based on weight, according to the WHO recommendation for children. This was titrated against the pain, and Haji's pain was controlled on 100 mg 4-hourly and 100 mg at night. The radiologists allowed him to receive radiotherapy without a biopsy. The tumour disappeared. The morphine was reduced until he was pain free and well.

Today Haji is well, aged 9 years, and is attending school.

Analgesics

Non-opioid analgesics

Non-opioid analgesics are used to relieve mild pain or, in combination with opioids, to relieve moderate and severe pain. **Paracetamol** is the drug of choice because it has a very high therapeutic ratio for children and can be given orally or rectally. It is available in an elixir, tablet and suppository form, and can be given 4- to 6-hourly. Non-steroidal anti-inflammatory drugs (NSAIDs) such as **ibuprofen** and **diclofenac** are also helpful (for doses, *see* Section 1.15).

It is now recommended that one should progress straight from paracetamol and NSAIDs to morphine.

Strong opioid analgesics (morphine)

Morphine is required either alone, or in combination with non-opioid analgesics and/or adjuvant drugs, to provide effective pain relief. Morphine does not have an analgesic 'ceiling affect' (i.e. there is no maximum dose), and children may require extremely large doses to obtain pain relief, but start at the recommended dose for severe pain (as described in Section 1.15).

The strong opioid of choice internationally is oral morphine.

The oral route is preferred for morphine, but if the subcutaneous or IV route is required, it can be given by a slow continuous infusion, which will give a steady level of analgesia and is preferred to intermittent subcutaneous or IV administration. Although a continuous infusion is commonly used in well-resourced countries, it is possible to achieve complete pain control with oral or rectal paracetamol or morphine in the palliative care setting. In resource-limited settings, children and their families may be alarmed by infusions.

Children have been found to rapidly eliminate morphine metabolites, and this is most marked in younger children (under 9 years). This group of children may require more frequent dosing and relatively higher doses to achieve pain relief. However, if oral doses are given at regular intervals, the most potent metabolite of morphine, M6G, accumulates and leads to smooth pain control.

Morphine must be available in all countries. However, this is not the case at present. In Africa, only 15 out of 56 countries have oral morphine available for use at home, which is where most terminally ill patients want to die. Oral morphine that is made up in the country or within a district of the country is the affordable ideal. The drug is then immediately available, so pain can easily be controlled with it.

More complicated formulae and preparations may be available as immediate- or sustained-release preparations, including immediate-release suppositories. Once-daily preparations are commercially available, but there is little experience of their use in children, and they are too expensive for most resource-limited countries. Ideally, morphine should be free to all in need, and prescribed by a recognised prescriber. Usually only doctors can prescribe. However, in Uganda, nurses can now prescribe after completing a Diploma in Palliative Care and clinical officers after a 9 week special training that emphasises prescribing methods and controls. Clinical officers have been trained for 4 years and can do more than nurses in most countries. In some African countries they are allowed to prescribe class A drugs after qualification.

Immediate-release morphine (from the list of essential medicines for children published by the WHO in 2010)

- Morphine tablets (Sevredol): 10 mg, 20 mg and 50 mg.
- Morphine sulphate mixture (Oramorph): 10 mg/5 mL.
- Morphine sulphate mixture (Oramorph concentrate): 100 mg/5 mL.

The most affordable preparation is a morphine solution made from morphine powder in a pharmacy without the exorbitant profit taken by the 'middle man' (*see* Section 1.15).

The oral morphine starting dose is 150–300 microgram/kg every 4 hours.

Immediate-release morphine should be given regularly every 4 hours. It may be useful to increase the night-time dose by 50–100% to eliminate night-time waking. Immediate-release oral morphine is the best choice in children because it is easier to titrate exactly against the pain.

Sustained-release morphine tablets (MST Continus) (5 mg, 10 mg, 15 mg, 30 mg, 60 mg, 100 mg and 200 mg) and morphine granules for suspension (MST Continus) (20 mg, 30 mg, 60 mg, 100 mg and 200 mg), although available, are very expensive and therefore inappropriate for most situations in resource-limited countries. Those planning for a service must keep in mind the needs of the poor and spend the money available for morphine wisely so that there is enough for all in need.

Breakthrough pain

Immediate-release morphine should be prescribed at a dose equivalent to the 4-hourly doses as soon as pain breaks through (i.e. 16–17% of the total daily dose). The WHO recommends that it should be 5–10% of the total daily dose. This can be given up to hourly for breakthrough pain, and the parents should be advised to keep a record of all extra doses given so that the regular dose of morphine can be titrated accurately, and more supplied as necessary.

Titration of the morphine dose

Pain relief should be reviewed regularly. The morphine dose should be titrated against the level of pain. If frequent breakthrough analgesia is required, the total dose of morphine taken during the day (regular doses plus 'breakthrough' doses) must be assessed. Usually increments of 20–50% of the previous total daily dose are required. Regular review allows the regular dose of morphine to be adjusted according to the level of breakthrough pain. **Remember to**

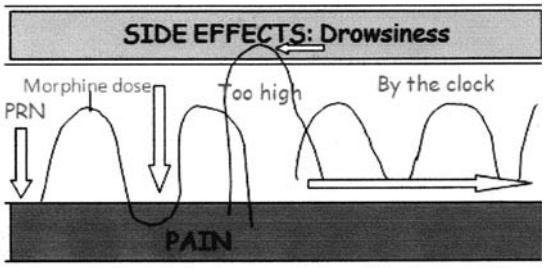


FIGURE 1.16.3 'As needed' (PRN) versus 'by the clock' versus 'high dose'. Initially, to the left, the PRN dosage regime results in episodes of unrelieved pain. In the middle, too high a dose produces drowsiness. To the right, the by-the-clock dosage regime results in constant relief of pain without drowsiness. (Diagram supplied by Dr Anne Merriman.)

increase the dose of breakthrough morphine accordingly, when the regular dose is increased.

Alternatives to oral route of administration

Indications for these include:

- persistent vomiting
- non-compliance with oral medication
- dysphagia
- bowel obstruction
- physical deterioration that prevents oral intake
- unsatisfactory response to oral medication.

Rectal route

This route may be acceptable for some children who are unable to take oral medication. Any oral preparation can be given rectally with similar effects:

- Paracetamol can be given as a suppository.
- Morphine solution (see above) can be easily given rectally and is very effective.
- Morphine suppositories (10 mg, 15 mg, 20 mg or 30 mg) can be given if available.

Although one can use the same dose and interval as for the oral route (i.e. 4-hourly), this is traumatic for the child, and generally a larger dose given in tablet suppository form as half the daily dose 12-hourly is more acceptable.

Subcutaneous route

Many drugs are well absorbed subcutaneously and can be easily established in those children who do not have established venous access. However, many resource-limited countries will not be able to use syringe drivers, and buccal and rectal administration may be just as effective, especially if human resources for managing the syringe driver/infusion pumps safely are not available, although some parents may be able to manage them.

Changing from oral morphine to subcutaneous morphine

The potency of morphine administered by injection is approximately twice that of oral morphine. Therefore use **half of the total daily oral morphine dose** as the equivalent 24-hour morphine dose for subcutaneous infusion.

If syringe drivers are not available, parents can be trained to give regular boluses of morphine subcutaneously or IV at home. The total daily dose of either morphine or diamorphine is divided by a practical number that coincides with the number of individual doses to be given (usually 1- to 2-hourly during the day, and 4-hourly at night).

Intravenous route

- This will usually only be indicated where a child has an established venous access, such as a Hickman line (unlikely to be available in most resource-limited countries), or when death is likely to occur within 7 days, when community health workers may place a peripheral venous cannula.
- Divide the total daily dose of oral morphine by two to obtain the equivalent daily dose of morphine given IV or subcutaneously.

As approximately 80% of children will die at home in resource-limited countries, oral or rectal morphine is likely to be the mainstay of treatment, with IV morphine only available to a small proportion of these patients.

Although diamorphine is the drug of choice for subcutaneous infusion, because it is more soluble, it is not available in most countries of the world. Divide the total daily dose of oral morphine by 3 to obtain the equivalent daily dose of diamorphine given IV or subcutaneously. The starting dose in opioid-naive patients is 12.5–25 micrograms/kg/hour by continuous infusion. For both subcutaneous and IV routes, the diamorphine should be titrated according to breakthrough pain in increments of 20–50%.

Side effects of opioids

All opioid drugs cause similar side effects. These problems are well known, and should be anticipated and treated whenever children are given opioids, so that pain control is not accompanied by unacceptable side effects. When appropriate, parents and children should be informed about the possible side effects and their management. Children on strong opioids should be assessed regularly.

Constipation

This is a common side effect, and laxatives such as bisacodyl (dulcolax) or senna or sodium docusate must always be prescribed with strong opioids (see below). Advice should be given to increase intake of fluids and fibre (vegetables, fruit and cereals) in the child's diet where appropriate.

Nausea and vomiting

Routine anti-emetics are not commonly needed, but should be prescribed if required in case of opioid-induced nausea and vomiting. When such symptoms do occur, they normally resolve within 3 to 4 days.

Drowsiness and confusion

Daytime drowsiness, dizziness and mental clouding can occur at the start of treatment and sometimes following a dose increase. They almost always resolve within a few days. Cognitive and psychomotor disturbances are minimal once the patient is receiving a stable dose of opioid.

Pruritus

Itching is a not uncommon side effect of opioid treatment in children. Simple skin care alone may be effective. Also consider the following:

- Avoid hot baths
- Avoid using soap. Add Oilatum to the bath water and use aqueous cream as a soap substitute.
- Pat the skin dry rather than rubbing it.
- Avoid overheating and sweating.
- Use cool cotton clothing and bedding.
- Keep the fingernails short to reduce damage caused by scratching.

If itching is persistent, review the medication. If itching is opioid related and the drug cannot be changed, the addition of a systemic antihistamine such as chlorpheniramine may be beneficial.

Pruritus associated with obstructive jaundice will require good skin care plus systemic medication such as stanozolol, ondansetron or levomepromazine, if available.

Respiratory depression

Respiratory depression is uncommon in the conscious patient with severe pain. If it does occur, management will

be dictated by the child's overall condition and the place of care.

Nightmares and hallucinations

Both can occur. If they are distressing and not resolved by reassurance or resolution of other anxieties, try giving haloperidol at night (50–100 micrograms/kg).

Urinary retention

Urine retention may be a problem, particularly after rapid dose escalation. Most children respond to simple measures such as a warm bath, warm packs or relief of constipation. Catheterisation may be required, but is usually only needed for a short period.

Morphine toxicity

This can occur as a result of:

- too high a dose
- too rapid dose escalation
- pain that is not morphine responsive
- renal impairment
- previous therapeutic intervention to relieve pain (e.g. radiotherapy or nerve block).

Warning signs include:

- drowsiness
- confusion
- pinpoint pupils
- myoclonic jerks
- hallucinations (auditory and visual)
- vomiting
- nightmares.

If toxicity occurs, consider reducing the morphine dose (several doses may need to be missed), then restart at a lower dose or stop morphine altogether.

Toxicity is rare when morphine is titrated against the pain. Constipation is the worst complication, and can be prevented by introducing a laxative when morphine is started, unless the child has diarrhoea already, in which case the constipation would be beneficial for a few days, but the laxative needs to be introduced as soon as it ceases.

Watch carefully for breakthrough pain. Address any side effects as discussed above. Escalating doses of opioids and metabolic disorders can exacerbate myoclonic jerks. Oral diazepam can be useful. If the child is unable to swallow, rectal diazepam or subcutaneous midazolam are effective.

Consultation with healthcare professionals who are experienced in palliative care is recommended.

Addiction and tolerance

Fear of addiction is not relevant when using opiates in palliative care, provided that a permanent source of opiates is available, **which must be the case**. In Uganda, in 2012, around 20 000 patients had been treated with affordable oral liquid morphine, without any abuse or addiction. Approximately 30% of these cases were children.

Prescribing opioids in patients with renal impairment

The active morphine metabolites are excreted by the kidney and accumulate in renal impairment, causing toxicity. When prescribing any opioid analgesics in children with renal failure, caution must be exercised, as patients with renal failure are extremely sensitive to opioids. Renal failure is part of the dying process, and the team must be aware of this and reduce doses or increase time intervals as the child approaches death.

Suggested management strategies are as follows:

- Prescribe smaller doses of opioid analgesic.
- If problems with toxicity continue, consider giving smaller doses less frequently (i.e. 6- to 8-hourly).

Alternatives to oral morphine for severe pain

For information on approaches that can be used in well-resourced settings, see the Further reading section on p. 91.

Adjuvant therapy

Few children are truly morphine intolerant, and if the pain is not responding to morphine, always consider the aetiology of the pain and review the use of adjuvant therapy.

Neuropathic pain

Co-analgesics such as an anticonvulsant or tricyclic antidepressants are essential, because this pain is only semi-responsive to opioids. The possibility of neuropathic pain should be considered if the pain has a burning or stabbing/shooting component. According to the WHO, there is no evidence on which to make recommendations for or against antidepressants and anticonvulsants. However, the WHO does agree that there is wide experience of the use of amitriptyline in children, and doctors are familiar with the use of the carbamazepine in children who have seizures. However phenytoin is more available, affordable and therefore of choice in less resourced countries. However some anti-retroviral drugs (ARVs) may interact with phenytoin so there is a need to check this out for children with HIV on ARVs.

Nerve compression pain

This may arise from compression of a nerve root, and morphine plus a trial of oral steroids should be tried. The steroid should relieve pain within 48 hours, probably by reducing oedema around the tumour. If there is no improvement, steroid treatment should be discontinued.

Nerve injury pain

This may arise either from tumour invasion of a nerve or as a side effect of radiotherapy.

Anticonvulsants

These drugs are useful for pain that is shooting or stabbing. Carbamazepine and sodium valproate are commonly used. Clonazepam and gabapentin are more recent additions that are not widely available in resource-limited countries. The cheapest, most effective drug with the fewest side effects is phenytoin.

Start at a low dose and gradually increase the dose to avoid sedation and toxicity. Low doses are usually the most effective, and this therapy should stop if the pain does not respond to low doses.

Carbamazepine

This drug is expensive, has side effects, and needs to be monitored, so is not so useful in the community setting.

- Starting dose: 2.5 mg/kg twice daily, increasing by 2.5–5 mg/kg/day at weekly intervals.

- Maintenance dose: 10–20 mg/kg/day in two to three divided doses, increasing gradually as above.

This corresponds to the *British National Formulary for Children (BNFC)* dose for epilepsy and trigeminal neuralgia.

Sodium valproate (often not available)
- Starting dose: 20/mg/day in two divided doses, increasing if required by increments of 5 mg/kg at weekly intervals.
- Maintenance dose: 20–30 mg/kg/24 hours in divided doses.

The *BNFC* doses for epilepsy are:
- Age < 12 years: initially 10–15 mg/kg/day in one to two divided doses, increasing to 25–30 mg/kg/day in two divided doses.
- Age ≥ 12 years: initially 600 mg/day in one to two divided doses, increasing by 150–300 mg every 3 days to 1–2 g/day (maximum of 2.5 g/day) in two divided doses.

Phenytoin
- Age < 12 years: (1.5–2.5 mg/kg starting dose to target) and then 2.5–5 mg/kg twice daily (maximum 7.5 mg/kg twice daily or 300 mg once daily).
- Age 12–18 years: 75–150 mg adjusted according to response up to 150–200 mg twice daily (maximum 300 mg twice daily).

The *BNFC* doses for epilepsy are:
- Age < 12 years: 1.5–2.5 mg/kg twice daily, increasing to 2.5–5 mg/kg twice daily (usual maximum 7.5 mg/kg twice daily).
- Age ≥ 12 years: 75–150 mg twice daily, increasing to 150–200 mg twice daily (maximum 300 mg twice daily).

Tricyclic antidepressants
- These drugs are useful for pain that is burning in nature.
- Give at night to avoid excessive sedation during the day. They can cause constipation.
- The analgesic effect begins after about 3–7 days of treatment, but may take longer than this.
- Starting dose: amitriptyline 0.5 mg/kg at night increasing, if needed, to 1 mg/kg/day. Increase carefully to avoid excessive drowsiness. Lower doses are the most effective.

The *BNFC* doses for neuropathic pain are:
- Age 2–12 years: 0.2–0.5 mg/kg (maximum 10 mg), increasing gradually to a maximum of 1 mg/kg twice daily.
- Age > 12 years: 10 mg at night, increasing gradually up to 75 mg at night if needed.

For difficult cases, consider referral to or discussion with a pain control team if one is available.

Bone pain

Non-steroidal anti-inflammatory drugs (NSAIDs)
- NSAIDs have analgesic, anti-pyretic and anti-inflammatory properties. They are often effective in relieving musculoskeletal pain that is associated with bone metastases or soft tissue inflammation.
- Regular dosing is required for their full effect, but the maximum effect is usually seen within 2 weeks.
- It is worth trying another NSAID if there is no response to the first type.
- Damage to the gastrointestinal mucosa is the most frequent side effect. Gastric erosion and bleeding can be severe and difficult to control. If possible, ensure that NSAIDs are taken after food.
- NSAIDs are not usually appropriate for children with thrombocytopaenia, because of their potential to cause gastric erosions and so increased tendency to bleed.
- According to the WHO there is no evidence for recommending the use of bisphosphonates in children. In adults, modest improvements in pain have been observed, but also serious side effects such as osteonecrosis of the jaw.

For common dosages of NSAIDs, *see* Section 1.15.

Steroids

Steroids have specific benefits in palliative care because of their ability to produce euphoria, improve appetite and increase weight gain. They also have an anti-inflammatory effect, which may be helpful in patients with nerve compression and raised intracranial pressure.

However, steroids should be used with caution in children, as the side effects of long-term steroid treatment can far outweigh its benefits. They include rapid weight gain, change in appearance, mood swings, behaviour changes and insomnia, which can be distressing for both the child and the parents, and the risk of gastric erosions. Most children experience symptom relief after short intensive courses, and if the prognosis is long, steroids should be withdrawn. If there is no improvement in symptoms within a short period of time (e.g. 5–7 days), steroids should be discontinued. If the initial symptom relief is not maintained, long-term use of these drugs should be avoided.

Dexamethasone

Dexamethasone should be taken before 6 pm, and ideally in the morning, in order to minimise insomnia.

High-dose dexamethasone is normally used to relieve pain associated with raised intracranial pressure, or spinal cord or nerve compression. Give steroids in the morning to avoid sleepless nights and to copy the normal diurnal rhythm of cortisol.

The initial dose is given in the morning as 25 mg for patients over 35 kg and 20 mg for patients less than 35 kg, followed by a sliding scale of reducing by 4 mg every 3 days until down to 10 mg per day, then continuing to decrease by 1–2 mg per day.

IM or IV in an emergency or until can swallow (usually once only):
- Age 1 month to 12 years: 100–400 micrograms/kg, once daily in the morning.
- Age 12–18 years: 8–24 mg daily.

Low-dose dexamethasone is normally used to improve appetite and well-being.
- Age 2–8 years: 0.5–1 mg, once daily in the morning.
- Age > 8 years: 1–2 mg, once daily in the morning.
- Radiotherapy.

This therapy is only available in just over half the countries in Africa.

Radiotherapy can be particularly useful for treating isolated sites of a disease if a tumour is radiosensitive. This may include bony metastases, spinal cord compression, and relief of nerve compression from a solid tumour and isolated cerebral metastases. Radiotherapy can also be used in the management of fungating tumours. Single treatments or short courses are often appropriate and effective in palliative care, if radiotherapy is available.

Non-pharmacological approaches

Non-drug therapies must be an integral part of the management of children's pain, complementing but not replacing appropriate drug therapy.

A combination of non-pharmacological approaches, used in conjunction with analgesics, may be extremely effective. These approaches include:

- progressive relaxation
- diversional therapy with music, art or traditional games, according to the age of the child
- hypnosis and guided imagery
- massage and reflexology
- heat pads or cold packs
- transcutaneous electrical nerve stimulation (TENS).

Management of other symptoms

Nausea and vomiting

These are common symptoms in palliative care. The causes may be multifactorial, and it is important to try to determine the cause(s) in order to implement an effective treatment plan.

Common causes

Cancer-related causes include:

- raised intracranial pressure
- the presence of an abdominal mass
- irritation of the upper gastrointestinal tract
- gastric outflow obstruction
- anxiety
- uraemia
- pain
- blood in the stomach.

Treatment-related causes mainly involve the side effects of drugs, especially:

- opioids
- chemotherapy
- NSAIDs
- carbamazepine
- antibiotics.

Management

- Identify the cause(s) as described above (e.g. constipation, raised intracranial pressure) and implement appropriate management.
- Consider stopping gastric irritants such as antibiotics, NSAIDs and steroids if possible.
- Prescribe an H_2-receptor antagonist (ranitidine, 2–4 mg/kg 12-hourly, or cimetidine, 5–10 mg/kg 6-hourly).
- Or the proton pump inhibitor omeprazole (age < 2 years, 700 micrograms/kg once daily increased to 3 mg/kg once daily, maximum dose of 20 mg once daily; body weight 10–20 kg, 10 mg once daily, increased to 20 mg if needed; body weight over 20 kg, 20 mg daily increased to 40 mg once daily if needed. Give the higher dose for 12 weeks only).
- Prescribe an appropriate anti-emetic according to cause.
- Review the therapy regularly and adjust it as required.
- IV fluids may be needed to counteract dehydration, but nasogastric tube insertion should be avoided where possible.
- If treatment is unsuccessful, consider the following:
  - Was the cause of the vomiting correctly identified and the appropriate anti-emetic prescribed?
  - Has the anti-emetic had time to work at maximum dose?
  - Is the route of administration appropriate for the child?

Anti-emetic therapy

Severe nausea and vomiting may require initial management by subcutaneous or IV infusion and then switching to oral medication when control is gained. The choice of anti-emetic depends on the cause of vomiting and the site of the anti-emetic action, so combinations of drugs with different sites of action are sometimes required, but to avoid side effects, avoid combining drugs of the same class. Extra-pyramidal side effects can occur with cyclizine, metoclopramide and domperidone (*see* Section 1.15).

Haloperidol is the anti-emetic of choice for opioid-induced vomiting. It acts on the chemoreceptor trigger zone.

Dosage: 12.5–25 micrograms/kg twice daily by mouth, subcutaneously or IV. Haloperidol can be given orally at night.

Cyclizine is used for nausea and vomiting caused by raised intracranial pressure or intestinal obstruction.

Dosage: all ages, by mouth, 1 mg/kg three times daily up to a maximum of 50 mg per dose.

The *BNFC* doses are as follows:

Oral or rectal route:

- Age < 6 years: 500 microgram–1 mg/kg (rectal 12.5 mg) up to three times daily
- Age 6–12 years: 25 mg up to three times daily
- Age > 12 years: 50 mg up to three times daily.

IV or subcutaneous route:

- All ages, 1 mg/kg 8-hourly or

Continuous IV/subcutaneous infusion:

- Age < 2 years: 3 mg/kg over 24 hours
- Age 2–5 years: 50 mg over 24 hours
- Age 6–12 years: 75 mg over 24 hours
- Age > 12 years: 150 mg over 24 hours.

Dexamethasone

Dosage: use moderate doses (e.g. 100 micrograms/kg 12-hourly).

Metoclopramide

This acts on both the upper gastrointestinal tract and the chemoreceptor trigger zone, and speeds up gastric emptying. The extrapyramidal side effects are more common in children. It is useful for oesophageal reflux, gastric stasis, gastric irritation, gastric outflow and high bowel obstruction.

Its use should be avoided in patients where there is complete bowel obstruction.

Dosage:

Oral route:

- Age 1–12 years: 100 micrograms/kg, two to three times a day
- Age > 12 years: 5–10 mg, two to three times a day.

Subcutaneous/IV route:

- Age 1–12 years: 500 micrograms/kg over 24 hours
- Age > 12 years: 15–30 mg over 24 hours.

Domperidone acts on both the upper gastrointestinal tract and the chemoreceptor trigger zone, and speeds up gastric emptying.

Dosage:

Oral route:

- Age 1–12 years: 200–400 micrograms/kg, three to four times a day
- Age > 12 years: 10–20 mg, three to four times a day.

Rectal route:

- Age 1–12 years: 15–30 mg, two to three times a day
- Age > 12 years: 30–60 mg, two to three times a day.

Constipation

Constipation is common in paediatric palliative care, and the causes may be multi-factorial. The prevention and relief of constipation in the terminally ill child is very important, as if left unresolved it can cause abdominal pain and discomfort, and nausea and vomiting.

Consider the following causes:

- drug induced (e.g. opioids, anticholinergics, antidepressants)
- reduced physical activity
- poor oral intake and general debility
- dehydration
- bowel obstruction
- spinal cord compression.

Management

- Treat the underlying cause where this is appropriate and possible.
- Constipation should be anticipated when opioid, anticholinergic or antidepressant drugs are being used, and laxatives should be prescribed prophylactically.
- Use laxatives appropriately and at the right doses, and avoid mixing two drugs from the same group (e.g. two stimulants).
- A good first choice is the combination of a stimulant laxative and a softening agent (e.g. senna plus sodium docusate).
- Titrate doses up as required, rather than adding a new laxative.
- If oral therapy fails, consider rectal measures such as suppositories/enemas.

Bowel obstruction

Bowel obstruction may be mechanical or functional, or both. The aim is to control pain and nausea. In children with advanced disease, surgical management is not usually indicated. The aim of treatment is the palliation of symptoms. Nasogastric tubes and IV fluids are rarely appropriate, although for persistent vomiting due to obstruction a nasogastric tube may be helpful.

Management

Elimination of pain and colic:

- For constant background pain, administer buccal morphine solution or morphine by continuous IV or subcutaneous infusion, using a portable syringe driver.
- If colic is present, avoid prokinetic anti-emetics (e.g. metoclopramide, domperidone).
- Discontinue bulk-forming, osmotic and stimulant laxatives.
- Relieve associated constipation, continue to use softening agents if possible, and use rectal measures to relieve faecal impaction.
- If colic persists, add hyoscine butylbromide (Buscopan), 10–20 mg orally 8-hourly or give IV as a single dose over at least 1 minute (age 2–5 years, 5 mg IV; 6–10 years, 10 mg IV; 11–15 years, 15 mg IV; 15–18 years, 20 mg IV). Repeat 8-hourly as required.

Elimination of nausea and reduction of vomiting

- The choice of anti-emetic depends on whether colic is present.
- If colic is present, cyclizine is the first-line drug. Add haloperidol if nausea persists.
- If colic is absent and flatus is present, a trial of subcutaneous or IV metoclopramide is indicated. If this is ineffective, instigate management as described above.
- Dexamethasone may be of benefit in second-line management.

Dyspnoea

Shortness of breath associated with pulmonary complications in advanced paediatric cancer can be very distressing for both the child and the parents, and requires effective management. The underlying pathophysiology needs to be considered when deciding on the management.

Common causes of dyspnoea include:

- metastases
- effusions
- pulmonary fibrosis
- anaemia
- infection
- superior vena cava (SVC) obstruction
- anxiety/fear
- increased secretions
- cardiac failure
- chest wall pain or constriction
- pulmonary embolus
- gross ascites.

Management

- Identify the cause.
- Give a clear explanation to the parents and the child.
- Treat the specific cause(s) or modify the pathological process (e.g. high-dose steroids and radiotherapy for superior vena caval obstruction).
- Non-drug measures are also important and include:
  - a calm approach
  - breathing exercises
  - an appropriate position
  - providing cool air (e.g. with a fan)
  - play therapy.

Drug treatment

Morphine has a complex effect on respiration, which is not fully understood. It can reduce the respiratory rate to a more comfortable level. This drug should be prescribed regularly in children with continuous breathlessness at standard analgesic starting doses. If the child is already on morphine, increase the dose by 30–50%.

The anxiolytic and sedative effects of **benzodiazepines** also cause relaxation of the respiratory muscles. This may be helpful if the child or teenager is very anxious, and these drugs should be administered as a single dose and then at night or twice daily. The long half-life of benzodiazepines (around 36 hours) means that they should be avoided if possible.

Diazepam (oral route):

Dosage:

- Age 4 weeks to 1 year: 200 micrograms/kg, two to three times daily
- Age 1–12 years: 2 mg, two to three times daily
- Age > 12 years: 5–10 mg, two to three times daily.

Lorazepam is not always available, but is well absorbed sublingually (so is useful for panic attacks), short acting, with a rapid onset of relief and a shorter half-life.

Dosage:

- Age 1–12 years: 50–100 micrograms/kg (maximum of 4 mg per dose) (*BNFC*).
- Age > 12 years: 1–4 mg per dose. The dose may be repeated after 12 hours.

Corticosteroids may be useful, particularly in patients with superior vena caval obstruction and multiple lung metastases. Moderate doses of dexamethasone should be used and the benefit should be apparent within 5 days. The dose should then be reduced to the lowest effective dose.

Oxygen will be of benefit for hypoxic patients, but is rarely available for home use. It may also be helpful if a child is very anxious.

Nebulised saline or **salbutamol** may provide subjective relief, especially if wheezing is present.

Cough

Consider the following causes:

- respiratory infection
- airways disease
- malignant obstruction
- drug induced
- oesophageal reflux
- aspiration of saliva.

Wherever possible, the cause of the cough should be treated. Symptomatic management should follow the guidelines for the management of dyspnoea.

Drug management may include the following:

- simple linctus
- codeine linctus (this will cause constipation, so add a stool softener)
- opioids (as above)
- nebulised saline
- oral antibiotics (these are indicated if symptomatic chest infection with a productive cough is affecting quality of life).

Anxiety

Anxiety is not uncommon in palliative care. Talk to the child and give enough time to both the child and the parents or carers to discover the cause, and give reassurance. Try to identify the cause of the child's anxiety (e.g. whether it is related to symptoms or fears about what is happening). Simple explanations, reassurance and a calm environment are important. Physical therapies such as relaxation and massage may be helpful, or anxiolytics such as diazepam or lorazepam as required or regularly may be of benefit if other measures fail.

Anxiety and discomfort go together, so reassess the child's pain.

Bleeding

Massive external bleeding

Death from massive external bleeding is uncommon in children, but the risk of this is frightening and distressing for both the child and the parents, and prevention of such bleeding should be the aim of management, although this may not always be possible.

Causes of external bleeding include the following:

- a low platelet count
- clotting deficiencies
- primary or secondary liver disease
- disease progression
- initial treatment (e.g. radiotherapy, chemotherapy).

Management

If there is a risk of massive haemorrhage, it is extremely valuable to have IV or subcutaneous morphine and an appropriate sedative (e.g. rectal diazepam, buccal midazolam) readily available at home.

Persistent surface bleeding

This is not uncommon in children with leukaemia, and can be alarming to both the child and their family, but can be managed in the home environment.

Management

- Topical treatment soaking gauze in adrenaline 1 in 1000 solution and applying it directly to the bleeding point.
- Other haemostatic dressings can be used for persistent surface bleeding (e.g. in fungating tumours). These include crushed metronidazole sprinkled on to the area, or an alginate dressing such as Kaltostat if this is available.
- Tranexamic acid can be useful if it is available, and can be used topically undiluted, applied directly to bleeding gums or nostrils, or used as a mouthwash. It can also be given systemically or parenterally as prophylaxis.
- The use of a dark-coloured handkerchief or towel at home to mop up the blood may help to reduce anxiety.

Spinal cord compression

Consider spinal cord compression if the following signs and symptoms are present:

- localised pain in the spine, radiating around the chest
- sudden onset of weakness (e.g. of the legs)
- sensory disturbance
- sphincter dysfunction.

This is usually a clinical diagnosis, and action needs to be taken immediately.

Investigations such as computerised tomography (CT) and magnetic resonance imaging (MRI) are not usually available.

Management

- Patients with paraparesis have a better prognosis than those who are totally paraplegic.
- Loss of sphincter function is a poor prognostic sign.
- Rapid onset of complete paraplegia has a poor prognosis.
- The main therapeutic options are:
  - corticosteroids that can shrink the tumour and relieve spinal cord compression
  - radiotherapy.
- Steroids should be given in high doses initially and then reduced according to the response. These drugs often bring about an early improvement and relief of pain by reducing the peri-tumour inflammation. Give steroids in the morning to avoid insomnia and to copy the normal diurnal rhythm of cortisol.
- High-dose **dexamethasone**: The initial dose is given in the morning as 25 mg for patients over 35 kg and 20 mg for patients less than 35 kg, followed by a sliding scale of reducing by 4 mg every 3 days until down to 10 mgs per day, then continuing to decrease by 1–2 mg per day. The intial dose can be given IV if urgency required but oral doses should then follow. However, if symptoms recur revert to a higher maintenance dose.
- Referral for concurrent radiotherapy should be considered if the prognosis is not very poor. This therapy is not available in around 30% of African countries, and unless the parents have enough financial resources to take their child to another country, palliative support is the best option.
- Surgery, such as laminectomy, is only rarely indicated.
- Consider using a pressure-relieving mattress, and give pressure area care.
- Pay attention to bowel function.
- Start physiotherapy to prevent contractures.
- Perform catheterisation.
- Avoid danthron-containing laxatives if the child is catheterised or incontinent, because of the risk of danthron burns.

Psychological support

Children experience significant psychological suffering as a result of loss of their ability to walk or run, as well as their inability to play and go to school. They therefore need understanding and sympathetic advice from their healthcare provider and carer at this time.

Convulsions

Convulsions may be a potential or existing problem for children with brain tumours or other neurological and metabolic disorders.

For emergency management of seizures in palliative and terminal care, **diazepam** given rectally is the drug of choice.

Dosage:

- Age < 1 year: 2.5 mg (half of a 5 mg rectal tube/rectal solution)
- Age 1–4 years: one 5 mg rectal tube/rectal solution
- Age 5–12 years: 5 mg or 10 mg rectal tube/rectal solution
- Age > 12 years: 10 mg rectal tube/rectal solution.

For continuing severe seizures, consider giving midazolam by the buccal route, subcutaneously or by IV infusion if the child is in hospital (*see* Section 5.16.E). Care is required with midazolam as it may give permanent anaesthesia so that communication becomes impossible.

Muscle spasm

Muscle spasm can be severe in children with neurological and neurodegenerative disorders. It may occur alone or be triggered by pain elsewhere (e.g. due to constipation).

Useful drugs for muscle spasm

Diazepam orally (initial doses are shown):

- Age 1 month to 1 year: 250 microgram/kg twice daily
- Age 1–5 years: 2.5 mg twice daily
- Age 5–12 years: 5 mg twice daily
- Age > 12 years: 10 mg twice daily up to a maximum dose of 40 mg/day (*BNFC*).

Baclofen orally

- Age 1–10 years: initial dose 300 microgram/kg/day in four divided doses, increasing to usual dose of 0.75–2 mg/kg/day in divided doses
- Age > 10 years: 5 mg three times daily, increasing to 20 mg three times daily (up to a maximum dose of 100 mg/day).

Incontinence

Incontinence can be the source of much discomfort and anxiety for both children and their families, as well as presenting difficulties in keeping the child clean and protecting their skin.

Children with some degenerative conditions may have had faecal or urinary incontinence for a long time, whereas for others this may become a feature during the end stage of their disease (e.g. due to local tumour, neurological/spinal cord damage to bladder control, laxative imbalance).

For children with long-standing difficulties, intermittent catheterisation or the use of an indwelling catheter may be a well-established, successful and accepted method (*see* Section 4.2.D).

Some useful suggestions include the following:

- Review laxatives where appropriate.
- Consider giving intranasal **desmopressin**, 20–40 micrograms at bedtime, if nights are disturbed by urinary incontinence. Alternatively, desmopressin tablets, 200–400 micrograms, or sublingual tablets, 120–240 micrograms, can be used (*BNFC* doses for enuresis). Care is needed as desmopressin can cause water retention and hyponatraemia, so start with lower doses.
- Keep a urinal or bedpan close to the bedside.
- Use cotton pads or towels (with plastic underneath) on top of the bed sheet. This will avoid the need to change all the sheets, and thus minimise disturbance to the child.
- Keep the area well ventilated (or keep a window open if appropriate).
- Try to ensure that the skin is kept clean, and use dimethicone, zinc and castor oil or other barrier creams if these are available.
- Help the child to wash regularly.
- Try to preserve and maintain the child's dignity at all times. Give reassurance and support to both the child and the parents.

Fungating wounds

Fungating wounds are rare in paediatric palliative care, but in resource-limited settings they are not infrequently encountered. They may occur with soft tissue sarcomas, often of the head and neck, which can be very distressing for the child and their family.

Useful tips for management (where available) include the following:

- Soak any dressings with saline or Ringer-lactate or Hartmann's solution to ease removal, as these tumours may be friable and prone to bleeding.
- If possible, have available topical adrenaline 1 in 1000, or an alginate dressing (e.g. Kaltostat, or tranexamic acid), to apply topically to the tumour if it bleeds profusely (e.g. during a dressing change).

These tumours can cause offensive smells due to anaerobic microorganisms, which can be distressing to the child and their family. Sprinkle crushed metronidazole tablets on the fungating area. Oral metronidazole does not penetrate the fungating area, as the blood supply to it is poor. Metronidazole is cheap and readily available in all resource-limited countries, and it is very effective. Charcoal dressings, if available, may help to absorb the odour. The use of honey for dressings is also of benefit in controlling bacteria and odour. Simple measures such as the use of aromatherapy oils around the home may be helpful, too.

The final days and hours of life

Terminal restlessness and agitation

These symptoms are not uncommon in the final stages of life. Useful drugs include buccal midazolam, and oral or rectal diazepam.

Midazolam is the sedative of choice, as it can be given via the buccal mucosa.

Dosage:

The initial regime is 30–100 micrograms/kg given as required. Titrate upwards as required (the upper dose may be limited by volume).

Rectal diazepam may also be useful.

Dosage:

5–10 mg rectal tube as required. The dose may be repeated if child remains very agitated and restless.

Increased secretions

- Increased secretions (the 'death rattle') can be more distressing for the parents and carers than for the child. It is important to explain this to those caring for the child.
- Good mouth care is essential.
- Anti-secretory agents are useful, but can cause drowsiness and anti-cholinergic side effects.
- Start drug treatment early in order to avoid build-up of excessive secretions.

Hyoscine hydrobromide (scopolamine)

- This drug is anticholinergic.
- It reduces pharyngeal secretions.
- It should be used prophylactically at the first sign of excess secretions.
- It mixes with other commonly used drugs.
- Potential routes for administration: oral, as a sublingual tablet, IV or subcutaneous.

Dosage:

Oral/sublingual route:

- Age 1–12 years: 10 micrograms/kg/dose, four times a day
- Age > 12 years: 300 micrograms/dose, four times a day.

Subcutaneous or IV infusion:

- All ages: 10–50 micrograms/kg/24 hours.

Loss of the oral route for food and medication

As a child's condition deteriorates it may become difficult to use the oral route for medication. Buccal and rectal routes are the best options in this situation, and work well. As discussed earlier, other routes that can be used at this point are the rectal, subcutaneous and (where already established) IV routes. Children who have been treated for cancer in well-resourced hospitals may have central IV access, which can be used effectively in palliative care, but usually only in hospital.

Drugs that can be given via the subcutaneous or IV route include analgesics, anti-emetics, sedatives, anxiolytics and anticholinergic drugs. These can be combined together in an infusion, provided that they are compatible with each other.

If they are available, it is possible to use small portable infusion pumps (e.g. Graseby MS 26, WalkMed) to deliver combinations of medication over 24 hours. However, these devices are unlikely to be available for home use in most resource-limited countries, and home palliative care teams would not generally be able to provide this form of treatment. Sometimes individual carers may be able to manage this form of treatment.

Additional notes

- Avoid administering high concentrations of drugs in combination, especially when using cyclizine.
- Avoid mixing dexamethasone with other drugs if possible.
- Never give chlorpromazine, prochlorperazine or diazepam subcutaneously.
- More than two drugs can be combined in portable syringe drivers, although there is little supporting evidence in the form of clinical data. Always consult your local pharmacist before using any unusual combinations.

Psychological support for the child, parents and siblings

Care that is child and family centred is an essential principle of palliative care. The availability of an experienced key worker to coordinate the child's care with community healthcare professionals is essential, with good communication both between professionals and between professionals and the family being of paramount importance.

Initially, parents may need a lot of support when deciding whether to withdraw curative treatment and where to care for their child. Whether the care setting is in hospital or at home, the parents will have many questions, fears and anxieties at this time, and if possible the opportunity to discuss their worries, changes in the child's condition and symptom management should be available 24 hours a day. Commonly asked questions include 'How long will it be?' and 'How will my child die?' These questions are not easy to answer, and will also depend on the nature of

the child's illness. For example, a child with leukaemia may have a very short period of palliative care, whereas a child with a brain tumour or neurodegenerative disease may live for several months. It is probably best to give an indication of time span, but to emphasise that every child is different, and to guide the parents as the disease progresses. 'Days or weeks', 'weeks or months' or even 'hours rather than days' give adequate warning without being too precise.

Parents may worry about their child being in pain, but also have anxieties about the use of strong medication such as morphine. A clear explanation of the use of analgesics is essential in this situation.

Many parents will want advice on talking to the dying child and their siblings. How to prepare the child's brothers and sisters will depend very much on their age and level of understanding, and on parental beliefs. For older children and teenagers it is probably best to be honest, to prepare them gradually for what is happening and allow them to ask questions and participate in their sibling's care if appropriate. With younger children, the language used must be very simple and clear. For example, it is important to avoid using the phrase 'going to sleep' as the analogy for death. It is probably more appropriate to prepare younger children for a sibling's death when the end is obviously very close. Cultural preferences also need to be taken into account.

Talking to the child who is dying is a very personal matter for parents, and will also be influenced by the child's age and understanding of the illness. For example, a teenager with cystic fibrosis may have anticipated death in adolescence or young adulthood, and a teenager who has had multiple relapses of cancer for many years may now realise that the treatment is no longer working. Where possible and appropriate, it is important that children and teenagers are given the opportunity to express their wishes and anxieties. When children are not allowed to express themselves they can become very anxious and agitated, or even withdrawn. Healthcare professionals can only try to encourage the parents to have an open and honest approach to their child's questions and wishes at this time.

Preparation for death

Parents commonly have many questions about the time and nature of death, and what happens afterwards. It can be very helpful to try to prepare them for what may happen at the time of death if they wish to have this information. Changes in breathing are commonly distressing, and simple explanations of, for example, Cheyne–Stokes respiration or the 'death rattle' can avoid unnecessary distress. A single expiratory breath after death if the child is moved is not uncommon, and it should be explained to the parents that this does not mean that their child is still alive. Explanations of the changes in colour and very cold feel of the skin are important for parents and siblings. If they are not warned in advance, parents may become distressed that their child was incontinent at the time of death. In the case of some diseases (e.g. leukaemia), the parents will need to be warned that their child may bleed from the nose or mouth at the time of or after death, and given simple practical measures for managing this situation.

Some families will require professional support around the time of the child's death, and it is essential that this is available.

After their child has died, the parents must be reassured that they need not rush to do anything, but may spend some time with their child. However, it is also important that any specific cultural or religious requirements are acknowledged and attended to. The parents should be encouraged, if they wish to do so, to hold, wash and dress their child. Some parents may want to take photographs, locks of hair, or hand and foot prints, or organise favourite toys, photographs, letters or other items for the child 'to take with them'. The participation of siblings in these activities can be very helpful.

In countries where it is usually necessary for a child's death to be confirmed by a medical practitioner it is very rare for a post-mortem to be required. The death certificate then gives the authority for the death to be registered (according to each country's prevailing law) and the funeral arrangements to be made.

The specific cultural and religious beliefs of the family and the country in which they live will play an important role in the child's funeral. However, the parents may need advice about the choice between burial or cremation, or about the funeral service itself.

Support after death

Support for parents, siblings and the extended family around the time of the child's death and in the weeks and months afterwards will be very much influenced by the family's culture and family network, and by the support provided during the child's terminal care. Bereavement contact from the professionals involved with the family should be offered wherever possible.

Clinicians need to be aware of the cultural support and customs that affect bereavement, and refrain from imposing their own personal needs and values on others.

Ongoing bereavement support should be based on the family's specific needs and requests, and the availability of appropriate bereavement support for both parents and siblings. Bereavement literature and parent support groups may be helpful where available.

Recognition of the child's birthday and the anniversary of their death provide an opportunity for healthcare professionals and friends to show the family that their child has not been forgotten.

Acknowledgement

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Further reading

Goldman A, Hain R and Liben S (2006) *Oxford Textbook of Palliative Care for Children*. Oxford: Oxford University Press.

Amery J (ed.) *Children's Palliative Care in Africa*. International Children's Palliative Care Network www.icpcn.org (accessed July 2014).

International Children's Palliative Care Network (ICPCN). www.icpcn.org.uk (accessed 9 December 2012).

World Health Organization. *Cancer Pain Relief and Palliative Care in Children*. www.who.int/cancer/palliative/en/ (accessed July 2014).

Palliative Care Formulary for Children (available on the Internet and as a hard-copy publication). www.palliativedrugs.com/palliative-care-formulary.html (accessed July 2014).

Merriman A (2012) *Freedom from Pain*, 2nd edition. Uganda: Hospice Africa. www.hospiceafrica.or.ug (accessed 9 December 2012).

Jassal S (2008) *Basic Symptom Control in Paediatric Palliative Care: the Rainbows Children's Hospice Guidelines*.

www.rainbows.co.uk/wp-content/uploads/2011/06/Rainbows-Hospice-Basic-Symptom-Control-In-Paediatric-Palliative-Care-8th-Ed-2011-protected.pdf (accessed 9 December 2012 but now requires a password).

Hain R and Jassal S (2010) *Paediatric Palliative Medicine*. Oxford Specialist Handbooks in Paediatrics. Oxford: Oxford University Press.

Jassal S and Hain RD (2011) *Association for Paediatric Palliative Medicine Master Formulary*. www.appm.org.uk/10.html.

World Health Organization. *Guidelines on the Pharmacological Treatment of Persisting Pain in Children with Medical Illnesses*. http://whqlibdoc.who.int/publications/2012/9789241548120_Guidelines.pdf (accessed July 2014).

British National Formulary for Children. www.medicinescomplete.com/mc/ (accessed July 2014).

1.17 Hospital issues regarding immunisation

Introduction

Immunisation is one of the most effective disease prevention strategies in children. In this process, an antigen is introduced into the body, where it stimulates immunity against the specific antigen by priming the specific memory cells. Subsequent natural infection produces an effective and vigorous response by the body, and the patient is thus protected from the disease and its effects and complications.

In 1974, the World Health Organization (WHO) initiated the Expanded Programme on Immunisation (EPI). This aims to develop widespread national commitment to achieve high vaccination coverage in mostly low-income countries. The choice of the original six EPI vaccines was based on the importance of the disease and the availability of safe, efficacious and low-cost vaccines.

The WHO recommended vaccination schedule is widely used in almost all countries, with newer vaccines being added as some programmes evolved (*see* Table 1.17.1).

TABLE 1.17.1 Current EPI vaccination schedule recommended by the WHO, May 2014

Age	Vaccine
Birth	BCG*, OPV#0, HBV#1
6 weeks	DTP#1, HiB#1, OPV#1, HBV# 2 PCV#1 RV#1
10 weeks	DTP#2, HiB#2, OPV#2, HBV#3 IPV#1 PCV#2 RV#2
14 weeks	DTP#3, HiB#3, OPV#3, IPV#2 PCV#3
9 months	MCV/RCV #1 Yellow fever (in countries where it poses a risk)
12–15 months	MCV/RCV#2
9 years girls	HPV#1 plus HPV# 2 after at least 6/12

BCG, bacillus Calmette-Guérin; OPV, oral poliovirus vaccine; IPV, inactivated polio vaccine HBV, hepatitis B vaccine; DTP, diphtheria, tetanus and pertussis; HiB, Haemophilus influenzae type B; Pneumococcus PCV; Rotavirus RV; Measles/Rubella MCV/RCV; Human papilloma virus HPV

*BCG must not be given if HIV infection is present or clinically suspected

See these links for further information:

www.who.int/immunization/policy/immunization_tables/en/

www.who.int/immunization/policy/Immunization_routine_table2.pdf?ua=1

Vaccine schedules are a continuously changing phenomenon. It is recommended that regional variations on programmes are followed.

Polio

Live oral poliovirus vaccine (OPV) and inactivated poliovirus vaccine (IPV) are the two effective vaccines that are available, but there are important differences between them.

- WHO no longer recommends an OPV only vaccination schedule, at least 1 dose of IPV should be added to the schedule.
- In polio-endemic countries and in countries at high risk for importation and subsequent spread, WHO recommends an OPV birth dose (a zero dose) followed by a primary series of 3 OPV and at least 1 IPV doses.
- The WHO target to eradicate poliomyelitis within the next 10 years is dependent on high infant immunisation coverage and national immunisation days (NIDs), which aim to eradicate the circulation of wild virus. NIDs are designed to complement routine immunisation by targeting the most vulnerable individuals in as short a time period as possible. OPV is given over a 2-day period, 1 month apart, and the NIDs are repeated annually for at least 3 years.

Pertussis

Fever and mild local reactions are common. Consider a two-dose schedule for those areas where services can be provided only twice a year.

Measles

Accelerated implementation of strategies to reduce the burden of measles is required. Targeting children under 5 years of age in major cities is a priority. Strategies to reduce the impact of infant measles include:

- increasing coverage to the 9–23 months age group
- a two-dose schedule at 6 months and 15 months is most appropriate for epidemic situations, and a two-dose

schedule at 9 months and 15 months is currently recommended routinely.

Tetanus

All healthcare workers at antenatal clinics should guarantee that no women attending will have a child who dies of neonatal tetanus, by giving immunisation and advice about umbilical cord care. Vaccination of young adolescent girls is recommended in areas with poor antenatal coverage. Mothers who were not seen antenatally should be vaccinated when they bring their infants to clinic.

BCG

This offers good protection against disseminated tuberculosis and also affords some protection from leprosy. Where the risk of tuberculosis is high, BCG is recommended at birth or as soon as possible thereafter.

It is recommended for children living in countries with a high-disease burden for HIV and for high-risk children living in countries with low-disease burden.

Children who are HIV positive or have unknown HIV status with symptoms consistent with HIV should not be vaccinated.

New vaccines and EPI

Hepatitis B and yellow fever vaccines have been recommended since 1992. The HiB vaccine is also a priority, and is given as combination now in EPI programmes with the DPT and HBV as three doses. Newly introduced vaccines are the pneumococcal conjugate vaccine (PCV) and the rotavirus vaccines. Unfortunately there is no vaccine yet available against HIV or hepatitis C.

Other vaccines to consider based upon local epidemiology and resource limitations would be:

- MMR (Measles, Mumps and Rubella) vaccine instead of MCV/RCV as at present recommended
- Typhoid vaccine
- Varicella vaccine
- Meningococcal (Conjugate) vaccine.

Contraindications to immunisation

All vaccines

- Anaphylactic reaction.
- Moderate to severe acute illnesses with or without fever.
- Evolving neurological disease.

Specific vaccines

- Encephalopathy (DPT/DaPT).
- Immunodeficiency (OPV, BCG, MMR).
- Anaphylactic reaction to egg and neomycin (MMR, VZV).
- Pregnancy (MMR, OPV, IPV).
- Precautions for DPT:
  - fever > 105 °F
  - collapse or shock-like state
  - seizures
  - persistent inconsolable crying.

Conditions that are not contraindications to immunisation

- Minor illnesses, such as upper respiratory infections or diarrhoea, with fever < 38.5 °C.
- Allergy, asthma or other atopic manifestations (e.g. hay fever, 'snuffles').
- Prematurity, small-for-date infants.
- Malnutrition.
- Child being breastfed.
- Family history of convulsions.
- Convalescent phase of illness.
- Penicillin or other allergies.
- Treatment with antibiotics, low-dose corticosteroids or locally acting (e.g. topical or inhaled) steroids.
- Dermatoses, eczema or localised skin infection.
- Chronic diseases of the heart, lung, kidney or liver.
- Stable neurological conditions (e.g. cerebral palsy, Down's syndrome).
- History of jaundice after birth.

HIV infection and vaccination

Individuals with known or suspected asymptomatic HIV infection should receive all EPI vaccines (including against rotavirus) as early in life as possible according to nationally recommended schedules. Because of the risk of early and severe measles, infants should receive a standard dose at 6 months, with a second dose as soon after age 9 months as possible.

Children who are HIV positive or have unknown HIV status with symptoms consistent with HIV should not be vaccinated with BCG.

Also *see* Sections 2.8.C and 6.2.D HIV Infection.

TABLE 1.17.2 WHO/UNICEF recommendations for the immunisation of HIV-infected children and women of childbearing age

Vaccine	HIV positive without symptoms	HIV positive with symptoms	Optimal timing of immunisation
BCG	No	No	
DPT	Yes	Yes	6, 10 and 14 weeks
OPV	Yes	Yes	0, 6, 10 and 14 weeks
Measles	Yes	Yes	6 and 9 months
Hepatitis B	Yes	Yes	As for uninfected children
Rotavirus	Yes	Yes	6, 10 weeks
Yellow fever	Yes	(No pending further studies)	–
Tetanus toxoid	Yes	Yes	5 doses

Additional vaccines that should be seriously considered in HIV-infected children include the following:

- Varicella vaccine:
  - recommended in asymptomatic/mildly symptomatic children
  - two doses should be given with a 3-month interval

  - strongly recommended for HIV-negative siblings and other children in the household
  - contraindicated in moderately and severely immunocompromised children.
- Other vaccines:
  - influenza virus vaccine annually, specific strain only
  - hepatitis A
  - parenteral typhoid vaccine (oral administration is contraindicated).

TABLE 1.17.3 Recommended vaccine storage time and temperature

Vaccines	Shelf life	Transport state-district	State/district	Transport to PHC	PHC
DTT/TT and typhoid	1–1.5 years (4–8°C)	+4 to +8°C	3 months (4–8°C)	4–8°C	1 month (4–8°C)
BCG	8 months (4–8°C)	+4 to +8°C	3 months (4–8°C)	4–8°C	1 month (4–8°C)
Measles and OPV	2 years at –20°C	–20°C to +8°C	3 months (–20°C)	–20°C to + 8°C	1 month (4–8°C)

Logistic actions to avoid unnecessary risk, vaccine wastage and missed opportunities are essential.

Immunisation instruments recommended by EPI

Disposable single-use plastic syringes are safe and economical, but it is important to correctly destroy and dispose of the syringes and sharps after use. Used needles and syringes should be placed in a hard container, sealed, autoclaved, and ideally incinerated for disposal.

- Opened vials of OPV, DPT and hepatitis B vaccines may be used in subsequent immunisation sessions until a new shipment arrives (provided the expiry date has not passed, vaccines are kept in the cold chain and the vials have not been used outside the health centre).
- Opened vials of measles, yellow fever and BCG vaccines must be discarded at the end of each immunisation session.
- Vaccine vial monitors (VVMs) will enable field staff to reject vials of vaccine that are heat damaged.
- Screen and immunise at every contact. The rate of non-immunisation of eligible children at clinics may be as high as 30%.
- Reduce wastage by choosing the correct vial size.
- Ensure appropriate use of the vaccine cold box. Cold boxes only work if they are kept cold with the lid tightly shut. Ice packs are placed in the bottom and around the sides of the box and on the top of the vaccines. Newspaper should be placed between the vaccines and the icepacks to protect DPT and tetanus vaccines from the ice. A thermometer should be placed with the vaccines to record the temperature of the vaccines when they are removed from the cold box. The diluent that is used to reconstitute measles and BCG vaccine must also be kept cold.
- Effective supervision requires focus on the essentials.
- Evaluate and monitor the programme.

Care of refrigerators

A constant supply of electricity, gas or kerosene is required. The electric plug can be taped to its socket to ensure that it is not inadvertently removed. For gas and kerosene fridges, a reserve full bottle of gas or can of fuel should always be present. A regulator valve should be used with the gas bottle. Kerosene tanks should be filled daily using a funnel and filter to remove dirt. The refrigerator should be positioned in a completely upright position with a draught blowing on the temperature exchanger to keep it cool. A fan can be used for this if there is no wind and the ambient temperature is high.

Summary

- Vaccines are the best form of prevention, especially for children under 5 years of age.
- They are safe, effective, generally economical, and easily available.
- Immunisation of a child should start at birth and continue until they are old enough to attend college.
- Standards must be maintained with regard to procurement, delivery, storage and administration of all vaccines.
- In the event of missed doses, in most cases the vaccination schedule can be completed from the time when the dose was missed.
- Mild fever and upper respiratory tract infections are not contraindications to giving vaccination.
- Do take every opportunity to recommend vaccination for children.

Immunisation issues in pregnancy

Vaccination against tetanus

The most important vaccination that should be given to all pregnant women and girls is to prevent tetanus in women and in the newborn infant. After two doses, protective antibodies are present in more than 80% of recipients. The vaccine is safe in pregnancy, and two doses of vaccination last for at least 3 years.

If the woman or girl has a tetanus-susceptible wound, including following an unsafe abortion, protect against future tetanus risks by immunising her immediately if she is not already protected. In addition, provide prophylaxis with tetanus immunoglobulin if the wound is large and possibly infected with soil or instruments contaminated with animal excreta.

In the antenatal setting, check the immunisation status of the pregnant woman (either by a history or from the record card), regardless of whether she intends to continue the pregnancy.

If the woman has not previously been vaccinated, or her immunisation status is unknown, give two doses of TT/Td 1 month apart as soon as possible before delivery, TT1 and TT2 (one dose is not enough to give protection to the mother or newborn baby). Two doses protect for 1 to 3 years. If there is time in the remainder of the pregnancy, give another dose, TT3, 6 months after the second initial dose; otherwise give the third dose, TT3, in the next pregnancy. Three doses protect for at least 5 years. A fourth

dose can be given at least 1 year after TT3, and protects for at least 10 years.

If the woman can prove her previous vaccination history, and provided she has had between 1 and 4 doses in the past, give one additional dose before delivery.

Before giving the vaccine, shake the vial and make sure that the material in the base of the vial is completely mixed with the liquid. If it is suspected that the vaccine has been frozen and thawed, this mixing may not occur and the vial should not be used.

If neonatal tetanus occurs, give the mother one dose of TT as soon as possible, and repeat the dose 4 weeks later and then again 6 months after the second dose.

Record the doses given on a central hospital/clinic register. However, it is of paramount importance to record them on a card or maternal health record kept by the mother.

Immunisation against hepatitis B virus (HBV)

All pregnant women and girls should ideally be offered screening for HBV.

They may have become infected at their birth (vertical transmission) or by sexual contact or through infected blood transfusion or use of dirty needles. Hepatitis B can be passed from a mother to her baby during or shortly after delivery. Having a Caesarean section does not prevent the virus from being transferred to the baby. If a ventouse delivery is undertaken a soft cap is preferred to the metal cup. Breastfeeding is safe.

During pregnancy, all women should have a blood test for a marker of hepatitis B virus, which is called hepatitis B surface antigen (HBsAg). Normally the HBsAg should be negative.

If a pregnant woman's HBsAg test or hepatitis B e-antigen (HBeAg) test are positive, the infant must be given hepatitis B immunoglobulin (HBIG) as soon as possible after birth to reduce the transmission rate from 70–90% to 5–10%.

Similarly, if a woman develops HBV infection during pregnancy, HBIG prophylaxis (400 IU given intramuscularly), which is safe, should be administered urgently within 24 hours of infection if possible. Acute HBV infection may be asymptomatic or present with signs of acute hepatitis. If available, antiviral therapy can be given to pregnant women who have high viral loads.

HBIG provides immediate protection for the woman or infant, but the effect only lasts a few months. Women or their babies should then be given a course of HBV vaccination (the initial dose being given at the time of HBIG, and then two further doses at 1 and 6 months after the initial dose).

The newborn infant, in addition to receiving the HBIG described above, should receive the hepatitis B vaccine at birth, again at 1–2 months, and finally at 6 months of age. It is important to complete all three doses for long-term protection. The infant should have a blood test for hepatitis B infection and for hepatitis B antibody at 9–18 months of age. If the antibody test is negative, a fourth dose of the vaccine should be given at that time.

Women who are HBsAg-positive must not donate breast milk.

Vaccinations that should not be given during pregnancy

Live vaccines

- BCG (live attenuated strain).
- Oral typhoid vaccine.
- Measles–mumps–rubella (MMR).
- Rotavirus.
- Varicella.
- Yellow fever (unless travelling to areas in which yellow fever is endemic).

Inactivated vaccines

- Oral cholera.
- 7-Valent pneumococcal conjugate.

WHO recommendations for Immunisation of Health Care Workers:

Hepatitis B. Immunisation is suggested for groups at risk of acquiring infection who have not been vaccinated previously (for example HCWs who may be exposed to blood and blood products at work).

Polio. All HCWs should have completed a full course of primary vaccination against polio.

Diphtheria. Particular attention should be given to revaccination of HCWs with diphtheria boosters every 10 years. Special attention should be paid to immunising HCWs who may have occupational exposure to *C. diphtheria*.

Measles. All HCWs should be immune to measles and proof/documentation of immunity or immunization should be required as a condition of enrolment into training and employment.

Rubella. If rubella vaccine has been introduced into the national programme, all HCWs should be immune to rubella and proof/documentation of immunity or immunisation should be required as a condition of enrolment into training and employment.

Meningococcal disease. One booster dose 3–5 years after the primary dose may be given to persons considered to be at continued risk of exposure, including HCWs.

Further reading

Vaccines and vaccination against yellow fever. WHO Position Paper – June 2013 www.who.int/wer/2013/wer8827.pdf

1.18 Recognition by hospital workers of the abuse and exploitation of pregnant women and children

For health workers in hospitals, the two most important issues are:

1 that abusive injuries are recognised and diagnosed
2 that future abuse is where possible prevented by the involvement of agencies such as social services, the police and legal teams working together.

Child abuse and family violence against pregnant women represent a worldwide problem.

Categories of ill treatment and abuse

A new way of looking at this subject divides the ill treatment or abuse into three categories based on the intention of the perpetrators.

Ill treatment resulting from human weakness

This occurs at some time in every family, often without realisation.

It is best addressed through education, religious or other community initiatives.

Ill treatment resulting from stress

This can involve violence, which is sometimes very severe. Perpetrators are often unhappy, are suffering from an undiagnosed or untreated mental illness, dependent on drugs or alcohol, unsupported, and were often inadequately parented in their own childhood. After violent acts, the perpetrator usually becomes distressed. They do love and care for their victim.

This problem needs professional support that is appropriately led by local social services staff, not punitive legislation.

Abuse that is undertaken for gain

This often involves the most serious and prolonged forms of violence, resulting in great suffering. The perpetrator usually has a psychopathic personality disorder and is immune or insensitive to the suffering of others. Indeed, they may even enjoy inflicting emotional or physical pain. Mental illness is not responsible for this form of abuse. Although the perpetrators are aware that what they are doing is wrong, they are gaining from doing it. They will do all that they can to avoid being detected, by employing elaborate and plausible lies, characteristically weaving objects of truth into a latticework of deceit. The perpetrators are usually dangerous and frighten local social workers, health visitors, doctors and teachers, who need to be involved in a protected manner. The perpetrators may work in groups such as the criminal gangs involved in human trafficking.

The kinds of abuse undertaken in this third category include:

- trafficking of women and children as slaves or for prostitution
- sadistic injuries (e.g. deliberate burns from cigarettes, scalding, holding the person against hot objects, etc.)
- multiple fractures, often inflicted at different times, reflecting the severity of violence
- excessive ritual punishments (e.g. regular and savage beatings, usually with implements)
- deliberate starvation, as distinct from neglect as in the second category
- the fabrication or inducement of illness
- sexual abuse.

The most difficult issue is to distinguish this form of abuse from perpetrator stress-related ill treatment (the second category above).

The possibility of ill treatment or abuse must be considered in the differential diagnosis of all children or pregnant women or girls who have suffered an injury and present to hospital.

All professionals who are working with children and pregnant women or girls need to be aware of the clinical manifestations of abuse and do everything that they can to protect their patients from further harm.

Some cultural practices are abusive. For example, female genital cutting (*see* Section 2.10) not only causes great suffering at the time, but can interfere with future childbirth and sexual relationships.

Abuse and ill treatment occurs across all social classes.

Features of family members known to be associated with ill treatment or abuse

Observe the relationship between the family and the patient.

- Is it loving and caring?
- Were any family members themselves abused as children?
- Are the parent(s) of a child young and/or unsupported?
- Are the parent(s) of a child single or substitutive?
- Does the parent of a child have learning difficulties?
- Do the parents of a child have a poor or unstable relationship?
- Is there existing domestic violence, drug or alcohol abuse in the family?
- Does the parent of a child have a mental illness (e.g. postnatal depression)?

Critical threshold for concern

Arriving at the critical threshold may be immediate and straightforward (e.g. the finding of bruising on a small infant, or a direct disclosure of abuse from a child or pregnant girl). In some circumstances the situation is less clear (e.g. if there are a number of non-specific signs or indicators, or in cases of neglect). At some point a balanced assessment is required between the provision of family support for a patient who is judged to be 'in need', and taking action directly to protect them.

The 'critical threshold' is that point beyond which behaviour(s) towards a patient can be considered to be ill treatment or abuse, and beyond which it becomes necessary to take action. That is the time to raise concerns with the parents, carers and/or family and the time to refer to the statutory agencies (either social services or the police, depending on the local legislative system).

1.19 Transport of ill patients

The transport of patients who are ill should follow the same principles whether the distance is long or short, and whether the journey is within or between healthcare facilities.

All transfers pose a potential risk, and should only be undertaken if safe treatment cannot be given within the facility where the patient is at present.

Preparation and planning allow mitigation of risks to both the patient and healthcare staff.

Staff who are trained in transport provide better-quality transfers.

Stabilisation prior to transport is preferable, as better-quality transport is of benefit to patient outcomes. However, time-critical pathologies may change the balance of risk and benefit between time spent on stabilisation and the need for rapid transfer for definitive treatment.

Never assume that resources and equipment will be available in transport vehicles. Prepare beforehand to be self-sufficient.

Use the principles of ABCD to guide management of the patient for transport.

Use a checklist (*see* Table 1.19).

Pregnancy-related emergencies involve two patients – the mother and the baby.

Many obstetric emergencies require urgent, rapid and safe transport from home to the nearest facility where there is comprehensive emergency obstetric care (EmOC). This is particularly relevant for emergencies such as massive obstetric haemorrhage, eclampsia, obstructed labour, shoulder dystocia and complicated breech delivery.

Ideally, every pregnant woman or girl should have a local transport plan ready in advance for an unexpected emergency. This could consist of a village taxi, a relative's car, or some other form of transport, the fuel for which needs to be secured in advance.

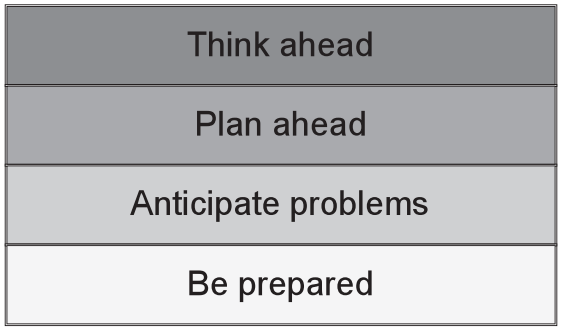

FIGURE 1.19.1 Safe transport rules.

Ideally, there should also be an emergency transport system based in the nearest health facility with comprehensive EmOC and having a midwife on call 24 hours a day who can go out with an ambulance containing suitable emergency equipment and drugs to the home of a mother with a life-threatening emergency, stabilise her and transport her back to the health facility.

The following paper describes a system of this type: www.reproductive-health-journal.com/content/pdf/1742-4755-7-21.pdf.

Motor cycle and side-car ambulances (e.g. www.eranger.com) can be extremely effective for transporting pregnant women and girls along difficult roads in rural areas to a hospital or clinic.

TABLE 1.19 Transport checklist

Airway/Breathing		Yes/No
Is the airway safe?	Is there anything that can be done to improve the airway?	Yes/No
Is oxygen required?	Pulse oximeter (battery operated with additional power from the ambulance cigarette lighter) can help to guide the need for oxygen	Yes/No
Is oxygen available?	Oxygen cylinders full and working – enough for the return expected journey	Yes/No
Is ventilatory support required?	Bag-valve-mask of the correct size available and working	Yes/No
Suction	Manual system and catheters available	Yes/No
Circulation		Yes/No
IV access	Working and secured	Yes/No
Volume	Ringer-lactate or Hartmann's solution bags and delivery kits	Yes/No
D Neurology		Yes/No
Temperature	Sufficient blankets available	Yes/No
Blood sugar level	Glucose for IV or gastric tube administration available	Yes/No
Other		Yes/No
Birthing needs	Delivery kit, bag-valve-mask for neonate, towels, oxytocin, misoprostol, magnesium sulphate and condom catheter	
Documentation	All relevant documentation with the patient	Yes/No
Family members	Family members know what the plan is	Yes/No
Healthcare communication	Receiving site is aware of the patient and their expected time of arrival	Yes/No

1.20 Ethics in healthcare

Introduction

Ethics is the study of morality. Morality is defined as the values used in human behaviour and decision making.

Medical ethics

Medical ethics is the branch of ethics that deals with moral issues in medical practice.

Anyone who is involved in patient care uses ethics, whether or not they have had formal teaching in medical ethics (most people have not).

Usually law and ethics are closely related, but there are some differences:

- Laws differ between countries, whereas ethics are applicable to all countries.
- Ethical obligations take priority over legal duties.
- When law conflicts with medical ethics, healthcare workers should advocate for changing the law.

There are four basic principles of ethics in healthcare which apply to most moral issues that arise in healthcare:

1 **Autonomy:** this means self-determination. If a patient is fully informed and competent (i.e. is able to understand the implications of having treatment or no treatment), they have the right to refuse or accept treatment. Such decisions must be respected, even if they are not thought by health workers to be in the patient's best interests.
2 **Beneficence:** this means doing good and promoting well-being. This has to be considered for the individual patient, and may conflict with autonomy.
3 **Non-maleficence:** this means doing no harm. In healthcare, it is recognised that there is a risk of harm whenever investigations or treatment are carried out to benefit the patient. Maleficence refers to harm inflicted with no intended benefit to the patient.
4 **Justice:** this means equality before the law or fairness. It refers to the fair allocation of scarce resources to patients, and the justification for money spent in the health service. This may mean equal access to healthcare, maximum benefit of resources available, or allowing people choice in their healthcare. This decision may not be able to be taken by an individual. In a society where justice prevails, the aim is for all citizens to have equal access to healthcare.

Medical ethics in different countries

Different cultures and societies have different expectations about the relative values of the individual ethical principles. Some societies expect a beneficent or non-maleficent approach, whereas others expect an overriding respect for autonomy. It is essential that, as well as working within professional ethics, health workers respect the law in the countries where they practise, provided that the law does not harm the patient.

If a law or laws do harm patients or fail to protect them from harm, the healthcare workers should advocate for appropriate change in those law(s).

Some cultures put less weight on individualism, and involve the family and/or community in decision making.

Gender may also affect decision making. In some societies, decision making is the man's responsibility and the woman has no autonomy.

In some countries, health workers will not be forced to do anything unethical, whereas in others, there may be pressure from the police or the army to participate in torture or reveal the names of patients and their injuries and so break confidentiality.

> In 2001 in South Africa, the Treatment Action Campaign (TAC) launched legal action to demand more widespread access to nevirapine to reduce mother-to-child transmission of HIV/AIDS. The High Court issued an order to the government to make nevirapine available to pregnant women with HIV.

In the USA, the emphasis is on the individual's autonomy, whereas in Africa the community may be more important, so the principles of beneficence and distributive justice may predominate.

Codes of ethics

The nursing and medical professions have their own international codes of ethics, adopted by the International Council of Nurses (ICN) and the World Medical Association (WMA), respectively.

There are more similarities than differences in medical ethics worldwide, and the World Medical Association has the role of setting standards in medical ethics that are applicable worldwide. The association was set up in 1947 to prevent a repetition of the unethical conduct of physicians in Nazi Germany and elsewhere. The WMA has developed an *International Code of Medical Ethics*, which was last revised in 2006.

The International Council of Nurses developed a code of ethics for the nursing profession in 1953, which was last revised in 2005.

WMA International Code of Medical Ethics

- This was adopted by the 3rd General Assembly of the World Medical Association, London, England, in October 1949.
- It was amended by the 22nd World Medical Assembly, Sydney, Australia, in August 1968.
- It was next amended by the 35th World Medical Assembly, Venice, Italy, in October 1983.
- It was most recently amended by the 57th World Medical Association General Assembly, Pilanesberg, South Africa, in October 2006.

Duties of physicians in general

A physician shall:

- always exercise their independent professional judgement and maintain the highest standards of professional conduct
- respect a competent patient's right to accept or refuse treatment
- not allow their judgement to be influenced by personal profit or unfair discrimination
- be dedicated to providing competent medical service in full professional and moral independence, with compassion and respect for human dignity
- deal honestly with patients and colleagues, and report to the appropriate authorities those physicians who practice unethically or incompetently or who engage in fraud or deception
- not receive any financial benefits or other incentives solely for referring patients or prescribing specific products
- respect the rights and preferences of patients, colleagues, and other health professionals
- recognise their important role in educating the public, but use due caution in divulging discoveries or new techniques or treatment through non-professional channels
- certify only that which they have personally verified
- strive to use healthcare resources in the best way to benefit patients and their community
- seek appropriate care and attention if they suffer from mental or physical illness
- respect the local and national codes of ethics.

Duties of physicians to patients

A physician shall:

- always bear in mind the obligation to respect human life
- act in the patient's best interest when providing medical care
- owe his or her patients complete loyalty and all the scientific resources available to him or her. Whenever an examination or treatment is beyond the physician's capacity, he or she should consult with or refer to another physician who has the necessary ability
- ensure that he/she remains competent to provide medical care in his/her field by continual professional development
- submit him/herself to assessment of health, probity, knowledge and competence by peers when appropriate
- respect a patient's right to confidentiality. It is ethical to disclose confidential information when the patient consents to it or when there is a real and imminent threat of harm to the patient or to others and this threat can be only removed by a breach of confidentiality
- give emergency care as a humanitarian duty unless they are assured that others are willing and able to give such care
- in situations when they are acting for a third party, ensure that the patient has full knowledge of that situation
- not enter into a sexual relationship with their current patient, or into any other abusive or exploitative relationship.

Duties of physicians to colleagues

A physician shall:

- behave towards colleagues as he or she would have them behave towards him or her
- not undermine the patient–physician relationship of colleagues in order to attract patients
- when medically necessary, communicate with colleagues who are involved in the care of the same patient. This communication should respect patient confidentiality and be confined to necessary information.

The ICN Code of Ethics for Nurses

This code has four principal elements that outline the standards of ethical conduct.

Elements of the code

1 **Nurses and people**
   - The nurse's primary professional responsibility is to people requiring nursing care. In providing care, the nurse promotes an environment in which the human rights, values, customs, spiritual beliefs of the individual, family and community are respected.
   - The nurse ensures that the individual receives sufficient information on which to base consent for care and related treatment.
   - The nurse holds in confidence personal information, and uses judgement in sharing this information.
   - The nurse shares with society the responsibility for initiating and supporting action to meet the health and social needs of the public, in particular those of vulnerable populations.
   - The nurse also shares responsibility to sustain and protect the natural environment from depletion, pollution, degradation and destruction.

2 **Nurses and practice**
   - The nurse carries personal responsibility and accountability for nursing practice, and for maintaining competence by continual learning.
   - The nurse maintains a standard of personal health such that the ability to provide care is not compromised.
   - The nurse at all times maintains standards of personal conduct which reflect well on the profession and enhance public confidence.
   - The nurse, in providing care, ensures that use of technology and scientific advances is compatible with the safety, dignity and rights of people.

3 **Nurses and the profession**
   - The nurse assumes the major role in determining and implementing acceptable standards of clinical nursing practice, management, research and education.
   - The nurse is active in developing a core of research-based professional knowledge.
   - The nurse, acting through the professional organisation, participates in creating and maintaining safe, equitable social and economic working conditions in nursing.

4 **Nurses and co-workers**
   - The nurse sustains a cooperative relationship with co-workers in nursing and other fields.
   - The nurse takes appropriate action to safeguard individuals, families and communities when their health is endangered by a co-worker or any other person.

Ethics in different situations, namely consent, confidentiality, end-of-life decisions and research, will be discussed below.

The ethics of consent

Informed consent is the process of a 'competent' patient receiving information needed to make a choice. It has five elements:

1 **Disclosure of information:** The patient has the right to the information necessary to make his or her decisions and to be informed of the consequences of his or her decisions.
2 **Comprehension:** The patient should understand the purpose of any test or treatment, the implications of the results, and the implications of not having the test or treatment.
3 **Voluntariness** (freedom from control by others): The patient has the right to self-determination, which includes making free decisions regarding him- or herself.
4 **Competence:** A mentally competent adult patient has the right to give or withhold consent to any diagnostic procedure or therapy.
5 **Choice:** Children may be able to consent to some procedures, but not to other more complex procedures.

Article 12 of the United Nations Convention on the Rights of the Child (1989) states:

> 'A child who is capable of forming his/her view has the right to express those views freely on all matters affecting the child, the views of the child being given due weight in accordance with the age and maturity of the child.'

The child's competence and parental involvement: respect for autonomy

Where a child is not competent to give or withhold consent to treatment, a person with parental responsibility must act as an advocate for the child to authorise investigations or treatment which are in the child's best interests. Parents have the right to be involved in the decision-making process, and this right is protected by law in most countries.

It is the doctor's responsibility to assess a child's capacity to decide whether he or she can consent to, or refuse, a proposed investigation or treatment before providing it. A competent child must be able to understand the nature, purpose and possible consequences of the proposed investigation or treatment, as well as the consequence of non-treatment. Competence is presumed at different ages in different countries. Children's competence is related to experience as well as to age, and young children can often clearly demonstrate that they have the competence to make decisions about treatment. Such competence has a legal standing in some countries (such as the so-called 'Gillick' competence in English law).

Providing the information: an essential component of consent

In some societies, disease and pain are interpreted in terms of sin and retribution. This may make it difficult for health workers to explain diagnostic and management options in medical terms.

Information should include details of the possible diagnoses and prognosis, possible management options, the purpose of a proposed investigation or treatment, and the likely benefits and probabilities of success, and discussion about any serious or frequently occurring risks. Wherever possible the information should be given in a way that is clearly understood and remembered.

All this information may be overwhelming for patients and their families. The principles of beneficence and non-maleficence might suggest that a more paternalistic and less forthright doctor might be behaving more ethically. However, it is important that personal views about how much to disclose are not imposed on the patient when explaining an illness or treatment to them.

When providing information, it is essential that professionals do their utmost to find out about the patient's (and family's) needs and priorities. This is often the most difficult part of the communication process, and involves responding honestly to any questions the patient or family raise and, as far as possible, answering these as fully as possible. It is for the competent patient, not the doctor, to determine what is in the patient's own best interests.

Finally, information for decision making should not be withheld from the patient and their family, unless it is judged that disclosure would cause the patient or family serious harm (the principle of non-maleficence). It may also be inappropriate to discuss treatments that are not available.

Emergency situations

If the patient is unconscious or otherwise unable to consent to, or decline, treatment and there is no one legally able to consent for them (this varies between countries, and may be the patient's child, brother, sister, etc.), urgent investigation and treatment may be carried out. This is sometimes called presumed consent, where the healthcare worker does what they think is in the best interests of the patient.

The UK General Medical Council (1998) advice on consent for emergencies includes the following:

> 'In an emergency, where consent cannot be obtained, you may provide medical treatment to anyone, provided the treatment is limited to what is immediately necessary to save life or avoid significant deterioration in the patient's health.'

Summary of consent

- Practise within the limits of the law of the country (unless this is harmful to the patient).
- Assess the level of competence of the patient before deciding how much and how to tell them.
- The patient and their family can tell you how much information they need to make a decision.
- All decisions must be free from coercion.

Confidentiality

This is not an ethical principle, but it involves a respect for autonomy, beneficence towards the patient, and a desire to act with non-maleficence.

Confidentiality respects an individual's autonomy and their right to control information relating to their own health. In keeping information confidential, the doctor is acting beneficently.

Most countries have laws to enable the breaking of confidentiality in some circumstances – for example, to protect the safety of a third person, or:

1 to prevent a serious crime, as information may need to be disclosed to the police
2 to report suspected child abuse
3 to report someone who is HIV positive who is unwilling

to inform their sexual partner(s) about this and does not consent to the healthcare worker telling the partner(s). The healthcare worker should inform the patient of his or her intention to inform the partner(s).

Information should only be disclosed without the patient's consent by health workers to individuals who need to know, and the recipient(s) of such information should keep it confidential.

Patient rights (family rights in the case of young children)

These are as follows:

1 to participate in developing a plan of treatment
2 to receive an explanation of how components of treatment will be provided
3 only to have confidentiality broken under certain conditions (e.g. knowledge or suspicion of child abuse, intent of the patient to harm him- or herself or others, or the presence of a communicable disease that may harm others)
4 to receive clinically appropriate care and treatment
5 to be treated in a manner that is free from abuse, discrimination and/or exploitation
6 to be treated by staff who are sensitive to the family's cultural background
7 to be given privacy.

End-of-life issues

These include the following:

- attempts to prolong the life of a dying patient
- euthanasia and medically assisted suicide
- care of terminally ill patients.

Attempts to prolong the life of a dying patient

Where there is no benefit to the patient these attempts are unethical. Futile treatments are those that are assessed as bound to fail and which are prolonging the dying phase. Withholding or withdrawing treatment is not the same as participating in assisted suicide or assisted euthanasia. This does not include palliative treatment, which must always be offered (*see* Section 1.16).

The patient may decide to discontinue treatment for a life-threatening illness while able to understand the information needed to make an informed choice, and prefer to die with dignity, being treated palliatively. Alternatively, they may wish to continue treatment even if they understand that it can provide little benefit. They must always be offered palliative treatment, whatever their choice.

> Euthanasia and assisted suicide are illegal in most countries and prohibited in most medical codes of ethics, and the WMA states that assisted suicide is unethical.

Euthanasia

Euthanasia (also known as 'assisted dying') means intentionally performing an act that is intended to end another person's life and:

- the patient has voluntarily asked for their life to be ended and is competent, informed and has an incurable illness
- the agent knows about the patient's condition and their desire to die, and commits the act with the intention of ending life
- the act is undertaken with compassion and without personal gain.

Assisted suicide

This is knowingly and intentionally providing a person with the knowledge or means to commit suicide, including counselling about lethal doses of drugs, prescribing or supplying the drugs.

This does not mean that healthcare workers should abandon dying patients, but rather they should provide compassionate end-of-life care, including relief of pain and suffering (*see* Section 1.16).

This includes patients who have refused potentially life-saving treatment while competent to do so. For example, if a patient refuses potentially life-saving surgery for a ruptured ectopic pregnancy, they should still receive nursing and medical care and symptomatic relief of suffering.

Withholding or withdrawing medical care

If the patient is a child, the healthcare team and the parents must enter a partnership of care whose function is to serve the best interests of the child.

1 Although there is no significant ethical difference between withdrawing and withholding treatment, there are significant practical differences.
2 Optimal ethical decision making concerning patients requires open and timely communication between members of the healthcare team, the patient and the family.
3 Parents must decide on behalf of a child who is unable to express preferences, unless they are clearly acting against the child's best interests. Cultural practices and religious beliefs may have an impact on this.
4 The wishes (antecedent, if known) of a child who has sufficient understanding and experience should be given substantial consideration.
5 Resolution of disagreement should be by discussion, consultation and consensus.
6 The duty of care is not an absolute duty to preserve life by all means.
7 A shift from life-sustaining treatment to palliation represents a change in aims and objectives, and does not constitute a withdrawal of care.
8 Health workers should never withdraw treatments that alleviate pain or promote comfort.
9 There is a difference between treatment of the dying patient and euthanasia. When a dying patient is receiving palliative care, the underlying cause of death is the disease process. Treatments that may incidentally hasten death are justified, if their primary aim is to relieve suffering.

Hospital ethics committees

Despite the growth of medical ethics and the publication of many professional codes of practice in recent years, it is still difficult for individuals to obtain guidance in resolving specific ethical dilemmas they face. Some hospitals have set up a hospital ethics committee or clinical ethics forum to discuss these dilemmas.

The jurisdiction of the ethics committee includes clinical

situations involving all patients, including infants and children under 18 years of age.

Function of hospital ethics committees

1 **Education:** The committee should provide members of the hospital/medical staff with access to the language, concepts, principles and knowledge of ethics.
2 **Policy review and development:** the committee can assist the hospital and healthcare staff in the development of polices and guidelines regarding recurrent ethical issues and questions which arise in the care of individual patients.
3 **Case review:** the committee should be a forum for analysis of ethical questions that arise in the care of individual patients.

Appointment and membership

The committee is multidisciplinary, and should include doctors, nurses, midwives, social worker, pastoral care, hospital director and chief of medical staff. A 30% membership from the general community has been suggested to ensure breadth of perspective and clarity of output.

Research ethics

Each year £35–40 billion is spent on healthcare research worldwide, but only 10% of this is aimed at the health problems of 90% of the world's population.

Under-resourced countries need research to help to prevent and treat diseases such as tuberculosis and malaria, but lack funds and trained personnel, and therefore need expertise and financial support from public and private sectors in wealthy countries. This can lead to exploitation of the people in the country where research is needed and undertaken.

The principles that should be followed by anyone who is designing or conducting healthcare research in under-resourced countries are as follows:

- to alleviate suffering
- to show respect for people
- to be sensitive to cultural differences
- not to exploit those who are vulnerable
- the scientific and social importance of the research should outweigh the risks and burdens to the study subjects
- all research should have social as well as scientific value
- the populations involved in the research should benefit from the results
- staff working in the public sector where there are insufficient staff to provide proper care for patients (e.g. in most of sub-Saharan Africa) should not be taken from their work in order to undertake research.

It is important that there are national guidelines in every country which set priorities for healthcare research, and if external sponsors propose research outside these priorities, it must be justified to the appropriate research ethics committees.

There should be three levels of review for each research proposal:

1 relevance to healthcare priorities in the country
2 scientific validity
3 ethical acceptability.

There are a number of national and international guidelines and regulations with regard to research (e.g. WMA, Council for International Organizations of Medical Science in collaboration with WHO, European Council and European Parliament), but these are often inappropriate for under-resourced countries.

Consent to research

For this to be valid, it should be given freely after full disclosure of all relevant information in a manner understandable by the research subject. Consent for the research may be withdrawn by the subject at any time without there being any adverse effects on the subject. However, in some communities it is usual for male members of the family or a community to make decisions on behalf of women and children.

Level of care

The level of care provided to the control group (i.e. the group that is not having the active potential treatment) is controversial. Some argue that, if the research is externally sponsored, the people in the control group should receive the same standard of care as would be received in the sponsor's country. Others argue that this prevents some research from being conducted. For example, if two treatments are being compared in the under-resourced country, it is more appropriate for the new treatment to be compared with the one currently available in that country, not one that is inaccessible there.

Post-research considerations

If an intervention is effective, should it be made available to the research participants and the community? The country concerned may not be able to afford this, particularly if it is a new and expensive drug, but a decision should be made with the national government via its research ethics committee about what will happen after the trial period is over.

Healthcare worker relationships

As well as having an ethical duty towards patients, healthcare workers have an ethical duty towards other healthcare workers, to the healthcare system and to society.

The health worker–patient relationship

1 The healthcare worker's primary role is to be an advocate for each patient's care and well-being. They should always place the interests of their patients first. The healthcare worker also has a duty to accept responsibility for his or her clinical decisions.
2 The healthcare worker must treat each patient with honesty, compassion, dignity and respect. They should not exclude or discriminate against any patient because of ethnic origin, race, sex, creed, age, socio-economic status, diagnosis, physical or mental disability, or sexual orientation.
3 The healthcare worker's commitment to patients includes health education and continuity of care by good communication with subsequent health workers.

The healthcare worker–healthcare worker relationship

Traditionally, healthcare workers have been part of a hierarchical system, both within and between professions.

Doctors have been at the top of the caregiving hierarchy, above nurses and other healthcare workers. This situation is gradually changing, with other healthcare professionals increasingly questioning the reasoning behind a doctor's decision.

1 Healthcare workers have a responsibility to maintain moral integrity, intellectual honesty and clinical competence. They should be aware of the limitations of their expertise and seek consultation or assistance in clinical situations in which they are not expert.
2 Healthcare workers should work as a team, supporting each other and working together for the benefit of the patient.
3 Healthcare workers have an obligation to educate and share information with colleagues, including trainee healthcare workers. They should be committed to lifelong learning and continuously improve their knowledge and clinical skills relevant to their practice.
4 There is an ethical obligation to report impairment or misconduct of colleagues in order to prevent potential harm to patients.

The relationship between the healthcare worker and the system of care

1 The healthcare worker's duty of patient advocacy should not be altered by the system of healthcare delivery in which they practise.
2 If there are conflicts of interest, the patient's interests should take priority over those of others.
3 Healthcare professionals should campaign against unethical practices.
4 Healthcare professionals should not be influenced by commercial enterprises (e.g. companies that manufacture drugs, diagnostic tools or equipment). The duty of the physician is to evaluate objectively what is best for the patient. Gifts designed to influence clinical practice are not acceptable.
5 Healthcare professionals should advocate to their departments of health for improved medical facilities and treatments for patients where acceptable basic facilities and treatments are lacking (e.g. oxygen, effective pain relief, blood transfusion services, access to vital skills such as surgery, basic life-saving drugs).

In many countries, there are huge divisions between the rich minority and the poor, exploited and disadvantaged majority. Healthcare professionals should be aware of this and acknowledge how their actions support such divisions, and aim to provide high standards of care independent of a patient's or family's ability to pay.

The relationship of the healthcare worker to society

Healthcare workers have a responsibility to society as well as to patients, and sometimes society's best interests may take precedence over those of the patient (e.g. mandatory reporting of patients with a designated disease, those who are unfit to drive and those suspected of child abuse).

In other circumstances there may be requests from the police or the military to take part in practices that violate human rights (e.g. torture). Healthcare workers should report unjustified interference in the care of their patients, especially if fundamental human rights are being denied. If the authorities are unhelpful, contact with a national medical or nursing association, the WMA or World Nursing Federation, or a human rights organisation may be needed.

The increasing mobility of society means that healthcare workers have a responsibility for global health, including preventing the spread of infectious diseases between societies and countries.

Another effect of globalisation is the mobility of healthcare professionals, and their migration from low-income to high-income countries. The shortage of healthcare workers is one of the biggest health problems facing low-income countries today.

The governments of low-income countries invest in the education and training of healthcare professionals, and therefore lose these resources and the contribution of these workers when graduates migrate. The factors considered by the migrant may be economic, social and/or family related. Often in low-income countries there are low wages, poor working conditions, lack of leadership and very few incentives, as well as limited opportunities for their children. High-income governments encourage migration when there is a need, often with no compensation for the government where the migrant was trained.

This presents an ethical dilemma whereby if emigration was prevented it would restrict the autonomy of the individual, but on the other hand the health of a society suffers if there is mass migration of healthcare professionals.

Further reading

World Organization Against Torture http://kofiannanfoundation.org/newsroom/speeches/2010/06/world-organisation-against-torture (accessed 9 December 2012).

Medical Foundation for the Care of Victims of Torture www.freedomfromtorture.org (accessed 9 December 2012).

Ethics – World Medical Association. www.wma.net/en/20activities/10ethics (accessed 9 December 2012).

The ICN Code of Ethics for Nurses – International Council of Nurses. www.icn.ch/about-icn/code-of-ethics-for-nurses (accessed 9 December 2012).

General Medical Council. GMC List of ethical guidance – General Medical Council. www.gmc-uk.org/guidance/ethical_guidance.asp

Nuffield Foundation. The Ethics of Clinical Research in Developing Countries. http://nuffieldbioethics.org/project/research-developing-countries-follow/

Naicker S, Plange-Rhule J, Tutt J *et al.* (2009) Shortage of healthcare workers in developing countries – Africa. *Ethnicity and Disease*, **19**, S1 60–4. http://txfvzgw.ishib.org/journal/19-1s1/ethn-19-01s1-60.pdf

Global Health Workforce Alliance (2011) *Progress Report on Kampala Declaration and Agenda for Global Action*. www.who.int/workforcealliance/knowledge/resources/kdagaprogressreport/en/

1.21 Traditional medicine and its relevance to hospital care

BOX 1.21.1 Minimum standards
- Consider traditional medicine as a possible cause of any child presenting with symptoms suggesting poisoning.
- ABCD structured approach.
- Hypoglycaemia and electrolyte disturbance management.
- Antibiotics.
- Wound management.
- Tetanus immunisation promotion.

Introduction

Traditional medicine encompasses diverse health practices, remedies, approaches, knowledge and beliefs incorporating plant, animal and mineral products, spiritual therapies, charms, manual techniques, exercises, and in fact any kind of salutary method applied singly or in combination to diagnose, treat and prevent illnesses or maintain well-being, which has been handed down by the tradition of a community or ethnic group. In contrast with conventional medicine, which focuses on experiment and disease-causing pathogens, traditional medicine postulates that the human being is both a somatic and spiritual entity, and that disease can be due to supernatural causes arising from the anger of ancestral or evil spirits, the result of witchcraft, or the entry of an object into the body. It is therefore not only the symptoms of the disease that are taken into account, but also psychological and sociological factors. Thus the holistic nature and culture-based approach to traditional healthcare is an important aspect of the practice, and sets it apart from conventional western approaches. Traditional medicine is culturally treasured by various communities around the world. It thus plays an almost inestimable role in healthcare delivery to the people.

In many parts of sub-Saharan Africa, it is estimated that about 80% of the population use traditional health services. Most rural and urban dwellers often supplement treatment by orthodox medical practitioners with treatment by traditional healers. In Ghana, Mali, Nigeria and Zambia, it has been found that the first-line treatment for 60% of children with high fever from malaria is the use of herbal medicines at home. Traditional medicine is extensively used in Latin America and Asia. In China, 40% of all healthcare is delivered by traditional health practitioners. In 2007, there were an estimated 190 000 traditional health practitioners in South Africa. They treat an array of health-related problems as well as culture-bound syndromes or ailments considered to be non-responsive to western medicine. In 2002, the World Health Organization (WHO) estimated that traditional medicine provided 80–90% of healthcare in Africa.

For example, among Nigerians, there are powerful cultural and religious beliefs and practices relating to health. Approximately 85% of the population use traditional medicine and consult its practitioners for healthcare. The majority (70%) of Nigeria's population is rural and relies almost exclusively on traditional medicine for its healthcare needs.

The popularity of traditional medicine has been attributed to poverty, limited or no access to good-quality orthodox medicine, illiteracy and ignorance. Other factors include affordability, availability, efficacy, costly or inefficient orthodox medical facilities, unfriendliness of hospital staff, poor communication (e.g. patients not being told the nature and cause of their illness), inadequate technical services leading to poor-quality care, treatment that is divorced from the patient's culture, family and community, and the treatment only addressing biological aspects of the illness rather than also addressing spiritual aspects.

The traditional healer, as defined by the WHO (1976), is a person who is recognised by the community in which they live as being competent to provide healthcare by using vegetable, animal and mineral substances and certain other methods based on the social, cultural and religious background, as well as the knowledge, attributes and beliefs that are prevalent in the community, regarding physical, mental and social well-being and the causation of disease and disability. They rely exclusively on practical experience and observations handed down from one generation to the next, whether verbally or in writing. For most countries of the world, a traditional healer may be able to perform many functions, thus being more versatile as a healer.

The elements of traditional medicine include, among others, herbal medicine, massage, homeopathy, mud baths, music therapy, wax baths, reflexology, dance therapy, hydrotherapy, mind and spirit therapies, self-exercise therapies, radiation and vibration, osteopathy, chiropractic medicine, aromatherapy, preventive medicine, radiant heat therapy, therapeutic fasting and dieting, spinal manipulation and psychotherapy.

Traditional healers

There are various categories of traditional healers. Some of them may have areas of special interest.

Herbalists

A herbalist is a person who specialises in the economic or medicinal uses of plants. The whole plant may be used or parts of the plant, including the whole root, root bark, whole stem, stem bark, leaves, flowers, fruits and seeds, which may be administered to the patient in the following forms:

1. a powder that can be swallowed or taken with pap/traditional porridge (cold or hot) or any drink
2. a powder that is rubbed into cuts made on any part of the body with a sharp knife
3. a preparation that is soaked for some time in water or local gin, and decanted as required before drinking; the materials could also be boiled in water, cooled and strained
4. a preparation that is pounded with native soap and used

for bathing; such 'medicated soaps' are commonly used to treat skin diseases
5 pastes or ointments, in a medium of palm oil or shea butter
6 soup which is consumed by the patient
7 herbal preparations may also be administered as an enema.

The plants are gathered from the environment, and are therefore part of every cultural tradition and have helped the development and growth of herbalism. Some of the plants that are facing extinction due to drought, bush burning, rapid growth of communities, farming or other factors are specially cultivated by some herbalists to maintain a steady source of supply.

Traditional birth attendants (TBAs)

A traditional birth attendant assists the mother at childbirth, and initially acquired her skills delivering babies by herself or by working with other birth attendants. TBAs are predominantly female. For example, around 60–85% of childbirth in Nigeria is overseen by TBAs, especially in the rural communities. They therefore occupy a prominent position in the healthcare system. Their skills are wide ranging, including diagnosis of pregnancy, antenatal care, conduct of labour and postnatal care. They are quite acceptable to those living in rural communities because their practice is linked to socio-cultural practices. For this reason, some governments have started to train TBAs in an attempt to reduce maternal and child morbidity and mortality.

Traditional bone setters

Traditional bone setters are knowledgeable in the art and skill of setting broken bones in the traditional way, using their skill to ensure that the bones unite and heal properly. They are involved in setting various types of fractures using wooden splints made from bamboo plants, and they use dry fibre from banana stems as bandaging. Wounds resulting from such fractures are usually cleaned and bleeding stopped by the application of plant extracts. Some practitioners fracture similar bones in a bird and treat it alongside the fractured limb of the patient. This is used to determine the time that it will take for the patient's fracture to heal, and the correct time for removing the wrapped splints and clay cast. Importantly, some bone setters collaborate with orthodox medical practitioners who treat the open wounds, offer radiological services and give advice on cases that require referral. This may help to reduce the number of complications occurring in their practices.

Traditional surgeons

These practitioners undertake minor surgery. The procedures that they perform include the cutting of tribal marks, male circumcision and female genital mutilation (*see* Section 2.10), ear piercing, and incision and drainage of abscesses, to name just a few. Complications such as haemorrhage, tetanus and sepsis have been reported in their practices.

Traditional psychiatrists

The traditional psychiatrist specialises mainly in the treatment of patients with mental disorders. Psychotics who are violent are usually restrained by chaining them with iron or by clamping them down with wooden shackles. Those who are diagnosed as demon possessed are usually caned or beaten into submission and then given herbal hypnotics or highly sedative herbal potions to calm them. Such herbal preparations include extracts of the African *Rauwolfia* species. Treatment and rehabilitation of people with mental disorders usually take place over a long period of time. Incantations and various forms of occultism are often employed.

Practitioners of therapeutic occultism

These are traditional practitioners who use supernatural or mysterious forces, incantations, or prescribed rituals associated with the community's religious worship, and they adopt various inexplicable methods to treat a range of diseases. They are usually respected within the community because of their ability to deal with unseen and supernatural forces. They are regarded as witches and wizards.

Traditional medicine ingredient dealers

These dealers are involved in the buying and selling of plants, animals (including insects) and minerals used to make herbal preparations. Some of them also cultivate certain medicinal plants. Although they are not traditional healers, they have knowledge of products that cure different disease conditions, and can therefore prescribe and administer these. Due to this fact, some of them are referred to as traditional healers.

Relevance of traditional medicine

Many communities have developed various traditional systems using locally available resources for the alleviation of their health problems. This has resulted in the appearance of a number of different categories of healers, and a variety of healing methods, strategies and medicines or remedies.

Most people who live in rural communities do not have access to orthodox medicine. For example, in Nigeria it is estimated that about 75% of the population still prefer to solve their health problems by consulting traditional healers. Furthermore, many rural communities have great faith in traditional medicine, particularly its inexplicable aspects, as they believe that it represents the wisdom of their forefathers which also incorporates their socio-cultural and religious background, which orthodox medicine seems to neglect.

There is some justification for the use of herbs by the various traditional healers. A range of herbs have been used in the treatment of various disease conditions, including the African *Rauwolfia* species (used to treat cardiovascular diseases such as hypertension), rose periwinkle (used to treat diabetes), the Chinese herb *Artemisia annua* (used to treat malaria) and lemon grass (used to treat diseases of the respiratory system). Although herbal medicines may have beneficial active ingredients, the dosage cannot be controlled as there is no assay system for defining potency, and this increases the risk to patients who receive such treatment.

In environments where illness is believed to have a magical/spiritual origin, people become involved in intense prayers and sacrifices to compensate for their frailty and powerlessness. Western explanations of illness are rarely taken seriously. Local people may embrace traditional medicine to the exclusion of all other approaches, or combine it with orthodox medicine. Adverse drug interactions may result from such combinations of approach. Medical

practitioners working in places where traditional medicine is practised must be patient and respectful in their encounter with patients who are using traditional approaches. With health education and therapy that bring real health benefits, local people will become persuaded to accept effective evidence-based treatment.

Although the disadvantages of traditional medicine are numerous, it does also have a few advantages. The traditional healers and their drugs are available in these communities and their drugs are relatively easy to obtain compared with those of orthodox medicine. The healing system cares for the body, mind and soul of the patient in the context of the family, community, God or gods. The relationship between the practitioner and the patient can be close, encouraging and intense, with active participation of the family and neighbours. The practitioners are well known, trusted and respected in the community, and their methods fit very well with the culture and customs of the people. The drugs are cheap and readily available, and the healers accept payments either as a whole, in part or in kind, which also makes their treatments much more accessible for the people.

Complications of traditional medicine

Contrary to popular opinion that traditional medicine, especially herbal medicine, is natural or safe, it can be hazardous to health if these preparations are taken in recommended or larger amounts, injected or combined with prescription drugs. Some Asian herbal products have been found to contain potentially dangerous concentrations of harmful substances such as arsenic, mercury and lead, many of which cause liver failure, haemorrhage or heart failure.

Where confidence in conventional medical care is low, there is a tendency to resort to more risky traditional remedies which may be more toxic. Conversely, when confidence in conventional medical care improves, there is an increasing movement towards the use of less toxic remedies, even though the use of some traditional remedies may continue to satisfy cultural and social needs.

In many low-income countries, patients are subjected to traditional treatment as first aid therapy in emergency conditions at home. Caregivers may apply interventions that are ineffective, harmful, and have no pathophysiological basis.

The application of traditional medical care that is ineffective may also lead to delayed presentation of potentially curable conditions to conventional care, resulting in unnecessary deaths and morbidity.

Some cultural practices are harmful to the health and survival of the newborn infant, and it is often young 'first-time' mothers who are most likely to follow these practices. Giving newborn infants cold baths, discarding colostrum, and providing food other than breast milk soon after birth is common practice. The application of butter, ash or other substances, such as cow dung, to the umbilical stump increase the risk of life-threatening infection.

Examples of problems resulting from traditional medicine practices

Experience of the use of traditional medicine in Nigeria

In Nigeria, as in most other developing countries, children are subjected to unorthodox treatment as first aid therapy in emergency conditions at home. Caregivers may apply interventions that are ineffective, harmful, and have no pathophysiological basis. The use of traditional medicine is largely ethnocentric.

Crude oil

In the Niger Delta region of Nigeria, crude oil is available in large amounts. It is highly regarded locally as a remedy for a variety of ailments, including febrile convulsions, gastrointestinal disorders, burns, 'foot rot' and leg ulcers, and poisoning. It is also used in witchcraft. The oil is applied to the skin, mixed with alcohol or water as a drink, and instilled into body orifices such as the nostrils, ears, anus, vagina and urethra. The use of crude oil as traditional medicine in Nigeria has been reported to have an analgesic effect comparable to that of aspirin. Complications associated with its use have been reported in children with febrile convulsions.

Complications caused by crude oil have been reported to affect a number of organs, including the skin, lungs, liver and kidneys. Skin exposure may result in the formation of vesicles, blisters and even extensive epidermolysis. Ingestion of crude oil may result in nausea, vomiting and diarrhoea, and the aspiration of crude oil during vomiting results in chemical pneumonitis. Central nervous system symptoms range from vertigo and headache caused by ingestion of small doses, to lethargy, convulsions, coma and death with larger doses. Renal failure has been described as another toxic effect.

Cow's urine concoction

'Cow's urine' concoction (CUC) is a traditional medicine used in the management of convulsive disorders in childhood among the Yoruba-speaking people of south-western Nigeria. It is prepared from leaves of tobacco, garlic and basil, lemon juice, rock salt and onion bulbs, which are soaked in cow urine, which acts as the vehicle in which the active principles of these constituents dissolve. Over 50 chemical compounds have been identified in CUC, the major ones being benzoic acid, phenylacetic acid, p-cresol, thymol and nicotine. These components are toxic, and have harmful effects on the different systems of the body. The main effects are severe respiratory depression, effects on the cardiovascular system and the central nervous system, and hypoglycaemia. These toxic effects acting singly or in combination are believed to be the cause(s) of death from CUC.

Cow dung

It is estimated that 30–40% of infections resulting in deaths from neonatal sepsis are transmitted at the time of childbirth and have early onset of symptoms (developing during the first 72 hours after birth). Worldwide, 60 million births occur outside healthcare facilities, and even within such facilities, hygienic practices may be suboptimal.

The unhealed umbilical cord is an important portal for local and invasive infections during the neonatal period. It is rapidly colonised by bacteria from the maternal genital tract and then from the environment. Infection can emanate from the bamboo stick that is used to cut the umbilicus, and from the cow dung (believed to have desiccating properties) that is used to dress the umbilical stump. Localised umbilical infection (omphalitis) emanating from these sources can spread to the abdominal wall, the peritoneum, or through the umbilical or portal vessels leading to systemic sepsis, which if untreated has a high fatality rate. Neonatal

tetanus is a very important complication resulting from these practices, which are common among the Yorubas of south-western Nigeria and the Maasai people of Kenya. Cow dung is also used to anoint the heads of the sick among the Maasai people.

Traditional eye medications

In one study, complications occurred in 55% of the individuals studied, and included corneal opacities, staphyloma and corneal ulcers. Other complications were panophthalmitis, endophthalmitis, uveitis, cataract and bullous keratopathy. Eleven individuals in one study underwent enucleation of the affected eye.

Traditional healers tend to prefer to use substances that cause irritation and pain, as these are perceived by both healers and patients to be more potent. Such substances may be acidic or alkaline, resulting in ocular burns. No particular attention is paid to concentration and sterility, as most of these concoctions (mixture of various substances, which may be plant or animal extracts) are prepared without regard for hygiene, including the use of contaminated water, local gin, saliva and even urine.

Most of these ocular conditions could have been adequately treated using standard medicines, which were sometimes available.

Experience of the use of traditional medicine in pregnancy in South Africa

A recently published review showed that a large percentage of pregnant women still use herbal remedies during pregnancy and childbirth, and in one study the use of at least 56 botanical species was documented.

Such herbal treatments are known collectively as *Isihlambezo*, which is taken as an antenatal tonic during the last trimester of pregnancy in the belief that it promotes a favourable pregnancy and a quick and uncomplicated labour. It is also used to treat common pregnancy-related ailments such as oedema, indigestion, constipation, infection and high blood pressure. It is even believed by some that such traditional medicines may be able to turn a breech baby.

Many different plants are ingredients of *Isihlambezo*, and the recipes for this tonic vary depending on factors such as the traditional healer consulted, the general state of health of the woman, the geographical area and the tribal community. The ingredients are boiled or infused in water and the 'tea' is then taken by the spoonful or cupful. The concentration of the mixture may be increased at the end of pregnancy in order to speed up labour.

Isihlambezo mixtures can be purchased from and dispensed by traditional healers and herbalists or 'muti' shops, and individual ingredients can be obtained from open herbal medicine markets throughout the country. In the rural areas, the ingredients for *Isihlambezo* are often harvested from the local countryside by senior women in the tribal community or by traditional birth attendants.

Imbelekisane and *Inembe* are more specific remedies used as uterotonic drugs in cases of prolonged and difficult labour. However, interviews conducted with traditional healers in KwaZulu-Natal revealed that *Imbelekisane* and *Inembe* are regarded by them as dangerous medicines.

Teratogenicity can be largely ruled out, as these remedies are usually only used in the last trimester. However, the potential for maternal and fetal toxicity remains. Sixteen of the species used in these remedies are known to be poisonous, and one of these, *Callilepis laureola* (*Impila*), is extremely poisonous and has been responsible for many fatalities resulting from hepato-renal failure. Other toxic effects that have been linked to the use of these medicines in pregnancy include low neonatal birth weights, fetal meconium staining of amniotic fluid, and fatal uterine rupture.

All of the plants investigated in the above-mentioned study were able to directly stimulate uterine contraction to varying degrees. *Clivia*, *Agapanthus* and *Rhoicissus* significantly augmented the initial response of the uterus to oxytocin, and were able to produce initial phasic contractions followed by tonic contractions at higher doses. Herbal remedies containing these plants must therefore be considered to have the potential to cause uterine hyperstimulation and its associated adverse effects, including uterine rupture.

Experience of traditional medicine in the Eastern Cape area of South Africa

In another publication, traditional remedies were found to be regularly used in the home management of children in the Eastern Cape, and probably in the great majority of cases these remedies do little harm beyond delaying presentation to the healthcare system. However, serious effects were occasionally identified. Most often the traditional remedy was given to treat a symptom of an underlying disease, rather than being the cause of the condition or symptoms.

- **iYeza lo moya:** commonly given to infants by mouth, with few problems reported. However, a traditional enema may also be given, which may have more toxic effects.
- **Senecio extracts:** infusions of this weed with yellow flowers have been reported to cause veno-occlusive disease in a small number of children.
- **Impila:** extracts from this root may cause fatal hepato-renal failure, often presenting with hypoglycaemia.
- **River onion:** this is used both orally and rectally, and causes hepato-renal failure in a significant number of children.
- **Jeyes fluid:** this is sometimes added to rectal and oral remedies, and causes local and systemic effects.

Surgical complications of traditional medicine in East Africa

A series of case histories in 2007 included a 6-year-old girl sustaining a spiral fracture of the humerus during a road traffic accident. The parents refused hospital treatment and took her to a traditional bone setter. Two weeks later she was brought back to the hospital with a gangrenous upper limb, which was the result of placing a tourniquet around the axilla. Debridement was undertaken but the child lost the whole of the skin of the forearm and most of the hand.

A second case involved an 18-month-old boy who underwent circumcision by a traditional practitioner. On subsequent admission to hospital he was found to have partial amputation of the glans penis.

Traditional medicine used in pregnancy in Malaysia

In one study, 108 mothers (51% of those studied) used at least one type of herbal medicine during pregnancy. The type most commonly used (by 64%) was coconut oil

ingested only during the third trimester. The most common indication (90% of cases) was to facilitate labour.

The older generation, parents and in-laws were those who most strongly encouraged the use of herbal medicines. The main reasons for using these medicines were to facilitate labour, to promote the baby's physical health and intelligence, to prevent a retained placenta or to promote abortion.

Management of suspected adverse effects of traditional medicine

These include a rapid assessment of:

- Airway
- Breathing
- Circulation
- Disability.

Regular assessment and treatment of these essential systems will ensure that management keeps abreast with progress and with the prevention of deterioration.

However, when treating patients who have been given traditional medicines, first look for a medical cause of the symptoms and signs before assuming that the illness is due to the traditional remedy.

TABLE 1.21.1 Serious complications caused by traditional medicines, and their management

System affected	Symptoms and signs	Treatment
Cardiovascular	Increased cholinergic actions such as lacrimation, salivation, rhinorrhoea, diarrhoea, vomiting and miosis, severe bradycardia or heart block	IV atropine may help
	Anticholinergic actions such as hyperthermia, tachycardia or tachyarrhythmias, mydriasis, constipation or acute urinary retention	Anticholinesterase drugs may help
Neurological	Weakness, epileptic fits, coma and intracranial bleeding	Check blood clotting Anticonvulsants
Pulmonary	Anaphylaxis, bronchoconstriction Severe interstitial pneumonitis, non-cardiac pulmonary oedema, acute eosinophilic pneumonia	Specific treatment for anaphylaxis and bronchoconstriction (*see* Section 5.1.B) Corticosteroids
Liver toxicity	Nausea, anorexia, vomiting, jaundice with elevated liver transaminases	Supportive (*see* Section 5.7.A)
Nephrotoxicity	Acute renal failure and tubular dysfunction	Supportive (*see* Section 5.6.C)
Heavy metal contamination with lead, arsenic, thallium or uranium	Gastrointestinal disorders, hepatitis, polyarthritis, encephalopathy (including ataxia and severe psychiatric disturbances)	(*see* Section 7.4)

- Clean any areas that are visibly affected with a topical application of sterile water, and apply a non-adhesive dressing if necessary.
- If available, laboratory investigations can be helpful for identifying organ systems that may be affected by a toxic traditional medicine. Take blood for a biochemical profile (urea and electrolytes, liver function tests, amylase and glucose) and a full blood count with indices. If there is any significant abnormality, refer the patient to the relevant specialist team.
- Symptoms and signs such as convulsions should be treated with diazepam injection, hypoglycaemia should be corrected with glucose infusion, and fluid and electrolyte disturbances should be corrected with appropriate oral administration or intravenous infusion.
- Appropriate antibiotics should be administered to patients with infective conditions.

Conclusion

Traditional medicine continues to represent a very large component of community healthcare, especially in resource-limited regions. Efforts to make traditional medicine safer are urgently required, and might include official regulation to monitor the activities of traditional practitioners, standardise their practices and undertake toxicity studies on their products, in collaboration with scientists and recognised institutions. However, this will also require the traditional healers to be willing to work with such control of their practice, which could be a problem if the healers see this as an attempt to limit their practice, or to steal their secrets and remedies.

1.22 Emergency equipment and drugs for obstetric and paediatric care

Introduction

Wherever healthcare is offered, people who consider that they need emergency care will arrive unexpectedly. All healthcare facilities should be prepared to receive and treat such patients as quickly, effectively and compassionately as possible.

Preparation, **training** and **practice** are the keys to success in emergency care.

Preparation involves considering and having available the necessary equipment and drugs for all of the possible pathologies requiring emergency care that are likely to present to the facility.

Training involves ensuring that healthcare workers in the emergency area have been trained to assess life-threatening and urgent care needs and to respond to these in a recognised and structured way so that no essential steps are omitted.

Practice involves the emergency team rehearsing their response to emergencies together so that they become competent when presented with real situations.

Hospitals should have a dedicated 'Emergency Room' where patients of all ages and with all conditions can present. However, patients will often attend the ward where they have previously been seen, and of course emergencies can arise within any ward, especially if that ward is understaffed.

Therefore it is vital that every ward, as well as the emergency room, is prepared with the drugs and equipment necessary to respond successfully to any emergency in that area.

This section describes the drugs and equipment necessary to treat emergencies in women and girls during pregnancy, labour and the postpartum period, as well as in infants and children.

The emergency room should be staffed at all times. The number of staff will depend on the size of the facility and the expected number of patients. In a large city hospital where hundreds of patients attend every day, there may be 10 to 20 nurses and 6 to 8 doctors on duty at any one time. However, in a small peripheral clinic, with only one or two inpatient wards and three or four labour-room beds, there may not be enough staff for one of them to spend all of his or her time awaiting an emergency. In that case, a simple and reliable means of calling for assistance must be put in place for emergency cases arriving at the facility. Again, **preparation** is key, and the immediate availability of the necessary emergency equipment and drugs, together with a **trained** and **practised** healthcare worker, is paramount.

Training in the structured approach to recognition and treatment of life-threatening illness and injury should be available to all healthcare workers who may be called upon to treat emergency patients. There are a number of training programmes available, including the World Health Organization's Integrated Management of Neonatal and Childhood Illnesses (IMNCI), the Emergency Triage Assessment and Treatment (ETAT) course, the Emergency Maternal and Neonatal Health (ESS-EMNH) and Emergency Child and Trauma Health (ESS-ECTH) courses of Maternal Childhealth Advocacy International (mcai.org.uk), and the Advanced Life Support Group (ALSG) courses (alsg.org).

Wherever there are unexpected emergencies, decisions have to be made about which patient is the most urgent one. Emergency healthcare is not offered on a 'first come, first served' basis. Those with the greatest need are treated first. This sorting system is called **triage** (for a detailed explanation, *see* Section 1.10).

Throughout this textbook, details of diagnoses and treatments, including practical procedures, for improving the care of patients with emergency healthcare needs can be found. In this section we now list the emergency equipment and drugs that are essential for providing this care.

Resuscitation equipment for the emergency room

Airway and breathing

- Suction apparatus:
  - wall, electrical or manual suction
  - Yankauer (adult and paediatric) and soft suction catheters
  - a manual suction device, for use by midwives.
- Face masks – adult, child, infant non re-breathing with reservoir bags (for delivering 100% oxygen).
- Self-inflating resuscitation bag with 500-mL (for infants and young children) and 1600-mL (for older children and adults) reservoir bags and face masks in a range of sizes (masks that are too large may be used inverted).
- Nasal cannulae for prolonged lower level oxygen delivery.
- Airway devices:
  - oropharyngeal airways in a range of sizes (000, 00, 0, 1, 2 and 3)
  - endotracheal tubes in a range of sizes (2.5–7.5 mm), and connectors.*
- Laryngeal masks (e.g. I-Gel Size 1, 1.5, 2, 2.5, 3 and 4).
- Laryngoscopes:*
  - adult curved and paediatric straight-bladed
  - spare bulbs and batteries.
- Magill's forceps.*
- Cannulae for cricothyroidotomy.*

Circulatory access and bleeding control

- Peripheral vascular cannulae in a range of sizes (18–25G).
- Intraosseous needles (16–18G) or EZ-IO drill with adult and paediatric needles.
- Sterile catheters 4, 5, 6.5, 8 Fr gauge 40 90 cm long (for suction, feeding, etc.) for umbilical access (for newborn), umbilical vessel dilator, and artery forceps.
- Central venous catheters.*
- Syringes, including a 50-mL syringe for fluid boluses, plus a three-way tap.
- Intravenous giving sets and graduated burettes.
- Condom catheter (*see* Section 2.5.D.iv).
- Cut-down instruments, scalpel and forceps.

*These items are to be used only if facilities exist for intubation and assisted ventilation (e.g. on a high-dependency or intensive-care unit).

Trauma

- Hard cervical collars (adult short and regular, paediatric) and sandbags/foam blocks.
- Peripheral vascular cannulae, (18–25G) three-way taps and syringes.
- Scalpels, sutures, needle holders and scissors.
- Splints.
- Chest drains in a range of sizes (12, 18, 20, 22, 28, 32 Ch).
- Dissecting forceps.
- Underwater drainage system, or flap valves.
- Nasogastric tubes in a range of sizes (4, 5, 6.5, 8, 10 Fr).

Drugs, fluids, etc.

- Oxygen supply.
- Ringer-lactate or Hartmann's solution or 0.9% saline, vials and bags or bottles.
- Colloid (e.g. 4.5% albumin, gelatine, hetastarch).
- Adrenaline, 100 micrograms/mL (1 in 10 000) and 1 mg/mL (1 in 1000).
- Amiodarone, 30 mg/mL.
- Glucose, 10%, 25% and 50%.
- Water for injection.
- Normal saline for injection.
- Mannitol, 20% and/or saline, 2.7% (or 3%).
- Diazepam, rectal solution.
- Lorazepam, diazepam or midazolam (can be used as buccal or IV treatment).
- Phenytoin.
- Phenobarbitone.
- Atropine.
- Sodium bicarbonate.
- Calcium chloride.
- Magnesium sulphate.
- Broad-spectrum antibiotic (e.g. cefotaxime, ceftriaxone, gentamicin).
- Penicillins: penicillin G, amoxicillin, flucloxacillin.
- Metronidazole.
- Hydralazine.
- Misoprostol.
- Quinine.
- Morphine/diamorphine.
- Naloxone.
- Insulin.
- Local anaesthetic (e.g. lignocaine) and general (e.g. ketamine) anaesthetic agents.*
- Paralysing agents.*
- Skin cleansing solution (e.g. chlorhexidine, alcohol, iodine).
- Vaginal antiseptic lotion (Hibitane).
- Steroids (prednisolone, hydrocortisone).
- Salbutamol nebules, inhaler and IV solution.
- Aminophylline.
- Furosemide.

Monitoring and other equipment

- Pulse oximeters.
- ECG monitors including one with with defibrillator with paediatric pads or an automatic external defibrillator (AED).
- Sphygmomanometer or blood pressure oscillometer.
- Thermometers (including low-reading thermometer).
- Nebuliser.
- Large-volume spacers.
- Blood/urine glucose testing kits.
- Urine protein testing sticks.
- Urinary catheters (silicon, rubber or soft feeding tubes) of various sizes (12–30 Fr).

*These items are to be used only if facilities and skills exist for intubation and assisted ventilation.

1.23 Grief and loss in societies affected by conflict and disaster

Introduction

Why do we grieve? Wouldn't life be much simpler if we did not experience all those painful emotions that occur when someone we love dies? Perhaps so – no weeping and wailing, no stoical silence, no anger and irritation, no smiling and carrying on as usual, no sudden flood of pain and memories to overwhelm and paralyse us, no rush of tears when we hear a familiar tune. That sounds much easier. The trouble is that grief is actually the price tag on another emotional experience, without which human life would be quite unbearable. We grieve because we love. Love is the essential emotion that keeps us connected and attached to family and friends and allows us to survive as rather puny animals in a hostile world. If we did not love we could not suffer loss, but neither could we survive in selfish isolation.

This section provides a brief introduction to understanding grief and loss in families living in societies affected by disaster and conflict, and offers some guidance on how to support these families. It will address the following questions:

- What is the impact of loss on individuals and groups in conflict and disaster settings?
- What is grief and how is it related to attachment?
- Is grief an illness?
- How does grief affect our health?
- When is grief abnormal?
- What is mourning and why does it matter?

- What happens when large numbers of people die at one time?
- How do we distinguish between the effects of traumatic events and the effects of loss?
- What is cultural bereavement?
- What are the effects of grief in childhood?
- What can we do to help grieving families and children?

In a society affected by conflict or disaster, most children will be seen in the company of their surviving adult relatives, whose own mental state will have a profound effect on the child. The family doctor must therefore be responsive to, and able to assess and support, the whole family. For this reason, this section looks at grief in both adults and children, and it outlines a general approach to supporting families and children. However, it does not give detailed management advice on the wide variety of specific symptomatic problems that can occur in grief (e.g. bedwetting, sleep disturbance), as there are a number of excellent manuals available on this topic.[1]

What is the impact of loss on individuals and groups in conflict and disaster settings?

The central experience for almost all of those living in communities affected by conflict or disaster is loss. Even if no one in your family dies, something will be lost. You may be injured or lose your health. Your home or your school may be destroyed, or the neighbourhood may be swept away. Your friends or work colleagues may be killed or flee. If you flee yourself you will lose everything that made up your world and kept you rooted and connected. As well as these external losses, you may lose aspects that are central to your internal sense of self, such as feelings of being safe and in control, and your sense of identity as, for example, a mother, father, schoolchild, farmer or shopkeeper. Some of the possible losses that can be experienced are listed in Table 1.23.1. Their effect can be overwhelming. Understanding how people react to such losses, how to distinguish between normal and abnormal grief, and how to assist in appropriate mourning will be some of the key tasks for healthcare workers in these contexts. It is also essential to understand other psychological reactions, such as post-traumatic stress disorder (PTSD), and set them in context.

TABLE 1.23.1 Some of the losses that can be experienced by those exposed to conflict, disaster, or life as a refugee

Internal losses	External losses
Control	Family members
Autonomy	Friends
Security	Home
Identity	Community/country
Self-respect	Work/school
Belief in the future	Money and other material possessions
Sense of belonging	Physical health
Trust	Religion
The past	Language
Meaning of life	Familiar life

What is grief and how is it related to attachment?

The ability to form strong relationships with others is necessary for our survival as human beings. We call this ability **attachment**. The sense of loss that we feel when a loved one is absent leads us to search them out. Attachment is the glue that keeps families and groups connected together. Human beings could not have survived in previous eras if they had not lived in groups that enabled them to feed and shelter themselves. Loss is the sense of sadness, fear and insecurity that we feel when a loved person is absent. It can also be felt in relation to objects and places.

In the 1950s, the World Health Organization (WHO) commissioned John Bowlby to observe what happened to small children when they were separated from their mothers. In Britain in those days, if a child went to hospital for an operation, the parent was not allowed to remain with them. John Bowlby sat watching the infant to see how they reacted, how they adapted to the separation, and how they behaved when the parent returned. He defined a cycle of behaviours that can be observed in any infant who is separated from their mother and then reunited with her.

First there would be a period of loud and angry protest. The child would hope that their cries would bring their mother running back. When this did not happen, a period of despair and withdrawal followed in which the child would cry, not wish to engage with others, and refuse to eat or play. Later the child might appear to 'adapt'. They would start to eat again, play with other children, make friends with the nurses and appear detached and indifferent to the loss of their mother. Indeed if the parent reappeared at this stage, the child's first response might be to ignore her, and then if they did engage with her, to be naughty and angry. Only after some time would the original relationship reform and re-engagement occur. Bowlby noted that this attachment/separation behaviour is most visible in children between 6 months and 3 years of age. However, these behaviours can reappear in any individual throughout the life cycle when they are faced with separation from someone they love.

> Attachment behaviour is any form of behaviour that results in a person attaining or maintaining proximity to some clearly identified individual who is conceived as better able to cope with the world. It is most obvious whenever a person is frightened, fatigued or sick, and is assuaged by comforting and caregiving. At other times, the behaviour is less in evidence. Nevertheless, for a person to know that an attachment figure is available and responsive gives him a strong and pervasive feeling of security and so encourages him to value and continue the relationship. Whilst attachment behaviour is at its most obvious early in childhood, it can be observed throughout the life cycle, especially in emergencies. Since it is seen in virtually all human beings (though in varying patterns), it is regarded as an integral part of human nature and one we share (to a varying extent) with members of other species. The biological function attributed to it is protection. To remain within easy access of a familiar individual known to be ready and willing to come to our aid in an emergency is clearly a good insurance policy – whatever our age.
>
> Bowlby, 1988[2]

Many writers have noted the similarity between a child's behaviour after separation from a parent and our reactions to the loss of a loved person who has died. Death reactivates attachment behaviour. Faced with the permanent loss that death represents, we may find ourselves angrily protesting, searching and yearning, trying our best to maintain and hang on to the connection. Or we may experience periods of indifference and denial as a way of avoiding the pain. Many people alternate between periods of acute grieving and yearning and periods of avoidance or detachment. In the past, some authors have argued that these feelings occur in stages. Elisabeth Kubler-Ross constructed a model of bereavement in which the individual was said to progress through the following periods, often cyclically:[2]

1 denial
2 anger
3 bargaining
4 depression
5 acceptance.

It was suggested that people could become stuck at different stages, and that 'grief work' was necessary to progress through all the stages to recovery. There is now a growing understanding of the enormous variability in our responses to bereavement. How people grieve and how they cope will depend on individual factors such as their temperament and personality. What were their experiences as a child? Were they loved and securely attached to those who cared for them or were they abused or insecure? This will affect the way that they form relationships with other people, and the way that they experience loss, as will their age, gender, and experience of previous losses. The way that people grieve will also depend on the nature of the loss and how it occurred. Was it sudden or expected? Was it violent, unjust, or part of a massive loss, or did it occur after a prolonged illness? What did the loss mean to the person? Were they thrust into isolation and poverty, or were they possibly liberated from an abusive relationship? In all cases, social factors such as cultural and religious beliefs and community and family dynamics will play a role in determining how grief is experienced and expressed. The current social situation will also influence this. Is the family in danger or in flight? What material resources do they have? Do they face legal difficulties because of the loss? Is social support available or are they isolated? The case examples below and the vignettes in the Appendix all illustrate these variations.

Table 1.23.2 lists the wide variety of emotional, cognitive, behavioural and physiological changes that can occur in response to bereavement. An individual may experience some, all or none of these. The reactions may occur in many different patterns and combinations depending on the factors described above. Some individuals experience few reactions, others more. Some people find that their reactions change over time or occur in varying combinations.

People may feel anger and sadness at the same time. An anniversary or a particular place may trigger a memory, which reactivates the feelings of grief again, perhaps years after the event, possibly interrupting a long period of acceptance. Some have described grief as a 'relapsing illness'. Stroebe and her colleagues have created a model to show how many people may fluctuate between a 'loss orientation' of yearning and sadness and a 'restoration orientation' of more avoidant states of denial and getting on with things (*see* Figure 1.23.1).

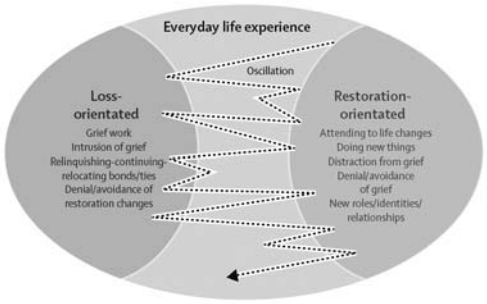

FIGURE 1.23.1 The dual process model of coping with bereavement. Thanks to Stroebe M, Schut H. *Death Studies* 1999; **23**: 197–224.

Which feelings and behaviours occur, which state dominates and what is regarded as normal for both children and adults will depend very much on how grief is expressed in that culture, by that family and in that individual, as well as on the religious values, temperament and personality of the individual. For example, in Bosnia it is regarded as appropriate for Serbian women to attend the funeral and to display their emotions visibly, keening and weeping. In Bosnia, Muslim culture values a more stoical approach and sees the open display of emotions as inappropriate. In some cultures, for example in parts of South-East Asia, vivid dreams may be regarded as appropriate messages from the dead. In western culture, dreams may be seen as an upsetting form of sleep disturbance. In Kosovar families with whom I have worked, there was often one individual (usually an older adolescent girl), who might cry a great deal, hyperventilate and faint, while the rest of the family remained stoical. The fainting girl might cause concern, but also seemed to play a role in vividly expressing grief for the rest of the family, whose concern for her also acted as a form of distraction from the loss (*see* Appendix, Vignette 2).

> Near the end of his life, Sigmund Freud was consulted by a woman who had become depressed following the death of her husband. After listening to her, Freud quietly stated, 'Madam, you do not have a neurosis, you have a misfortune.'

Is grief an illness?

Acute grief may be painful and feel like an illness, but it should be understood, in all its variety, as a normal reaction to loss. Some combinations of reactions do appear to mimic certain acute mental illnesses. For example, loss of appetite combined with sleep disturbance, sadness, ruminations and various somatic complaints appears similar to clinical depression. However, that diagnosis should not be made if someone has suffered an acute loss. Some individuals may adopt the behaviours of the deceased, dress in their clothes, act strangely or hear their voice, see them and talk to them. Again this should not be regarded as psychotic behaviour, but rather as a possible manifestation of acute grief. Or there may be flashbacks, vivid intrusive thoughts and dreams of the deceased, and the individual may be anxious and aroused, similar to those with PTSD. None of these reactions are necessarily pathological.

TABLE 1.23.2 Reactions to bereavement[3]

Affective	Cognitive	Behavioural	Physiological-somatic
Depression, despair, dejection, distress Anxiety, fear, dread Guilt, self-blame, self-accusation Anger, hostility, irritability Anhedonia (loss of pleasure) Loneliness Yearning, longing, pining Shock, numbness No reaction	Preoccupation with thoughts of the deceased, intrusive ruminations Vivid memories Sense of the presence of the deceased Lowered self-esteem, self-reproach Helplessness, hopelessness, pessimism about the future Suicidal ideation Sense of unreality Memory and concentration difficulties Suppression, avoidance, disbelief Fantasies	Agitation, tenseness, restlessness Fatigue, apathy Overactivity Searching Weeping, sobbing, crying Social withdrawal Normal behaviour and continuation of normal activities *In children* Acting out Regressive behaviour School difficulties Rapid maturing	Loss of appetite Sleep disturbances Energy loss, exhaustion Somatic complaints Physical complaints similar to those of the deceased *Endocrine and immunological changes* Susceptibility to illness, disease, mortality

How does grief affect our health?

That is not to say that bereavement does not have physical and mental health consequences.[4] Bereaved people experience more physical complaints, have more health consultations, use more medication and experience more hospitalisations than those who are not bereaved. Paradoxically, those who are grieving intensely actually have fewer health consultations than the normal population, and high-intensity grief is a predictor of more severe physical disorders 1 year later. Perhaps this is because early warning signs are missed. Regarding the impact of bereavement on mental health, the majority of people recover but there is a greater vulnerability to depression, anxiety and PTSD. Bereavement is associated with increased mortality from many causes. People who have suffered a recent bereavement are more likely to die of alcohol-related disorders, coronary artery disease, unnatural deaths and suicide. It is thought that this additional risk may be due to a number of factors, including loneliness, changes in social circumstances, a reduction in material resources, and lack of care. The mortality risk is higher in the earliest months and in specific groups, namely mothers who have lost a child and widowers. Therefore there is some basis for the saying that you can die of a 'broken heart'.

When is grief abnormal?

The decision as to what is abnormal and inappropriate grief will depend on an understanding of the individual, the family, the culture and the wider context. You cannot decide what is abnormal without this cultural and personal knowledge. The community and family may be able to tell when they feel that the grief is too intense, too long or unusual in its manifestations. The new diagnostic formulations,[5] *DSM-V* and *ICD-11*, that psychiatrists are using to categorise mental disorders are considering formulations for prolonged or complicated grief. For example, the suggested definition of prolonged grief disorder in *ICD-11* is as follows:

> 'Prolonged grief disorder is a disturbance in which, following the death of a person close to the bereaved, there is persistent and pervasive yearning or longing for the deceased, or a persistent preoccupation with the deceased that extends beyond 6 months after the loss and that is sufficiently severe to cause significant impairment in the person's functioning. The response can also be characterised by difficulty accepting the death, feeling one has lost a part of one's self, anger about the loss, guilt, or difficulty in engaging with social or other activities. The persistent grief response goes far beyond expected social or cultural norms, and depends on cultural and contextual factors.'

What is mourning and why does it matter?

Mourning refers to the culturally appropriate processes that help people to pass through grief. All societies and cultures mourn, but they do so in different ways. Mourning processes usually include acknowledgement and acceptance of the death, saying farewell, time periods for grieving, processes for continuing to focus attention on the dead, and processes for moving beyond the loss and forming new attachments. It might be helpful to take a moment to jot down on a sheet of paper the ways in which you mourn the dead in your own culture. Try to answer the following questions:

- How do other people know that someone has died or that you are bereaved?
- What happens at a funeral?
- What are the burial customs?
- What happens to the body?
- Who visits the bereaved?
- What are the different roles, if any, for men and women?
- What do younger and older children do?
- Are there different ceremonies at different time periods after the death to mark different stages of mourning?
- What ways do you use to remember the dead?
- What is the role of the dead person in continuing family life?

Different societies have different time periods set aside for mourning, and different ideas about what is appropriate

behaviour for different family members. They may also have different views on the appropriate role of children in these rituals. Sometimes families may be in conflict over what is appropriate to communicate to children and what is the appropriate way to mourn. This is particularly the case in societies that are in a state of upheaval (*see* Appendix, Vignette 1).

What happens in situations of massive loss?

Conflict, disaster and displacement disrupt the possibility of appropriate mourning. There may be uncertainty about missing relatives. The body may have been lost, abandoned, treated inappropriately, or buried in a mass grave. During flight it is impossible to carry out the normal mourning rituals. Other processes also occur in large-scale upheavals. For example, in Aceh, Indonesia, after the 2004 Tsunami, people found themselves living in a landscape that had been swept completely clean by the Wave, where every familiar marker had disappeared along with their communities, families and livelihoods. There were no bodies and no places to go to remember the dead. In Haiti, after the earthquake, people camped out among crushed houses that entombed their families. Massive losses that affect whole communities may remove entire social networks of support. Moreover, even in functioning communities, they have the effect of depriving each individual of the normal support that they would have received if their loss had been a singular occurrence. Because everyone is affected, few are in the position to play the role of visitor and comforter. There is no one to come round, help the bereaved widow with the childcare and household tasks, arrange the funeral and cook a meal, because everyone who survived is in the same situation. Everyone struggles alone. And the bereaved may become more reticent than usual about their own feelings, not wishing to burden similarly affected neighbours. At the same time, the pain of the loss is amplified by the knowledge that the bereaved person's loss is one of many in a community. The outside world is focused on the scale of the event: '*300 000 dead*', '*half a million killed*'. Lost within these figures, the individual bereavement becomes insignificant, just one of many thousands, adding to the pain of the survivor.

CASE EXAMPLE: Giving significance to loss

In early 2005 I was working on the East Coast of Sri Lanka after the tsunami. On one occasion, when I was walking along a completely deserted, devastated street, a man came running up to me. I was holding my camera and assumed I might have offended him by taking pictures. 'No, no,' he said, 'please take a picture of ***this house***.' I looked at the gutted empty building and did as he requested, then turned back. He was near to tears. 'My mother died here,' he said. So we sat on the ground and he talked for some time about his mother. I suddenly realised that for this man I was more than just a sympathetic ear, I was the outside world witnessing and memorialising his individual loss. Not just 10 000 dead, but his mother. I was making her significant.

Traumatic experiences, grief and mourning

Traumatic experiences can interfere with mourning. Avoidance that may be protective in helping the bereaved to cope with the memories of a traumatic event may make it difficult for them to mourn their loss because the memories of the lost person are always accompanied by painful memories of the circumstances of the loss, so 'remembering' is too painful. In such circumstances, the traumatic symptoms may need treatment before the bereaved person is able to mourn. Table 1.23.3 lists the differences in emotional, cognitive and behavioural reactions that may occur.

Cultural bereavement

The Australian anthropologist and child psychiatrist Maurice Eisenbruch has pulled some of these experiences together in the term 'cultural bereavement' to describe the massive losses experienced by refugees and all those displaced by war:

> 'Cultural bereavement is the experience of the uprooted person – or group – resulting from loss of social structures, cultural values and self-identity: the person – or group – continues to live in the past, is visited by supernatural forces from the past while asleep or awake, suffers feelings of guilt over abandoning culture or homeland, feels pain if memories of the past begin to fade, but finds constant images of the past (including traumatic images) intruding into daily life, yearns to complete obligations to the dead and feels stricken by anxieties, morbid thoughts and anger that mar the ability to get on with daily life. It is not in itself a disease but an understandable response to catastrophic loss of social structure and culture.'[7]

In his work with Cambodian adolescents, Eisenbruch found that those refugee children who had been encouraged to assimilate rapidly into a new culture suffered more cultural bereavement than those who were encouraged to participate in traditional ceremonies and cultural practices. He believes that the concept allows for a more integrated and culturally sensitive approach to the experience of loss than attempting to classify any disabling symptoms only in terms of pathological categories according to western diagnostic criteria such as PTSD or traumatic bereavement. Disabling symptoms may be best addressed by a combination of restoring appropriate cultural practices and, if necessary, symptomatic relief.

Grief in childhood

The following are some frequently asked questions about children who have suffered a bereavement:

- Do children grieve?
- Are they too young to understand?
- Should we protect them from unpleasantness and distress?
- Will loss in childhood cause later mental illness?

Children's understanding of and reactions to death

Children's reactions to death are as variable as those of adults, and any or all of the reactions listed in Table 1.23.2 may occur. The most important point to note is that their understanding of death changes according to their development and life experiences. The following notes are based on western experience, and should be taken as a guide only. Working with victims of conflict and disaster in many low-resource settings has taught me that in many societies, particularly rural ones, children understand death at

TABLE 1.23.3 Distinguishing between the effects of traumatic events and loss[6]

Reactions to loss	Reactions to traumatic event
Separation anxiety	Anxiety about threat presented by traumatic event
Sadness more than anxiety	Anxiety more than sadness
Yearning and preoccupation with loss	Fearful, anxious and preoccupied with traumatic event
Sense of security intact	Personal sense of safety challenged
Primary relationships disrupted	Primary relationships intact
Intrusive memories are images and thoughts of the deceased	Intrusive memories of traumatic event plus re-experiencing accompanying emotions
Memories are positive and comforting	Uncontrollable intrusions are negative and distressing
Dream of the dead person is comforting	Nightmares of event are terrifying
Seeking out reminders of the loved one	Hypervigilant, scanning environment for threat
Avoidance of reminders of the absence of the loved one (denial)	Avoidance of reminders of threat
Anger at loss	Irritable, diffuse, unfocused anger and rage
Guilt about not doing enough	Guilt about surviving
Mourning as a tribute to the dead person	
Sleep EEG is normal	Increased REM sleep intensity
Coping involves reconstructing life without the loved one	Coping involves re-establishing a sense of safety
Recovery: Resolves attachment issues	*Recovery:* Habituates to fearful responses

an earlier age. In other respects the categorisation below holds true.

Children under 5 years

There is little understanding that death is final. For example, a 4-year-old child in England, having helped to formally bury his dead pet rabbit in the garden, asked if he could now dig it up so that he could have the rabbit back again. Magical thinking results in misconceptions about cause and effect. An egocentric view of the world can lead to feelings of responsibility (e.g. 'Mummy won't come back because I was naughty'). Reactions are similar to those following any separation – the longer the absence, the greater the distress. The death may be followed by detachment, so that the surviving family may think the child does not care about the loss. Regressive behaviour, soiling, bed wetting, clingy behaviour, sleeplessness and minor illnesses can all occur.

Children over 5 years

Children begin to understand that death is irreversible, that certain physical changes occur, and that there is permanent separation. They may still not regard it as something that can affect them. They may continue to have some magical, concrete and egocentric thinking. At this age, children more commonly use concepts of good and bad, they are curious about cause and effect, and are able to articulate concern for others.

There is a desire to stay connected to the dead parent. Many children dream about and talk with the dead parent frequently, feel that the dead parent is watching them, and keep physical objects associated with them. One study found that 43% of children in a large community sample thought about their dead parent on a daily basis 1 year after the death.[8] The reactions were variable. Boys were already learning to suppress their feelings, 91% of the children in the same study cried on the first day, and 50% had transient emotional and behavioural problems. Concentration and school work are also affected, and repetitive play is very common.

Children from 10 years to adolescence

There is a growing understanding of abstract concepts – for example, that death is universal and inevitable and can affect the child or adolescent personally. There is a growing concern with justice and injustice, and an awareness of inconsistencies. The conflict between the desire for autonomy and the need for closeness can be resolved by 'indifference and detachment', or by identification and nostalgia. In a group for adolescent refugee boys who had been 'ethnically cleansed' from Northern Bosnia (all of them had lost their homes, and some had also lost their family), all of the boys spoke passionately and with great longing about their home towns, describing them as the 'most beautiful place to live'.[9] Revenge fantasies are not unusual. There are fewer somatic and behavioural problems, and a depressed mood is common. Poor concentration and lack of interest occur at school. The oldest child in the family who has lost a same-sex parent is at greatest risk.

CASE EXAMPLE: The surviving brother

G is a 13-year-old boy. During a long and brutal war his older brother was killed on the front line. G had always been very close to his brother. Three years later he continued to think about him on a daily basis. He visited the grave frequently and watched the video of the funeral once a week. He did not like to sleep alone, and he felt sad much of the time, although he was doing well at school. He talked about his brother a great deal. He wanted to be as much like his brother as possible, whom he believed was one of the bravest and most incorruptible people. He was angry about the peace agreement. He felt that it was unjust and made a mockery of the aims for which his brother fought.

As in adults, the reactions of children to bereavement are enormously variable. Age, personality, culture and family values, and especially the way the parents or surviving caregivers react, will all affect the expression of grief.

Children within one family exposed to the same losses may all handle grief in different ways (*see* 'Case example: When to tell the story', p. 118). And the experience of grief may wax and wane. When discussing grief feelings with children, I sometimes use the image of a wave. (This is obviously inappropriate with children who have either never seen the sea or who have experienced the Tsunami.) I ask them to imagine that they are standing at the edge of the sea and that a big wave comes along and knocks them over. They feel terrible, but manage to struggle to their feet. Then there is a period of calm water before the next wave. This time they are more prepared, so that when the next wave comes it does not knock them over. What will happen over time is that, although the waves never go away completely, the periods of calm sea will grow longer, the waves will get smaller and the child will grow stronger (*see* Figure 1.23.2).

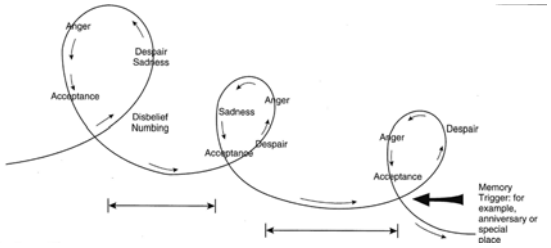

FIGURE 1.23.2 Waves of grief. The time intervals between waves get longer, and the waves get smaller.

Long-term effects

Many people worry that if children experience the loss of someone significant early in life this will have long-term effects on their mental health. Research evidence suggests that children who suffer an early bereavement do have a higher incidence of psychiatric disorder in later childhood, and that adults who lost a parent in childhood are more vulnerable to psychiatric disorder than the general population, and are particularly vulnerable to depression and anxiety precipitated by further losses.

Research has shown that the following life events are most likely to be associated with later mental illness:

- those that require people to undertake a major revision of assumptions about the world
- those that are lasting in their implications
- those that take place over a short period of time without preparation.

A traumatic death can have all of these features. However, there are significant factors that can modify the impact of a bereavement. The child's long-term mental health also depends on the following:

- the response of the surviving parent or relatives
- the availability of other support
- subsequent life circumstances
- the degree of continuity in the child's life
- how the loss is viewed by others
- what resources are available.

This list provides an immediate guide to what needs to be done to enhance a child's resilience and coping in the face of loss. The 'Case example: Different girls' from Pakistan illustrates how important these aspects are and what a great difference the behaviour of the surviving relatives can make.

CASE EXAMPLE: Different girls

After the Pakistan Earthquake in December 2005, I worked with children who had lost their parents. Contrast the experiences of two young teenage girls from the same rural Islamic society, affected by the same terrible event, but living in somewhat different settings with quite different responses from those caring for them. Shamsa was 14 and living with her aunt and uncle and her six younger brothers and sisters in one tent in a displaced persons camp near the town of Balakot. Her village had been completely destroyed and her mother and father had been killed. Shamsa acted as mother to her siblings and helped her aunt to care for her cousins. The aunt and uncle had told the children 'Your mother is in the village and will come soon.' Shamsa and her smaller sisters looked ill-kempt and neglected. They cried constantly, which suggested that the comforting lie was not working. They knew that their house had been turned to rubble, so where was their mother now? When I asked Shamsa what she thought, she told me in a whisper that her mother was dead. The aunt and uncle gave me permission to explain to all the children what had actually happened. Their calm reaction suggested that I was confirming something they already knew. Shamsa also told me she would like to get out of the tent. As she was the oldest girl, she carried the burden of household tasks and childcare, and her aunt was very reluctant to let her go to the camp school or any of the other activities arranged for children. However, she let the younger ones go and the improvement in their mood was very apparent. Shamsa continued to weep and grieve. Finally, when the aunt herself became involved in a livelihood programme with other camp women, she gave Shamsa permission to go to school. This had the immediate effect of alleviating some of Shamsa's sadness. In contrast, 12-year-old Sadia still lived in her village higher up in the mountains above the town. She too had lost her mother when their house was destroyed. She moved in with her grandmother but stayed in her village. When I met her she was laughing and playing with the other village children. She had just had her hands hennaed in beautiful flower patterns. She had been told that her mother was dead and said she still felt very sad. But she liked living with her grandmother and she did not cry all the time. When playing with the other village children she was able to be happy, and she had many relatives and friends who cared about her.

NOTE: names changed for reasons of confidentiality

How do we assist grieving families?

TABLE 1.23.4 Key actions to support grieving families

• Attend to their basic needs
• Access resources
• Assist mourning in a culturally appropriate manner
• Answer questions and provide information
• Accompany them
• Be available
• Focus attention on their individual loss: give it significance
• Altruism opportunities
• Avoidance as required
• Advice as needed

Not all grieving families require a health worker's intervention. But in situations of conflict, disaster and displacement the natural sources of social support are absent for the reasons listed above. In this case, the healthcare worker is the supportive community if unaffected him- or herself. Some key activities are listed in Table 1.23.4. Your role may be to accompany and support the bereaved as any neighbour might do in normal times. Obviously if a family lacks basic resources or is not safe, helping to address these basic needs is a priority. Help may be needed to trace missing bodies or identify them. Outsiders may have a significant role to play simply by encouraging and taking part in the normal processes of mourning. This may involve assisting an individual to organise a funeral, or it may involve helping a community. Vignette 3 provides an illustration of how one non-governmental organisation (NGO) assisted mourning in a disaster-affected community. If any individual has such severe symptoms of distress that they cannot function or carry out necessary tasks, providing symptomatic relief will help.

Regarding discussion of the loss, you should follow the lead of the bereaved. This usually means being available and able to listen without forcing them to talk. There is no evidence that 'grief work' (i.e. the experiencing, confronting and working through of negative emotions) is helpful, and there is some evidence that it may have long-term negative consequences. Contrary to some popular western stereotypes, positive emotions in the early period after loss are indicative of good outcomes, not pathology. Individuals who choose the more avoidant orientation (*see* Figure 1.23.1) are not in harmful denial, and this does not have to be challenged.[10]

On the other hand, it is not necessary to 'break down' continuing attachment to the deceased. Good memories assist mourning and give pleasure and comfort. This connection may be maintained throughout a bereaved person's life without pathological effect. Depending on the culture, it may involve regular visits to the grave, talking actively or praying to the dead, frequent dreams or visions. Indeed, ritualised celebrations of connection with the dead in some societies actually strengthen living family bonds as they bring families together.[11,12] A continuing connection should only cause concern if continuing yearning, searching and longing cause misery and dysfunction, dominate life in the long term and prevent the bereaved from forming any new attachments.

If the loss has occurred as a result of some form of political injustice or abuse, unresolved issues of reparation and justice may prolong grief and make mourning difficult. Helping the victims to access justice may be another part of your role (*see* 'Case example: When to tell the story' on p. 118).

How do we help grieving children?

Many families present to healthcare workers because they have concerns about the long-term impact of events on the child, and want advice on how to talk about such abnormal events with their children. The healthcare worker's role should be to facilitate the process of normal grieving, and to help to sustain and support the protective aspects mentioned in this section. While treating pathology where it is evident, you should take care to avoid pathologising where it is not.

A particularly important role may be to facilitate clear communication between family members. As some of the case studies and vignettes in this section illustrate, many families are concerned that telling the child what happened will cause unnecessary distress, and that as the child is 'too young to understand', it is better to lie or avoid the subject when it comes up. Children are very protective of surviving parents, and are quick to sense when a question is causing distress. They may avoid asking for information because the questions make their parent cry. False information leads to confusion and a lack of trust. The following case example illustrates this.

CASE EXAMPLE: Telling the truth

The father of this family was a member of a 'Liberation Army', and was killed in the fighting. His 32-year-old wife had two surviving children aged 8 and 9 years, and continued to live with her husband's relatives. She told the children that their father was working in another country. The children would frequently ask her why he did not phone and if he would bring them presents. They were confused because other children in the village told them their father was dead. When they questioned their mother she would start to cry, so they became nervous about asking her. The mother and her brother-in-law asked for advice about what to do, and accepted my suggestion that they should sit with the children and explain in simple terms what had happened, answering all the children's questions as they came up, and sharing the experience of grief. The mother told me that the relief of not having to lie to the children had slightly eased her own distress and made it easier to respond to them. Moreover, rather than being bewildered by their father's silent absence, the children now talked about him in the village with pride.

The following is a list of pointers specifically for supporting grieving children:

1. **Provide consistent, enduring, appropriate care.**
   - Reunite children with their families or extended families as soon as possible.
   - In the absence of family, create enduring family-type networks with a low ratio of caretaker to children.
   - Consistent caregiving by one or two caregivers, not a number of different volunteers (however well intentioned), is essential to prevent attachment problems, particularly in younger children.
2. **The more continuity that there is with the child's previous life the better.** Children may wish to avoid traumatic reminders, especially at the outset, but removing them completely from a familiar environment will cause more pain and problems in the long term.
3. **Support the carers by attending to their basic needs and their own mental states.** Help them to access the appropriate agencies to solve the practical problems that they will encounter. Attention to basic needs is essential. Engaging in the process of rebuilding their lives helps families to come to terms with their losses (*see* Appendix, Vignette 1).
4. **Facilitate normal grieving and mourning** with memorials for absent bodies, and appropriate religious ceremonies.

5 **Don't hide the truth.**
   - Children need clear, honest, consistent explanations appropriate to their level of development.
   - They need to accept the reality of the loss, not be protected from it.
   - Magical thinking should be explored and corrected. What is imagined may be worse than reality, and children may be blaming themselves for events beyond their control.

6 **Grief work and debriefing may not be therapeutic or appropriate.** The insistence on getting a child to 'debrief' or tell the story of their loss may not be therapeutic or appropriate. Not all cultures put as high a value on the ventilation of individual feelings as western culture does. The therapist's goal should be to encourage a supportive atmosphere for the children, where open communication is possible, difficult questions are answered, and distressing feelings are tolerated. This means that the child will be free to express their grief in the manner that they find appropriate to the person they most trust, and at a time of their own choosing.

7 **Provide symptomatic relief.** Help the family to cope with traumatic symptoms such as bedwetting, nightmares and regressive behaviour, if they occur. Give the parents information about what to expect and straightforward management advice.

8 **Restart normal educational and play activities as soon as possible.**

9 **Help the child to maintain connection with the lost parent.** Encourage the surviving parent to allow the child to choose a memento to keep, to give them access to photographs, or to let the child draw a picture, make objects, or create a memory box. Answer the child's questions about the dead parent.

10 **The question of justice** will be important for families in situations of political violence. Many will state that they cannot come to terms with their losses while the fate of loved ones is unknown, bodies remain unidentified, or perpetrators are still at large. These issues will affect the children, and older children may bring them up spontaneously and wish to discuss them. Healthcare workers may be asked for their own views. Stating a willingness to learn and understand, along with an acknowledgement of one's own biases and subjectivity, is the most helpful position. Political and cultural literacy are essential. The family should be put in touch with the appropriate human rights or justice agencies if they wish to give formal evidence, so that the therapeutic and confidential nature of your own work remains clear and the family are not confused about the purpose of the interview. Giving testimony to such agencies should always be at their own request. In this case it may prove therapeutic (*see* 'Case example: When to tell the story', below).

CASE EXAMPLE: When to tell the story

The family consisted of three surviving children (two girls and a boy) who had witnessed the death of their mother and aunt and 15 other members of their extended family. They had been physically injured in the attack and spent some time in hospital. At our first meeting, 4 months after the event, two of the children did not believe their mother was dead. They hoped she had survived as they had. We sat together with the children's father, who told them gently that he thought that in all probability she was dead. The children cried and we did not discuss it further that day. The following week the bodies had been identified, funeral notices posted and the funeral arranged. The family had returned to the house where the massacre had occurred and appeared to be functioning well. The boy had no symptoms, although the younger girl was sad and quiet. When asked if they wanted to talk about what happened, she said no. Her brother said that he had already talked with journalists and did not feel a need to go over it again. The older girl (aged 14 years) had some intrusive thoughts and memories, and poor sleep and appetite. She wanted to walk me around the site and retell the events in detail.

The other children did not wish to join in. During the walk the older girl told me that she now knew her mother was dead. All the children then wanted to show me all their old photographs, and they participated in identifying their dead relatives and telling me stories about their life before the war. After the funeral (which only the older girl attended, at her own request) the children appeared more cheerful, and all of them were looking forward to school. The surviving family provided an extremely loving and supportive network, and although the father was extremely sad, he allowed the children to talk about their mother whenever they wanted. Later the whole family was sent to another country for medical treatment for the children. They attended local schools where they learned English, and appeared to be adjusting well.

One year after the events the International Criminal Tribunal wished to interview the family about the massacre, and the three children insisted that they would like to give their accounts. All the children made statements that were recorded on video, and gave similar detailed stories about the events surrounding the massacre. Although they found it distressing, they each obviously regarded it as significant and important, and were pleased to have had the chance to contribute in this way. This example demonstrates that children in the same family will not all deal with their grief in the same way. If given the opportunity they will find the most appropriate time to tell their own stories in the way that will give their loss significance and meaning for themselves.

Appendix

The following three examples are drawn from fieldwork in various conflict and disaster situations. They illustrate the variability of responses and provide examples of practical ways to support grieving families and communities.

Vignette 1: Complex needs and conflict in a grieving family

A is an 18-year-old high-school student, living in a rural area in the heart of a conflict region, the second oldest of seven children (four girls and three boys). She wanted to study medicine. Her life and health were normal until the shelling began and her family fled to the forest, where they spent 3 months. The local police, who were of a different ethnic origin, found them and separated the men from the women and elderly men and sent the latter home. They got home to find their village full of soldiers and police and themselves under siege at their home, where they were harassed and sometimes beaten. Meanwhile their invalid

pensioner father was shot in a massacre of 10 men from the village. He was buried while they were under siege. A was referred to me 1 month after this by a local doctor who was concerned about her mental state. When I first saw her she was extremely sad and frightened. She was crying all the time, and ruminating about her father being captured. She found everywhere frightening, and was too afraid to go to sleep. When she did fall asleep, she woke early. She had no appetite, and a diurnal mood swing.

I first assessed her at the doctor's home, where we had a long talk, at her instigation, about everything that had happened to her. I felt that the severity of her depressive symptoms might necessitate use of an antidepressant, but delayed making a decision until I was able to assess her at home with her family. I visited them a week later and found all seven members of the family living in one restored room of their fire-damaged home. To my surprise, A was a great deal better, her sleep and appetite having returned to normal over the course of the week. She informed me that she felt this was because she felt she had someone to talk to, and who 'wanted to come and visit'. However, all the female members of the family were preoccupied with the father's death, tearful when discussing it, and had conflicting views about how to manage the grief. The mother and one sister no longer wanted to wear the symbolic mourning clothes, but to move on. The other three sisters were wearing black mourning bands in their hair and wanted to do so for the appropriate period of 1 year. One of these sisters complained of having some panic attacks. They also all felt angry and concerned about their material circumstances. They had no access to their father's pension, as this would have meant going to a police station run by the ethnic group in power to get new identity papers (all of theirs had been burnt), and identifying themselves as from a conflict area and as being members of a family with a massacre victim. Anxiety made sleep difficult.

Interestingly, the boys in the family (aged 7, 8 and 14 years) appeared cheerful, busy and well, insisting that they were symptom free, although they missed their father. All the boys attended school regularly. The girls did not go, as there was no money for books. They therefore sat around at home with little to do.

We agreed to have family meetings to help them to resolve their conflicting views about how to grieve, and relaxation therapy to provide some symptomatic relief. We did this as a group and they practised themselves on a daily basis, with the mother running the group. Over the next weeks there was a marked improvement in the whole family. The three girls continued to wear their mourning bands, and the mother was more tolerant of this. A began to press me to help her to get an ID card so that she could go to a nearby town, get a job and earn some money. However, the security situation deteriorated too much for this to be possible. My last visit before evacuation was distressing, as there was fighting on the nearest main road and the sound of shelling of nearby villages. We all knew that they might have to flee again in the near future.

I returned to see the family 3 months later. They had spent these months internally displaced, being pushed from one village to another, and with very little to eat. During this time, the 14-year-old son, who had separated himself from the family because he believed that he endangered them, had been killed along with another male relative. The family had returned to their home to find it completely burnt to the ground except for an outhouse. They had nothing left and were using an ammunition box as a table, and sleeping under a small piece of plastic in the garden, because the outhouse attracted snakes. As before, the healthiest members of the family appeared to be the smallest boys, who denied any symptoms except some tearfulness now and then. They appeared active and cheerful except when witnessing their mother's distress. The mother was devastated, and could not stop crying. She could not sleep, eat or function, and expressed suicidal ideas. A had moved away to live with an aunt in a nearby town, and had a number of somatic symptoms. We provided clothes for the family and basic material equipment for the house. The mother was started on antidepressant therapy.

The family then lost contact with our service for 6 months. They had been provided with materials to build a warm room, but the aid agency had failed to realise that with no adult males left in the family there was no one to build it. The family therefore moved into a grim damp refugee flat in town. The mother had found the antidepressants helpful but had run out of medication. Two daughters had escaped the situation by marriage. The boys were well and attending school. The other daughters remain trapped within the prison of their mother's unremitting grief. They spent all day in the flat with their mother talking and crying. She did not wish to be left alone. They wanted to show her how much they cared for her and insisted on doing every household task, which added to her feeling of being a useless burden. We began 'family work' again, encouraging the girls to join the free local youth club and to allow the mother to re-establish her maternal role in the family, supporting her by restarting the antidepressant medication at her request, and getting in touch with the aid agency about the family's house.

Some reflections on this case: For most families of this particular ethnic group, the immediate and respectful burial of the dead is crucial. This is followed by 7 days of visiting by friends and family, who sit all day with the bereaved and discuss the dead. These normal mourning processes had not been possible either for the father or for the son. It seems likely that the surprisingly sudden symptomatic relief that A gained from my initial intervention was a result of my contributing to some of this normal mourning by being an outsider who visited and listened. A family approach meant that differences could be brought out in the open in a respectful way. The family also formed a natural group so could encourage and support each other in doing relaxation work. Attending to human rights concerns such as identity papers and security was also important. However, all this was undone by the second round of conflict and loss. There is something particularly devastating about loss coming again immediately a family has begun to work its way towards recovery. Being made homeless and not being given support to rebuild their house have contributed to their sense of bereavement and powerlessness, and prolonged the period of grief. The mother told me repeatedly that if she could start rebuilding her house she would feel better.

Some families are strongly patriarchal. There are different coping strategies available to boys and girls. All the women in this family came across as strong and capable, but all of them felt that the loss, first of an invalid father and then of the oldest son, had completely destroyed the family's capacity to function. Much of the work with grieving female survivors has to address their insecurity and lack

of confidence in their own self-worth. This family required a complex approach, including participation in normal mourning, attention to basic needs, help with family communication, symptomatic relief, help with re-establishing normal family roles, and adapting to new roles in the absence of male support.

Vignette 2: Supporting the whole family

Family B had lost more than 20 members, mostly female and children, in a massacre. I was asked to visit because of concerns about the mental health of the surviving children who had witnessed the attack and were all under 6 years of age. At the first session, most of the remaining extended family, including the children, had gathered to meet me in the only intact room in the house. I already knew the outline of what had happened, and used this first meeting to draw a genogram. I have found that in situations of mass violence, in a culture where the extended family is of central importance, this simple technique has a number of useful functions.

- It is a collective act, with everyone joining in, introducing themselves and explaining their connection to others.
- It is interesting for the children, who join in the actual drawing on a large sheet of paper in the centre of the room.
- By asking the family to include those who have died, it allows for a collective naming of the dead. In this family my symbolically putting a simple black line through these names took on a ritual significance, and the children were quick to point out when I missed someone out.
- The naming allows the person who has died to be identified, but how much is said about that person or what happened is up to the family. Thus it provides the opportunity for storytelling without forcing the issue.
- What is said about the dead is said in front of the whole family, so there is a collective narrative from which the children are not excluded.

Once the genogram had been drawn, the family told me their concerns about the children and their own fears about letting the children talk, as it seemed to upset them. At this meeting, I gave the simple advice about communication outlined above, and arranged to meet the family regularly and to have play therapy with the children. At the next meeting, the family informed me that they were concerned about the oldest teenage girl, who fainted regularly at the same time every afternoon, and was the most nervous and sensitive member of the family. Her sister was one of the dead, and her mother was particularly concerned about her health, but never cried herself. They wanted reassurance that the girl was not seriously ill. Having provided this, I wondered aloud if the teenage daughter was in some way grieving for the whole family and that this exhausting work might be causing her to faint. It also meant that the mother did not have time to think about her own sadness. The daughter said that she wished her mother would cry a little and not worry about her so much, in which case she could look after her.

By the next meeting, the daughter was no longer fainting and the mother was now actively grieving. I continued with family meetings and play therapy over the next 6 months. During this time the oldest child (5 years of age) of another section of the family, in which the mother had died, began to tell his father fragments of what he had seen and to ask questions about his mother. The father had taken out photographs of his wife to show to all the children. At no point did the children tell the story to me, nor did I insist upon it, seeing my role as facilitating and supporting communication within the family. Over the following year the children became much less tearful and withdrawn, and increasingly outgoing, cheerful, communicative and energetic. They all attended the formal reburial of their family. Their father remarried and their new stepmother was well accepted. The father began on the process of rebuilding his house. They remained well at our last contact, and the oldest child had begun school without problems.

Vignette 3: Assisting communal mourning

The South-East Asian tsunami that occurred on 26 December 2004 destroyed an area along the coast of Northern Sumatra 300 miles long and 6 miles wide. At least 130 000 people were killed in that country alone, and 400 000 were left homeless. In some villages more than 70% of the community were killed. One issue was the problem created by large mass graves. For example, outside the provincial capital Banda Aceh, approximately 20 000 people were buried in a small piece of land next to the main road, with no identification and no acknowledgement of their lives. Nothing grew there. Driving from the airport, one might witness a lone figure standing or sitting on the ground in quiet meditation or prayer. Our non-governmental organisation (NGO) psychosocial team talked with local community leaders in an effort to understand how to assist the Acehnese people in their mourning at this site, and took up their suggestion to collaborate in building a Quiet House. The house was built by local people in less than 10 days with NGO supervision. It overlooked the grave site and provided shelter, privacy and beauty for the relatives of the dead, without the traffic of the main road intruding. The house was designed to emphasise traditional culture, and was landscaped with flowering plants and trees. To provide comfort for the bereaved, the Imam wrote a well-known Muslim prayer: 'From him (Allah) we come and to him (Allah) we return.'

One of the local workers became tearful, explaining 'I think my family are buried here but I don't know. This is why I don't come here … but now I can come and talk to them. It is very important for the people of Aceh to have a place where they can come and feel a sense of loss and family again.' The project led to requests for further Quiet Houses at other sites.[13]

Note: Dr Jones is a members of the WHO ICD-11 Working Group on the Classification of Disorders Specifically Associated with Stress, reporting to the WHO International Advisory Group for the Revision of ICD-10 Mental and Behavioural Disorders. The views expressed in this article are those of the author and, except as specifically noted, do not represent the official policies or positions of the International Advisory Group or the World Health Organization.

References

1 Macksoud M (1993) *Helping Children Cope with the Stresses of War: a manual for parents and teachers*. New York: UNICEF.
2 Kubler-Ross E (1969) *On Death and Dying*. London: Routledge.

3 Adapted from Stroebe M, Schut H and Stroebe W (2007) Health outcomes of bereavement. *Lancet*, **370**, 11960–73.
4 Stroebe M, Schut H and Stroebe W (2007) Health outcomes of bereavement. *Lancet*, **370**, 11960–73.
5 Maercker A, Brewin CR, Bryant RA *et al.* (2013) Proposals for mental disorders specifically associated with stress in the International Classification of Diseases-11. *Lancet*, **381**, 1683–5.
6 Adapted from Hendricks JH, Black D and Kaplan T (2000) *When Father Killed Mother: guiding children through trauma and grief.* London: Routledge.
7 Eisenbruch M (1991) From post-traumatic stress disorder to cultural bereavement: diagnosis of South East Asian refugees. *Social Science and Medicine*, **33**, 673–80.
8 Worden JW and Silverman PR (1993) Children's reactions to the death of a parent. In: Stroebe MS, Stroebe W and Hanson RO (eds) *Handbook of Bereavement.* Cambridge, UK: Cambridge University Press.
9 Jones L (1998) Adolescent groups for encamped Bosnian refugees: some problems and solutions. *Clinical Child Psychology and Psychiatry*, **3**, 541–51.
10 Currier JM, Neimeyer RA and Berman JS (2008) The effectiveness of psychotherapeutic interventions for bereaved persons: a comprehensive quantitative review. *Psychological Bulletin*, **134**, 648–61.
11 Bonanno GA, Papa A and O'Neill K (2002) Loss and human resilience. *Applied and Preventive Psychology*, **10**, 193–206.
12 Bonnano GA, Brewin CR, Krzysztof K *et al.* (2010) Weighing the cost of disaster: consequences, risks and resilience in individuals, families and communities. *Psychological Science in the Public Interest*, **11**, 1–49.
13 Jones L, Ghani H, Mohanraj A *et al.* (2007) Crisis into opportunity: setting up community mental health services in post-tsunami Aceh. *Asia-Pacific Journal of Public Health*, **19**, 60–68.

1.24 Obstetric and paediatric anaesthesia in low resource settings

The Safe Anaesthesia Working Group of the World Health Organisation's 'Safe Surgery Saves Lives' global initiative updated the 1992 International Standards for the Safe Practice of Anaesthesia in 2010. The aim of these Standards is to contribute to decreased patient morbidity and mortality worldwide, particularly in lesser resourced countries where regions have not adopted their own standards.

The fundamental principle of these Standards is the continuous presence of an appropriately trained, vigilant anaesthesia professional. The Standards also highly recommend pulse oximetry during anaesthesia, which means it is mandatory, although compromise may be unavoidable in emergencies.

Compliance with these International Standards should be advocated by health care workers in all facilities where anaesthetics are given.

Obstetric anaesthesia

The limiting factor is often the availability of doctors and nurses trained in anaesthesia; women, babies and children die because of the lack of trained staff.

Remember that there are two patients – the mother and the baby. The condition of the mother affects the condition of the baby. Therefore maintaining adequate oxygenation and resuscitation of the mother is the best initial way of treating and preventing fetal distress.

All pregnant mothers after 20 weeks' gestation who are lying down must be put in the left lateral tilt position to avoid aorto-caval compression and supine hypotension.

Conduct of anaesthesia

Considerations in the obstetric patient in addition to routine anasethesia include those listed below.

1 Physiological

Hypoxaemia

Pregnant women are at risk of hypoxia. They use oxygen faster than non-pregnant women, and because of the pregnancy it is more difficult for them to breathe deeply.

Hypovolaemia

Signs of hypovolaemia eg. due to bleeding occur later than in the non-pregnant, because blood volume increases during pregnancy. This means that blood pressure, a late sign of blood loss, may be maintained in the hypovolaemic patient until induction of anaesthesia, when there may be catastrophic hypotension. Estimation of blood loss is difficult and it may be concealed eg. placental abruption with retroplacental bleeding. Placental perfusion is compromised before blood pressure,so fetal distress may be a warning of possible maternal circulatory compromise.

Acid regurgitation

Hormonal effects cause relaxation of the lower oesophageal sphincter, and pressure effects from the gravid uterus contribute to an increased risk of regurgitation and aspiration if laryngeal reflexes are impaired (e.g. during anaesthesia or eclamptic fits). An H_2 receptor antagonist and sodium citrate or other appropriate non-particulate antacid should be given to all pregnant women beyond the first trimester before general anaesthesia, which should involve a rapid sequence induction with cricoid pressure.

2 Pregnancy-related disease

- Pre-eclampsia/eclampsia
  - blood pressure control
    - » Blood pressure should be controlled prior to anaesthesia if possible. Spinal anaesthesia is recommended for Caesarean section if there are no contraindications (signs of coagulopathy or raised intracranial pressure). If general anaesthesia

is needed, attempts should be made to obtund the hypertensive response to intubation (see general anaesthesia for Caesarean section).
  - Treatment with magnesium
    - Magnesium potentiates the effect of non-depolarising muscle relaxants, so smaller doses of muscle relaxant are needed if general anaesthesia is necessary.
  - HELLP (Haemolysis, elevated liver enzymes, low platelets)
    - If platelet count is less than 100 000 $\times 10^9$/L, a coagulation profile is indicated prior to spinal anaesthesia. If platelet count is less than 75 000 $\times 10^9$/L, there is a risk of a spinal haematoma and so spinal anaesthesia is contraindicated. This has to be considered against the risks to the patient of alternative anaesthesia (general or local infiltration).
  - Oedema of tissues
    - This includes facial and airway oedema. The larynx and vocal cords may be involved and a smaller than usual diameter endotracheal tube may be required eg. 6.5 mm, 6.0 mm.
- Risk of increased intra-operative blood loss eg. if there has been antepartum haemorrhage, placenta praevia, long labour, maternal dehydration and ketosis or blood clotting abnormality (due to pre-eclampsia and HELLP syndrome, or anticoagulant medication). Ensure IV access with 2 wide bore patent cannulae prior to induction of anaesthesia.
- Sepsis (due to ascending genital tract infection or intrauterine infection). Early recognition of sepsis may be difficult, so it is important to suspect it from the patient's history (e.g. prolonged rupture of membranes).

3 Underlying medical conditions
- Examples include known cardiac abnormalities, previous cardiac surgery, and diabetes, all of which may be affected by pregnancy.
- Symptoms of chest pain or dyspnoea may indicate an undiagnosed heart valve abnormality, which may be either congenital or acquired (e.g. from rheumatic fever). unmasked by the circulatory changes in pregnancy and labour.

4 Drugs
Ketamine: This causes an increase in blood pressure, so should not be given to women with hypertension, but it can be used for induction of anaesthesia for women needing general anaesthesia for Caesarean section. It may increase uterine tone, which may cause fetal distress, or difficulty delivering the baby at Caesarean section.

Opioids: These drugs cross the placenta, so ideally should not be given until the cord is clamped, otherwise the baby may be slow to establish regular breathing.

5 Equipment
It is vital to ensure that all resuscitation equipment is available and working, in order to prevent avoidable delays if there is an emergency. Check the bag-valve-mask, airway equipment, oxygen, IV fluids, suction, saturation monitor and blood pressure machine before every operation. Ensure that difficult airway equipment (e.g. stylets, bougies) is readily available.

Choice of anaesthesia for Caesarean section

The choice of anaesthesia for major surgical procedures such as Caesarean section depends on the clinical condition of the patient, the anaesthetist's experience, and the equipment and drugs available. It should be decided after a balance of risks and benefits has been considered.

1 Most Caesarean sections are performed with spinal anaesthesia unless there are contraindications (see below).
2 General anaesthesia is used when spinal anaesthesia is contraindicated. Intubation as part of a rapid sequence induction is needed to minimise the increased risk of regurgitation and aspiration in a pregnant woman.
3 Local anaesthetic infiltration can be used in situations where there is no trained anaesthetist, or if the patient is moribund.

Spinal (sub-arachnoid) anaesthesia for Caesarean section
A spinal injection gives a dense block of rapid onset (within 5–15 minutes) that lasts for about 2 hours, and can be ideal for Caesarean section. The mother remains conscious. Spinal anaesthesia can also be used perinatally for
- evacuation of residual products of conception
- manual removal of placenta
- repair of third- and fourth-degree tears.

Spinal anaesthesia causes vasodilatation with consequent hypotension. This can be prevented with fluid loading before spinal insertion, and treated with IV fluid boluses and a vasoconstrictor (e.g. ephedrine).

Uses of spinal anaesthesia
It can be used for:
- Caesarean section
- laparotomy (not optimal)
- evacuation of residual products of conception
- manual removal of placenta
- repair of third- and fourth-degree tears.

Precautions
- Correct hypovolaemia first.
- Be aware of the presence of a coagulation disorder (e.g. with severe pre-eclampsia, eclampsia or placental abruption), which can lead to a dangerous bleed around the spinal cord. Spinal anaesthesia should not be used in these circumstances.

Contraindications
These include the following:
- maternal refusal
- inadequate resuscitation facilities
- uncorrected hypovolaemia
- coagulopathy (e.g. if there is spontaneous bruising)
- fixed cardiac output (e.g. aortic valve stenosis)
- allergy to local anaesthetics
- local infection around the spinal area.

Giving a spinal anaesthetic
Preparation
- Explain to the patient the type of anaesthesia.
- Do not give a pre-operative sedative, as it may reduce the baby's respiration and conscious level at birth.

- Give an antacid (e.g. sodium citrate 30 mL) immediately prior to anaesthesia.

Procedure

- Ensure that there is a **large-bore IV cannula (14 or 16G) and IV infusion running**.
- Infuse 500–1000 mL of IV fluids (Ringer-lactate or Hartmann's solution) to preload the mother and avoid hypotension. Also ensure that atropine 0.6 mg and ephedrine 30 or 50 mg diluted to 10 mL with Ringer-lactate or Hartmann's solution are immediately available.
- Check the patient's blood pressure.
- Sterility is critical. Use antiseptic skin solution to clean the patient's back over a wide area. Use sterile gloves and ideally a sterile apron. Do not touch the point or shaft of the spinal needle with your hand. Hold the needle only by its hub.
- Prepare the spinal anaesthetic (heavy bupivacaine 0.5%, 2–2.5 mL).
- Inject 1% lidocaine solution using a fine 25G needle to anaesthetise the skin over the site (L3/4 or L4/5). Do not use a space above L2/3 because the spinal cord ends at around L1/2.
- Introduce the finest spinal needle available (24G) (ideally using an introducer needle if available) in the midline through the anaesthetised skin, at a right angle to the skin in the vertical plane. Fine spinal needles greatly reduce the risk of post-dural puncture headache.
- If the **needle hits bone** it may not be in the midline. Withdraw the needle and reinsert it, directing it slightly upwards while aiming in the direction of the umbilicus. It is important to have two correct planes (i.e. midline and also not too near to the spinous processes above or below).
- Advance the spinal needle towards the sub-arachnoid space. A loss of resistance may be felt as the needle pierces the ligamentum flavum.
- Once the needle has passed through the ligamentum flavum, push the needle slowly through the dura. You may feel another slight loss of resistance as the dura is pierced.
- Remove the stylet. Cerebrospinal fluid (CSF) should flow out of the needle.
- If CSF does not come out, reinsert the stylet and rotate the needle gently. Remove the stylet to see if fluid is flowing out. If you continue to fail, try another space.
- Once CSF flows out of the needle, inject 2–2.5 mL of the local anaesthetic solution described above.

Never proceed with the injection if the patient complains of pain on injection.

- All patients should have their head and shoulders raised on a pillow to prevent high spread of the anaesthetic. When using 'heavy' (i.e. heavier than CSF) bupivacaine, as is used in a spinal anaesthetic, the position of the patient affects where the local anaesthetic collects, and can be used to influence the height of the block. The position of the block can be brought higher by placing the table head down. Gravity can be made to influence the level of the block for up to 20 minutes after the injection.
- Lie the mother on her back. Have the operating table tilted at least 15 degrees to the left, or place a pillow or folded linen under the mother's right lower back to decrease the risk of supine hypotensive syndrome.
- Recheck the blood pressure every 5 minutes after the spinal needle is inserted until the end of the procedure. A fall in blood pressure is likely.
- If there is significant hypotension (i.e. systolic blood pressure < 100 mmHg or a fall in blood pressure of more than 20%), or if the mother has nausea or vomiting:
  - Give the IV infusion as fast as possible.
  - Give ephedrine in 3–6 mg increments or an alternative available vasopressor until there is a response.
  - Give high-flow oxygen via face mask.
- After the spinal injection wait 5 minutes and check for weakness of the legs, then pinch the skin with forceps. Start below the umbilicus and work up on both sides of the body until pain is felt. Wait 5 minutes, and then retest the level of the spinal block until there is no pain with pinch up to the level of the nipples. Anaesthesia should now be adequate for Caesarean section.
- After surgery the mother does not have to lie flat, but may not be able to move her legs for 2 to 4 hours. The first time she mobilises after a spinal anaesthetic she should be accompanied in case she has residual weakness.

Complications of spinal anaesthesia

1 Hypotension.
2 Sensory block: if the bladder is full it will be unnoticed by the patient.
3 Headache can occur following a spinal anaesthetic, but is uncommon if small gauge spinal needles are used. Headache occurs because of leakage of CSF, which causes traction on intracranial structures. A typical headache is frontal and/or occipital, and worse on sitting or standing, but better when lying down. It can be immediate or delayed. Management consists of analgesia as per the WHO pain ladder (*see* Section 1.15) and keeping the patient well hydrated.
4 If there is bradycardia, tingling or weakness in the hands, or difficulty breathing, the block is likely to be too high. Give the mother atropine 0.6 mg if she is bradycardic, increase the IV infusion rate and give ephedrine.
5 Rarely, intracranial spread can also occur. It produces loss of consciousness and apnoea, and is termed a total spinal block. Resuscitation is required.

Management of spinal blocks which are too high or total

Call for help.

Airway:

- Assess and maintain patency.
- Give oxygen 15 litres/minute via face mask, and measure SpO_2 using a pulse oximeter (which should already be attached).

Breathing

- Assess and give chest inflations with a bag-valve-mask if there is apnoea or inadequate breathing.
- Ideally protect the airway by intubation if the patient is unconscious (P or U on the AVPU scale).

Circulation

- High or total spinal blocks can cause cardiac arrest.
- Assess pulse and blood pressure.

- Give chest compressions if the patient is in cardiac arrest or has an inadequate central pulse (the blood pressure may be unrecordable).
- Tilt the patient to the left if this has not already been done.
- Treat hypotension with IV Ringer-lactate or Hartmann's solution and ephedrine.
- Treat bradycardia < 50 beats/minute in the mother with atropine 0.6 mg IV, repeated after 3 minutes as necessary.

Check the fetal heart after maternal resuscitation and consider the timing and method of delivery.

Consider and exclude other causes of unconsciousness (e.g. eclampsia, hypoglycaemia, epilepsy, opioid drugs, intracranial bleed).

Keep a chart of pulse, blood pressure, respiratory rate, SaO_2, fetal heart rate and treatments given.

For management of anaphylaxis, *see* Section 2.7.C.

General anaesthesia

If spinal anaesthesia is contraindicated, rapid sequence induction and intubation is the recommended anaesthetic if expertise and equipment are available. See in Paediatric anaesthesia section of this section for the '10 golden rules of anaesthesia', essential monitoring, essential drugs, essential equipment, and how to intubate steps 1–6.

General anaesthesia is indicated

1 If spinal fails or is refused by the patient
2 If there is a medical contraindication for spinal anaesthesia:
   - suspected coagulopathy,
   - raised intracranial pressure (impaired consciousness following eclamptic fits)
   - fixed cardiac output (e.g. aortic stenosis)
3 If there is no time for a spinal anaesthetic to be given.

Conduct of General Anaesthesia

1 Minimise aspiration risk by the following:
   - restrict oral intake, especially solids for women in labour
   - give H2 receptor antagonist e.g. ranitidine 150 mg orally if time, or 50 mg IV if emergency
   - give sodium citrate 30 mL orally just prior to induction of anaesthesia
   - assess patient, with particular attention to airway.
2 Check drugs available:
   - Induction agents
     – Thiopentone 3–5 mg/kg or
     – Ketamine 1.5–2 mg/kg – causes less hypotension than thiopentone, useful if patient hypovolaemic e.g. if antepartum haemorrhage. Contraindicated if pre-eclampsia or eclampsia or suspected raised intracranial pressure.
   - Muscle relaxant – Suxamethonium 1–2 mg/kg
   - Other drugs – to reduce hypertensive response to intubation, given if the patient has severe pre-eclampsia/eclampsia, magnesium 4 g (2 g if already receiving magnesium) or lidocaine 1.5 mg/kg, and/or rapid onset opioids if available. If opioids are used, the baby may need naloxone after initial resuscitation if not breathing adequately.
3 Check equipment – laryngoscopes, endotracheal tubes and ensure difficult airway equipment, including stylets, bougies, laryngeal mask and cricothyroidotomy kit are available.
4 Lie patient on theatre table with left lateral tilt and ensure suction is on and under pillow. Connect monitoring.
5 Start an IV infusion of Hartmann's solution via a large gauge (14 or 16G) cannula.
6 Explain to the patient and anaesthetic assistant about cricoid pressure and pre-oxygenate the patient for 3 minutes.
7 Give predetermined dose of induction agent and suxamethonium and support jaw until relaxed, or until fasciculations subside.
8 Intubate patient and inflate cuff. Check position of endotracheal tube before allowing cricoid pressure to be released.
9 Maintain anaesthetic with a volatile agent or intermittent boluses of ketamine.
10 After the baby is delivered, oxytocin is given, as requested by the surgeon, usually 5 units as a bolus, followed by an infusion. Oxytocin may cause tachycardia and hypotension, so care must be given to patients with hypovolaemia or other patients for whom tachycardia would cause cardiovascular compromise e.g. stenotic cardiac valve disease. In these patients, the oxytocin bolus can be drawn up into 20 mL 0.9% saline and given slowly over 5–10 minutes. After delivery the mother can be given opioid analgesia for post-operative pain relief.

Failed intubation

This is more likely to occur at emergency Caesarean sections, when it is often unexpected and leads to rapid oxygen desaturation. An early decision should be made to abandon repeated attempts at intubation.

The priority is to OXYGENATE the patient.

1 Maintain cricoid pressure. This should not interfere with bag-valve-mask ventilation if correctly placed, and may need to be adjusted.
2 Inform surgeon and scrub nurse to help.
3 Ventilate the patient with 100% O2, initially with mask.
4 If mask ventilation not successful,
   a. insert oropharyngeal airway
   b. consider using 2 hands to maintain airway with assistant squeezing bag
   c. insert laryngeal mask.
5 If ventilation is still inadequate, a percutaneous cricothyrotomy should be performed.
6 If this is unsuccessful, either surgeon or anaesthetist should perform surgical cricothyrotomy or tracheostomy.

If ventilation and oxygenation is possible at any of the steps before cricothyroidotomy, and the Caesarean section is elective, the patient should be woken up and a spinal or local infiltration should be used.

If the Caesarean section is an emergency, you should consider whether to wake the patient up and give spinal anaesthesia, or proceed with the patient breathing spontaneously and give volatile anaesthesia or intermittent ketamine IV.

If spinal anaesthesia is not possible, intubation fails, or expertise and/or equipment is unavailable, and Caesarean section is urgently needed, the priority is to maintain oxygenation with bag-valve-mask and anaesthetise with either a volatile agent or ketamine depending on the experience of the practitioner.

Ketamine in early pregnancy

Ketamine causes a trance-like state where patients become mentally removed from their surroundings. It causes sleep, analgesia and short-term memory loss (amnesia). The patient is unconscious, pain-free and has no memory of the time under anaesthesia. The airway protective reflexes are usually present but cannot be guaranteed. Therefore it is important that the patient is **starved and anaesthetised on a tipping table with suction available**. It can only be used as a sole anaesthetic agent in the first trimester and if there is no increased risk of regurgitation. Patients should be fasted for 6 hours prior to ketamine anaesthesia.

Ketamine is contraindicated in patients with high blood pressure (including pregnancy-induced hypertension), eclampsia or heart disease.

Effects of ketamine:

Central nervous system: Ketamine causes sympathetic nervous system stimulation. The additional use of diazepam (after delivery if ketamine is used for a Caesarean section) will reduce the amount of sympathetic stimulation. Ketamine also raises intracranial pressure, which makes it unsuitable for patients with eclampsia.

The effects start 10–15 seconds after IV injection. Ketamine produces a 'dissociative state'. The eyes may remain open and may make quick side-to-side movements (nystagmus), and the patient may move during surgery if ketamine is the only drug used. The patient can be quite agitated, crying and distressed on waking up. This can be minimised by using diazepam with ketamine and avoiding stimulation while emerging from anaesthesia. This can also be helped by including diazepam (see below) as part of the premedication.

Cardiovascular system: Ketamine causes mild stimulation of the cardiovascular system. The blood pressure rises by about 25% and heart rate increases by about 20%. This increases the workload of the heart.

Respiratory system: If given too quickly, IV ketamine can cause the patient to stop breathing for up to a minute. If this happens, ventilate the patient until the effect wears off. The airway is usually maintained, but still needs to be monitored closely. The oxygen saturation may decrease, so give oxygen.

Ketamine causes bronchodilatation. Laryngeal spasm may occur, and may be partly caused by increased secretions resulting from ketamine use (see below for the importance of an atropine premedication in helping to prevent this). If it occurs, continuous positive airways pressure by mask with oxygen or manual ventilation with a bag and mask should relieve this potentially dangerous problem. If it doesn't relieve the obstruction and oxygen saturations are falling, or the patient is cyanosed, give a short acting muscle relaxant (suxamethonium 1 mg/kg IV) and continue bag valve mask ventilation until adequate breathing returns (usually about 5 minutes later).

Muscle: Ketamine increases muscle tone. This makes it an unsuitable drug for major abdominal surgery where abdominal relaxation is necessary. Some body movements can occur.

Uterus and placenta: Ketamine may increase the tone of the uterus. It readily crosses the placenta, so the fetus receives some of the drug.

Premedication before ketamine

- Atropine 10–20 micrograms/kg (up to a maximum of 600 micrograms) IM 30 minutes before or IV at the time of induction of anaesthetic.
- Diazepam 100 micrograms/kg (up to a maximum of 10 mg in pregnancy) can be given IV at the time of induction to prevent hallucinations. When performing a Caesarean section after ketamine induction, give diazepam only **after** the baby has been delivered as diazepam can cross through the placenta and prevent the newborn baby from breathing.
- Give oxygen at 6–8 litres/minute by mask or nasal cannulae.

Administration of ketamine in pregnancy

1 Should only be used without intubation in the first trimester.
2 Can be used as an induction agent as part of rapid sequence induction in 2nd and 3rd trimester if there are no contraindications, e.g. pre-eclampsia, eclampsia.

Start an IV infusion of crystalloid and ensure that a reliable IV cannula is in place.

Ketamine may be given by IV injection or by IV infusion. At doses of **250–500 micrograms/kg IV** ketamine is a good **analgesic**. At doses of **1–2 mg/kg IV** ketamine is an **anaesthetic**.

Giving IV diazepam 100 microgram/kg will reduce nightmares and hallucinations, but respiratory depression is more likely than with ketamine alone.

Ketamine injection

- Check vital signs (pulse, blood pressure, respiration and temperature).
- Oxygen should be given to ensure that SaO_2 remains above 94%, ideally near 100%.

Induction of anaesthesia is achieved by slowly administering ketamine 2 mg/kg body weight IV slowly over 2 minutes. For short procedures lasting less than 15 minutes, this will provide adequate anaesthesia.

- Check the adequacy of anaesthesia at the operation site before proceeding with the surgery. Pinch the incision site with forceps. **If the pregnant woman feels the pinch, wait 2 minutes and then retest.**
- Monitor vital signs (pulse, blood pressure and respiration) every 5 minutes during the procedure.

Give additional IV boluses of ketamine 1 mg/kg body weight as needed.

Ketamine infusion

- For longer procedures, infuse ketamine 200 mg in 100 mL of 5% dextrose at 2 mg/minute (i.e. 20 drops per minute with a standard giving set with a drop factor of 20) and titrate to response. More or less may be needed. Stop the infusion 10 minutes before the end of the operation. If the patient needs a blood transfusion, give it through a different IV line.
- Monitor vital signs (pulse, blood pressure and respiration) every 5 minutes during the procedure.

Post-procedure care

Discontinue ketamine infusion and administer a post-operative analgesic appropriate to the type of surgery performed. The patient takes about 2 hours to wake up, and needs to be in a quiet area. Let her wake up naturally without stimulation. Maintain observations every 30 minutes until the patient is fully awake.

Local anaesthesia for Caesarean section

In extreme situations, Caesarean section can be undertaken under infiltration with local anaesthetic. Although not ideal, this can be necessary in an extremely ill patient (e.g. if unconscious and/or eclamptic), where general anaesthetic/intubation is not available and spinal anaesthetic is inadvisable.

Up to 100 mL of lidocaine 0.5% with adrenaline 1:200 000 is used to infiltrate the layers of the abdominal wall either side of the midline from the symphysis pubis to 5 cm above the umbilicus.

Paediatric anaesthesia

This must only be undertaken by anaesthetic practitioners with adequate experience, preparation and equipment. If these skills and equipment are not available, the child should be referred to a more experienced hospital if at all possible.

Ketamine anaesthesia is commonly used in children and is usually safe, but it must still be undertaken with care.

The '**10 golden rules of anaesthesia**' (originally defined by Maurice King in his manual *Primary Anaesthesia*) form the basis of essential safe anaesthetic practice for all cases, and are listed below.

1 Do an adequate pre-operative assessment.
2 Ensure that the patient has been nil by mouth for an appropriate time.
3 Use a tipping table.
4 Check all equipment and drugs.
5 Have suction ready.
6 Keep the airway open.
7 Be prepared to ventilate the patient (with oxygen).
8 Check the pulse, blood pressure and oxygen saturation (SpO_2).
9 Have a vein open with a reliable venous cannula.
10 Have an assistant ready to apply cricoid pressure.

In addition:

- Create a non-frightening environment. If possible and appropriate, the parents should be present up to the time of induction of anaesthesia.
- Be aware of anatomical, physiological and pharmacological concepts relevant to infancy and childhood.
- Know the normal values of the main physiological variables.
- For all emergencies, remember ABC for assessment and treatment, and call for help early.
- Know the hourly fluid and blood requirements for every patient (for children these are based on their weight).
- Ensure that all equipment and drugs are available for the child.

Pre-operative assessment

- Past medical history (including anaesthetic history), in particular any cardiorespiratory illness, and the presence of respiratory tract infection, which increases the risk of adverse respiratory events during anaesthesia.
- Medication and allergies.
- Nil-by-mouth guidelines (if unsure, ensure 6 hours nil by mouth for all oral intake)
  - clear fluids: 2 hours
  - breast milk: 4 hours
  - food: 6 hours.
- Weigh the child.
- Note the physiological status: airway, oxygenation and ventilation, cardiovascular stability, hydration.
- Assess airway and ease of intubation. Burns, facial deformity, small chin and reduced mouth opening are all signs of a potentially difficult airway. If any problems with airway or intubation are anticipated, consider referring the child to a more experienced hospital.
- If the child is sick, consider whether the procedure is really necessary, and if it is, ensure adequate resuscitation prior to any procedure.
- Plan the fluid requirements. **Do not give hypotonic solutions such as 0.18% saline in 5% dextrose. Give Ringer's lactate or Hartmann's solution, which are best and essential intra-operatively.** Neonates, infants and sick children need glucose (dextrose) intra-operatively, and therefore a 5% or 10% solution of glucose in Ringer-lactate or Hartmann's solution is ideal. Check the blood glucose levels regularly, and give additional glucose (10%) 2 mL/kg as required.
- **Basic maintenance fluids in children:**
  - Give 4 mL/kg/hour for the first 10 kg of body weight.
  - Then add 2 mL/kg/hour for the next 10 kg of body weight.
  - Then add 1 mL/kg/hour for each kg thereafter.
- **Additional fluids:** Judge these clinically: cardiovascular status and urine output (> 0.5–1 mL/kg body weight/hour for a child).
- **Premedication:** give oral paracetamol. Avoid sedative premedications unless you are experienced in their use.
- **Explain what is to happen to the child and their family.**

Intra-operative considerations

Planning the anaesthetic

- Maintenance of normal physiological status is part of balanced anaesthesia.
- **General anaesthesia** involves a reduced conscious level (sleep), muscle relaxation and analgesia. Anaesthetic drugs rarely provide all three of these (e.g. ketamine is a poor muscle relaxant, ether is not analgesic, local anaesthetics provide no fall in conscious level). Therefore modern anaesthesia uses combinations of drugs to provide balanced anaesthesia.
- **Avoid general anaesthesia wherever possible.** Most operations can be performed using one or all of the following: sedation, local anaesthesia and ketamine. These techniques should be the basis of anaesthesia for the non-specialist anaesthetist.
- **General anaesthesia is indicated** where other methods are precluded due to lack of knowledge, lack of drug, the nature of the surgical procedure (abdominal surgery) or contraindication for ketamine/local anaesthetic drug.
- Inhalation anaesthesia with or without muscle relaxant

and local anaesthetic/opioid as analgesia is the standard combination.
- Intravenous ketamine is an excellent induction agent unless it is contraindicated. Thiopentone is a useful alternative if inhalational anaesthesia is planned and intravenous induction is required.
- Induction can be achieved by inhalation of anaesthetic gases, provided that there is adequate expertise and equipment. This is not safe for patients with a full stomach, but in those with acute upper airway obstruction it must be used (intravenous induction often leads to apnoea or a worsening of airway obstruction).
- **Neonates and infants form a special group. Do not undertake anaesthesia without concern in this age group, and it should be administered only by an experienced practitioner.** Sedation and ketamine anaesthesia are more difficult to perform safely. Under general anaesthesia, neonates and infants do not breathe well (due to difficult airway maintenance, unfavourable chest wall/lung mechanics and limited reserve in the face of hypoxaemia). Therefore, in general, ventilation must be controlled. Caution must be exercised with regard to drug doses (opioids and local anaesthetics due to side effects, suxamethonium is required at a higher dose), and post-operative risks are increased. Ketamine or inhalational anaesthesia with controlled ventilation is the technique of choice.

For all anaesthesia:
- Remember the '10 golden rules'.
- Give oxygen if it is available (especially at altitude).
- Use all monitoring that is available. The best monitor is the anaesthesia provider closely watching the patient at all times. A pulse oximeter is the most essential basic monitor.
- Maintain normothermia (using warm fluids and high ambient temperature).
- Give fluids for maintenance with additional fluid as indicated clinically.
- The optimal haemoglobin level depends on age, but preferably should always be higher than 8 g/dL. Correction of chronic anaemia is not necessary unless major blood loss is expected.
- Analgesia: paracetamol, non-steroidal anti-inflammatory drugs, local anaesthetic infiltrations and blocks, and opioids (morphine and pentazocine).
- Plan to maintain spontaneous ventilation wherever possible. Never use muscle relaxants without knowledge of and experience in how to intubate.

When to intubate
- **To protect the airway/lungs:** All acutely ill children and pregnant women have poor gastric emptying. If in doubt, or if there is a strong indication of a 'full stomach' (acute abdomen) you must protect the lungs with an endotracheal tube. Intravenous induction with the application of cricoid pressure prior to intubation is the technique of choice. Prolong nil by mouth times post trauma to minimise the risk of regurgitation.
- **To ensure a safe maintained airway:** In the case of a difficult airway or potentially difficult intubation, **never** give muscle relaxant until the airway is secured with an endotracheal tube (i.e. keep breathing!). Upper airway obstruction is a contraindication to intravenous anaesthesia, including ketamine.
- **To provide positive pressure ventilation:** Prolonged surgery, where muscle relaxant is essential (abdominal surgery).
- **To improve oxygenation in neonates and infants:** You can administer 100% oxygen and maintain better lung volumes with positive end-expiratory pressure (PEEP).

Post-operative care
- **Basic recovery care:** attention to ABC, maintenance of normothermia, continued fluid therapy, and provision of safe and effective analgesia.
- Commence oral fluids as soon as possible.
- If intravenous fluids are required (due to ongoing losses or nil by mouth), give at 70% maintenance with additional fluids matched to losses.
- Regular oral/rectal analgesia (paracetamol, non-steroidal anti-inflammatory drugs) with opioid as rescue analgesia. Consider opioid infusion (*see* Section 1.6 and Section 1.15).
- Pain assessment scores to titrate analgesia (*see* Section 1.16).
- Family care and communication.

Techniques
Sedation
In pregnancy and in children should only be administered by experienced health workers; usually an anaesthetist.
- Conscious sedation through to general anaesthesia: based on loss of airway self-maintenance, gradual loss of protective reflexes and decreased responsiveness.
- All drugs can have unpredictable and prolonged effects.
- Cardiorespiratory compromise is the greatest danger.
- **Avoid sedation altogether in patients with upper airway obstruction.**
- Prepare as for general anaesthesia.
- Drugs: chloral hydrate, midazolam or diazepam.
  - chloral hydrate: 25–50 mg/kg orally (infants)
  - midazolam: 200 micrograms/kg intranasally, orally or sublingually
  - diazepam: 200 micrograms/kg IV (500 micrograms/kg rectally).

Local anaesthetic
- **Advantages:**
  - It is cheap, and minimal equipment is required.
  - Its use can avoid the need for general anaesthesia.
  - The procedures are simple and brief.
  - It can be used for post-trauma analgesia and post-operative analgesia.
- **Disadvantages:**
  - Slow onset, and prolonged effect.
  - Each block can have major complications.
  - Toxicity: central nervous system (seizures) and cardiovascular (arrhythmias).
  - All techniques can be lethal.
  - It is not sedative!
- **Safety:**
  - Always ensure sterility.

  Never exceed the maximum doses of local anaesthetics: lignocaine 3 mg/kg (7 mg/kg with adrenaline), and bupivacaine 2 mg/kg (with or without adrenaline).

- Be very cautious with doses in neonates.
- Know the **anatomy**.
- Use blunted needles (easier to identify layers), ideally 25–29 gauge.
- Always **aspirate** before any injection (this is not a 100% guarantee of avoiding intravascular injection).
- All injections should be **easy** (i.e. there should be no resistance to injection; resistance indicates intra-neural injection).
- Be aware of the possibility of toxicity, and assess for it during and after administration of local anaesthesia (an early symptom of toxicity is tingling of the lips, which are a highly vascular area).

Applications

This can be administered topically, by infiltration or by regional blocks.

Do not combine local anaesthetic with adrenaline in digital or penile blocks.

- **Topical application:** easy to do and can be very effective (e.g. Ametop or EMLA skin anaesthesia, local anaesthetic soaked dressings, eye drops).
- **Infiltration:** use a small needle, and slow injection.

Nerve blocks

For all blocks, first consider whether ketamine anaesthesia would be safer and more tolerable for the child.

- Explain this type of anaesthesia to the patient and carers, and gain their consent.
- Warn the patient about motor blockade and the sensation of sensory blockade.
- Apply the principles of safe use of local anaesthetics.
- The onset of effect can be slow (30–60 minutes).
- The effect can be prolonged (up to 24 hours).
- Be aware of the distribution of analgesia for each block.

Femoral block/'3 in1'

- Femoral shaft fractures, burns, grafts from anterior thigh.
- Medial calf only blocked below the knee.
- Lie the patient in a supine position. The femoral nerve lies lateral to the vascular sheath just below the inguinal ligament (the nerve, artery and vein lie laterally to medially, respectively).
- Sterilise the skin, and provide skin analgesia.
- Identify the artery. The injection point is 0.5–1 cm lateral to the artery.
- Advance a 21G blunted needle at 45 degrees to the skin until two 'pops' are felt (the fascia lata and fascia iliaca).
- Aspirate, inject lignocaine 1% with adrenaline (1 in 200 000), 0.5– 0.7 mL/kg.
- Larger volume blocks obturator and lateral cutaneous nerves in addition, hence '3 in 1'.

Brachial plexus block (axillary approach)

- This is the easiest and safest approach.
- It blocks the whole arm except for the upper arm and shoulder.
- Lie the patient supine, abduct the arm to 90 degrees, rotate it externally, forearm to 90 degrees.
- Identify the artery, sterilise the skin, and provide skin analgesia.
- Advance 1 inch with a 22 G needle, aiming for the apex of the axilla, over and parallel to the artery.
- After one pop is felt, let go of the needle. It will bounce with arterial pulsation if correctly sited.
- Support the needle, then carefully aspirate and inject 0.5 mL/kg lignocaine 1% with adrenaline 1 in 200 000. Intravascular injection is a significant risk.

Intercostal block

- This is useful for fractured ribs and upper abdominal surgery.
- The risk of complications is high, but it is an effective block.
- Identify the postero-medial curve of the rib.
- Sterilise the skin and provide skin analgesia.
- Advance a 22–24G needle perpendicular to the skin until you hit the rib.
- 'Walk' the needle just under the rib, aspirate and inject.
- Repeat at each rib.
- Beware of the maximum dose, 0.5 mL/kg of 1% lignocaine with adrenaline 1 in 200 000, as intravascular uptake from this site is high.

Intravenous regional anaesthetic (IVRA)/Bier's block

- This is used for distal limb excisions and fracture manipulations.
- It involves intravenous injection of local anaesthetic into an arm with a tourniquet blocking off the arterial and venous supply. It is therefore dangerous and must only be performed with the appropriate equipment.
- Exsanguinate the arm by elevation.
- Apply the tourniquet (a double one if available).
- Insert two IV cannulae – one in the limb to be blocked as distal as possible, and the other for safety in another limb.
- Inflate the tourniquet (to twice the arterial pressure).
- **Inject lignocaine 1% (10 mL at 1 year, 20 mL at 5 years, 30 mL at 10 years) into the cannula in the limb to be blocked (but not with adrenaline and not with bupivacaine).**
- There is a 10-minute onset, and it is safe to release the tourniquet after 30 minutes.

Ilioinguinal/iliohypogastric block (field block)

- This is used for hernia repair and orchidopexy.
- Lie the patient supine and identify the anterior superior iliac spine.
- This is 1 cm medial and 1 cm caudal.
- Sterilise the skin and provide skin analgesia.
- Advance a 22 G blunted needle perpendicular to the skin until one pop is felt (after the skin). Then aspirate and inject.
- Two pops are acceptable. Three pops or 'feels too far' runs the risk of femoral nerve block.
- Infiltrate 0.5 mL/kg 1% lignocaine with 1 in 200 000 adrenaline after aspiration.
- Withdraw to skin and infiltrate.

Central blocks

Central neural blockade should only be used by experienced anaesthetic practitioners in older children. It is not appropriate to discuss central blocks for children in this textbook. Please refer to a specialist anaesthetic textbook.

Ketamine

Ketamine anaesthesia is not always safe, and must only

ever be undertaken with great care. Remember the 10 Golden Rules of anaesthesia and ensure that adequate preparation has taken place.

Ketamine is an analgesic, dissociative anaesthetic that induces a trance-like cataleptic state dissociated from the environment.

- **Advantages:**
  - airway maintenance
  - cardiovascular stability
  - useful for short procedures, and limb and extra-cavity surgery.
- **Disadvantages:**
  - airway is not guaranteed, and interference risks laryngospasm and bronchospasm; cardiovascular stability is no alternative to good resuscitation
  - **hypoxaemia and apnoea**, especially after bolus administration
  - hypertonus, especially with prolonged anaesthesia (greater than 1 hour)
  - resistance is unpredictable except in developmentally delayed children
  - it raises the intracranial and intraocular pressure
  - emergence phenomena (e.g. hallucinations), although these are perhaps less common in children, and can be minimised with benzodiazepines.
- Use as low a dose as possible.
- Recovery may be prolonged.
- Use only with great caution in neonates (apnoea is very likely to occur).

Ketamine doses

- 1 mg/kg slow IV bolus.
- Repeat half the first dose (500 micrograms/kg) after 15 minutes.
- 7 mg/kg IM induction dose.

For IV infusion:

- Make up a solution of 1 mg/mL by placing 500 mg in a 500-mL bag of 5% glucose or 0.9% saline.
- Maintenance after the initial bolus.
- Aim for 2–4 mg/kg/hour for general anaesthesia.
- Aim for a lower dose, of 500 micrograms to 1 mg/kg/hour, for analgesia.

Marked tachyphylaxis can occur with infusions that last for more than 30–60 minutes.

Inhalational anaesthesia

Do not undertake this unless you are trained in anaesthesia.

- **Airway maintenance skills and the ability to recognise an appropriately anaesthetised patient are the absolute minimum requirements for safe practice.**
- The best simple guide to depth of anaesthesia is the level of sympathetic nervous system arousal.
- The equipment for this type of anaesthesia is generally more specialised.
- Spontaneous ventilation via mask or endotracheal tube and breathing system is the safest application.

Ether is a relatively safe drug to use, although it is no longer widely available. It can be given by an open method or by a breathing system and vaporiser, usually of the draw-over type. Induction of anaesthesia is slow and relatively predictable. Respiratory depression is late, and cardiovascular stability is well maintained. Recovery can be prolonged. Ether has **no analgesic effect**.

Halothane is a potent but highly effective inhalational anaesthetic agent. It can only safely be given via a vaporiser. It is easy and dangerous to use too much.

Trichloroethylene (trilene) has the advantages of slow onset, high potency and an analgesic effect. Tachypnoea and post-operative nausea are seen. It is rarely if ever used alone.

Essential equipment

This should follow the World Health Organization (WHO) or World Federation of Societies of Anaesthesiologists (WFSA) standards. The minimum is Level 1 facility.

Minimum equipment required for ketamine and local anaesthesia provision

- Equipment to support the airway and ventilation (bag-valve-mask).
- Suction (foot operated or electric).
- Intravenous cannulae.
- Syringes.
- Needles.
- Pulse oximeter.

Preferred equipment for ketamine, inhalational anaesthesia and resuscitation

- Oxygen masks: with and without reservoir bags (paediatric and adult sizes).
- Oxygen supply: cylinders with oxygen flow meter or oxygen concentrator.
- Intravenous fluids (isotonic solutions such as Hartmann's, Ringers-lactate or 0.9% saline) not dextrose solutions without electrolytes, except in the first 2 days of life.
- Intravenous administration sets (ideally burettes).
- Paediatric anaesthetic face masks (ideally clear masks with inflatable rims that provide an airtight seal and have minimal dead space).
- Oropharyngeal airways (Guedel), sizes 0–4.
- Bag-valve-mask incorporating non-rebreathing valve (paediatric), reservoir tubing/bag and self-inflating bag (preterm neonatal (250 mL) and full term neonatal and child (500 mL) sizes.
- Ayre's T-piece, with Jackson–Rees modification (open-ended 500-mL bag).
- Endotracheal tubes: 2.0–9.0 mm internal diameter, cuffed and uncuffed, PVC.
- Laryngoscopes: straight-bladed and curved-bladed.
- Magill's forceps (adult and paediatric sizes).
- Fixation tape.
- Suction apparatus (manual, foot/hand pump).
- Suction catheters.
- Yankauer suckers, paediatric and adult.
- A means of administering inhalational anaesthetic agents: continuous-flow (Boyles type) require a continuous oxygen supply; simple draw-over (OMV, EMO based, triservice); or new hybrid machines, such as the Universal Anaesthesia Machine (www.gradianhealth.org) or the Glostavent (www.diamedica.co.uk) (please refer to specialist anaesthetic textbooks).

Essential monitoring

- This improves patient safety, reducing morbidity and mortality.

- Use in any location and for any technique, including sedation.
- Use from induction through to recovery.
- Documentation is essential.

The best and only universally available monitor is the presence and vigilance of the person administering the anaesthetic.

Minimum monitoring includes colour, pulse rate and volume, chest wall movements, capillary refill time, respiratory rate and auscultatory findings, and pupil size. This monitoring can and should be performed repeatedly by the anaesthetist.

Always remember to check:
- equipment prior to use
- whether there is enough oxygen
- whether oxygen is flowing into the patient
- the patient's arterial oxygen saturation (SpO_2), electrocardiogram, non-invasive blood pressure (this is extremely valuable), temperature (ideally core temperature), blood glucose levels, urine output, and capnography (expensive but useful).

Essential drugs
- Oxygen.
- Intravenous fluids.
- Local anaesthetics (lignocaine and bupivacaine).
- Ketamine.
- Atropine.
- Diazepam.
- Midazolam.
- Paracetamol.
- Morphine or another opiate.
- Suxamethonium bromide (if no refrigeration facilities are available), (lasts 5 minutes, higher dose is needed in neonates, salivation, hyperkalaemia, masseter spasm, anaphylaxis).
- Pancuronium (or atracurium or vecuronium); neostigmine.
- Adrenaline (resuscitation doses: 1 in 10 000 = 100 micrograms/mL; 1 in 1000 = 1 mg/mL).
- Thiopentone (apnoea, hypotension).
- Inhalational agents.

Intubation
This is used:
- to secure the airway
- to protect the airway
- for prolonged ventilation
- for intra-operative ventilation
- for tracheo-bronchial toilet
- for the application of high airway pressures and positive end-expiratory pressure (PEEP)
- for cardiopulmonary resuscitation (all of the above)
- in patients with raised intracranial pressure to maintain normal oxygenation and normocapnia.

Choice of tube
- Uncuffed under 25 kg: the larynx is narrowest below the glottis at the circular non-distensible cricoid ring (modern cuffed tubes are increasingly available for infants and young children).
- The correct tube is that which passes easily through the glottis and subglottic area with a small air leak detectable at 20 cmH_2O (i.e. sustained gentle positive pressure).
- Size of uncuffed tubes: measure the tube internal diameter against the diameter of the little finger of the child:
  - preterm neonates: 2.5–3.5 mm internal diameter
  - full-term neonates: 3.0–4.0 mm internal diameter
  - infants under 1 year of age and after the neonatal period: 3.5–4.5 mm internal diameter
  - children over 1 year: internal diameter in mm = age/4 + 4
    length of tube in cm = age/2 + 12 for oral tube
    = age/2 + 15 for nasal tube.

Aids to intubation
- Laryngoscope: blade (straight for neonates and infants because of their long, floppy epiglottis; curved for older children and pregnant mothers), bulb and handle.
- Magill's forceps.
- Introducer (not further than the end of the tube itself).
- Gum elastic bougie (over which the tube can pass).
- Cricoid pressure (can aid visualisation of the larynx).
- Suction apparatus must be available, plus Yankauer and other catheters.
- Syringe (cuffed tube).

Predictors of difficulty
- Difficulty in opening mouth
- Reduced neck mobility
- Laryngeal/pharyngeal lesions
- Congenital: Pierre-Robin syndrome, mucopolysaccharidoses.
- Acquired: burns, trauma.
- **Look from the side: a small chin is a predictor of difficulty.**

Complications
- Displacement: oesophageal, endo-bronchial, out of larynx.
- Obstruction: kinking, secretions.
- Trauma: from the lips to larynx.
- Hypertensive response.
- Vagal response.
- Laryngeal or pharyngeal spasm.
- Aspiration of gastric contents.

How to intubate
1 Prepare and check the equipment.
   - Choose an appropriate tube size, with one size above and one size below available.
   - Get the tape ready to fix the tube.
   - Suction must be available.
   - Induce anaesthesia and give muscle relaxant unless completely obtunded. **Do not attempt this in a semi-conscious patient.**

2 Position:
   - Children over 3–4 years of age and pregnant mothers: 'sniffing morning air' position (head extended on shoulders and flexed at neck).
   - Children under 3 years (especially neonates and infants): neutral position (large occiput).
   - Keep in a neutral position with in-line immobilisation if there is an unstable cervical spine (e.g. due to trauma or Down's syndrome).

3 Pre-oxygenate every child prior to intubation.
4 Introduce the laryngoscope into the right side of the mouth, sweep the tongue to the left, and advance the blade until the epiglottis is seen.
   - Curved blade: advance the blade anterior to the epiglottis, and lift the epiglottis forward by moving the blade away from your own body.
   - Straight blade: advance the blade beneath the epiglottis into the oesophagus, pull back, and the glottis will 'flop' into view.
   - Recognise the glottis.
   - Insert the endotracheal tube gently through the vocal cords.
   - Stop at a predetermined length.
5 Confirm that placement is correct.
   - The chest moves up and down with ventilation and equally on both sides.
   - Listen to breath sounds in the axillae and anterior chest wall.
   - Confirm that there are no breath sounds in the stomach.
   - Oxygen saturations do not go down.
6 Secure the tube.

If you are skilled, proceed to nasal intubation. This is best for long-term ventilation, but is contraindicated in base of skull fracture.

- Fresh gas flow through T-piece circuit to prevent re-breathing CO_2.
- Minute ventilation (MV) is 1000 mL plus 100 mL/kg.
- For spontaneous ventilation: 3 × MV.
- For positive pressure ventilation: 1.5 × MV.
- Minute ventilation = rate × tidal volume.
- Ventilator rates and tidal volumes (by hand or mechanical).
- Tidal volume is that which is **enough to see the chest expand adequately**, or 5–10 mL/kg.
- Rates:
   - neonates: 30–40 breaths/minute
   - infants: 25–30 breaths/minute
   - children: 20 breaths/minute
   - adolescents: 15 breaths/minute.

Further reading

Merry AF, Cooper JB, Soyannwo O *et al.* (2010) International Standards for a Safe Practice of Anesthesia 2010. *Canadian Journal of Anesthesia*, **57**, 1027–34.

Bartholomeusz L. (2007) *Safe anaesthesia: a training manual where facilities are limited.* Available as a DVD from TALC – Teaching-aids At Low Cost. ISBN: 9780955258770

King M. (2003) *Primary anaesthesia*. Oxford Medical Publications. ISBN: 019261592-0

1.25 Non-invasive respiratory support

Introduction

Respiratory support is needed when the patient fails to sustain an adequate airway, oxygenation or ventilation, despite treatment of the condition leading to respiratory failure. Respiratory failure may result from:

- respiratory illnesses
- severe shock
- coma
- convulsions
- meningo-encephalitis
- neuromuscular disorders
- raised intracranial pressure (e.g. from trauma).

Infants and young children are more likely to progress to respiratory failure because:

- they are more susceptible to infection
- their airway is smaller
- their thoracic cage is more compliant
- their ribs are (nearer) horizontal
- their respiratory muscles are more prone to fatigue.

Pregnant women and girls are also more susceptible to respiratory failure. They have reduced immune function, an expanding abdominal mass which impairs lung expansion, and are more prone to gastro-oesophageal reflux and aspiration of gastric contents.

As respiratory failure progresses, it will ultimately lead to cardiorespiratory arrest and death. Thus recognition of the severity of the conditions that lead to respiratory failure, followed by appropriate treatment, will reduce morbidity and mortality.

Use of respiratory support

The following **clinical signs** should be observed when assessing the adequacy or inadequacy of breathing:

- intercostal, sub-costal and supra-sternal recession
- respiratory rate
- inspiratory and expiratory noises
- use of accessory muscles
- adequacy of breath sounds and chest expansion
- heart rate
- skin colour
- mental status.

To help to assess the development of respiratory failure, it is necessary to assess **changes** in the clinical signs listed above. In the following situations, however, these signs are less useful because there is absent or decreased work of breathing:

- in patients with fatigue or exhaustion (e.g. after prolonged respiratory effort)

- in those with cerebral depression due to raised intracranial pressure, poisoning or encephalopathy
- in children with neuromuscular disease.

In these cases, pay more attention to the chest expansion and air entry on auscultation of the chest, heart rate, skin colour, mental status and, if available, SaO_2 measurement.

Pulse oximetry measures the arterial oxygen saturation through the skin (SpO_2 or SaO_2). Values of SpO_2 lower than 94% in air at sea level (for values at high altitude, *see* Section 5.1.D) are abnormal and would warrant at least initial treatment with additional inspired oxygen. Values of less than 85% in oxygen are very low, but even values greater than 95% in oxygen may be associated with significant hypoventilation. **It is essential to remember that, in respiratory failure, even a normal SaO_2 while receiving additional inspired oxygen is likely to be associated with significant hypoventilation or intrapulmonary shunting.** Measurement of transcutaneous, end-expired or blood carbon dioxide levels will confirm this.

When respiratory fatigue is severe, oxygenation is poor or deteriorating, or carbon dioxide levels are raised, respiratory support should be used, if available. The various forms of respiratory support are outlined in Table 1.25.1, along with their indications.

TABLE 1.25.1 The various forms of respiratory support, with nursing care and medical treatment required, and examples of relevant conditions treated

Mode of respiratory support	Interface with patient	Level of nursing care	Associated medical treatment	Clinical use	Examples of relevant conditions treated
High-flow high-humidity oxygen	Nasal cannulae	Home, ward, HD	Nil	To provide a flow above the patient's needs, that helps to wash out dead space, and improves comfort and clearance of the airways. It may provide mild CPAP	Bronchiolitis, post-operative, chronic lung disease of prematurity
Continuous positive airways pressure (CPAP)	Nasal cannulae or nasopharyngeal tube	HD	Sedation or analgesia may be needed	To keep the upper and lower airways patent and maintain adequate lung volume (oxygenation)	Neonatal respiratory distress syndrome, **bronchiolitis***
	Nasal mask or face mask	Home, ward, HD	Nil		Sleep-related upper airway obstruction
		Intensive care (IC)	Sedation or analgesia may be needed		Acute upper airway obstruction before, **instead of*** or after extubation
Intermittent positive pressure ventilation (IPPV)	Nasal mask or pillows, face mask (NIPPV)	Home to IC	Nil	To treat hypoventilation (raised CO_2) when airway control and clearance are adequate	Chronic (e.g. central, neuromuscular) Acute (e.g. after surgery)
	Endotracheal tube	IC	Anaesthesia for intubation. Sedation or analgesia will be needed	To treat hypoventilation when clearance/support of airway(s), or when close control of ventilation is needed	Procedures or surgery requiring anaesthesia Severe respiratory illnesses, raised intracranial pressure
	Tracheostomy	Home to IC	ENT surgical procedure	Long-term ventilation where day and night support is needed	Brainstem/high spinal injury or neuromuscular disease
Continuous negative extrathoracic pressure (CNEP)	Chamber or jacket	Home to IC	Nil	To keep the lower airways patent and maintain adequate lung volume	Bronchiolitis and other severe lower respiratory infections, especially where the nose is blocked by secretions
Intermittent negative pressure ventilation (INEP or INPV)				To treat hypoventilation where airway control and clearance are adequate or maintained by CPAP	Central hypoventilation (e.g. apnoea of prematurity or neuromuscular disease)

HD, high dependency; IC, intensive care.

Shaded areas are those that require a lower dependency of care (e.g. they have been used in the home setting), but may be useful in acute conditions.

* High-risk situation, in which CPAP may be ineffective and intubation may be required.

Notes on the use of positive pressure ventilation

1 Monitoring of patient status and either airway or extra-thoracic pressures is necessary when undertaking any form of respiratory support except for high-flow, high-humidity oxygen (see below).
2 Positive airway pressure involves a flow of air or other gas mixture to the patient's airways. This flow may be continuous (as in CPAP) or intermittent (as in IPPV). It may vary with inspiration and expiration (as in BiPAP), or to accommodate the leaks or variable compliance of ventilator tubing, airways or lung units.
3 Mask ventilation can be well tolerated by children, but it may be more difficult for infants and young children to tolerate appliances on their face.
4 In the presence of excess airway secretions or an open mouth, nasal masks and nasal cannulae may not produce as effective airway pressures as ventilation with tracheal intubation (or relatively higher pressures may be needed to achieve the same effect).
5 The pressures used with masks and cannulae may be higher than those used with tracheal intubation, because of the greater potential for air leaks and other volume loss in compliant upper airway structures.
6 Infants and young children will sometimes only tolerate masks and cannulae if sedation is used, in which case close monitoring of respiratory failure must be undertaken in case full intubation and ventilation are needed.
7 Endotracheal intubation should be undertaken with rapid-sequence drug or gaseous induction, and subsequent analgesia, anxiolysis and sedation must be provided.
8 Positive pressure ventilation administered through an endotracheal tube must be accompanied by adequate humidity of the inspired gases.
9 Oxygen may be administered either using a built-in mixer in the ventilator, or by entraining a supply in the ventilator tubing nearer to the patient.
10 Positive pressure ventilators should be able to provide manipulation of either the pressure or volume administered, and the time intervals for inspiration and expiration. There should be alarms for failure to cycle, and for excessive pressure/volume administered.