Lewisham and Greenwich NHS Trust

Division of Women's, Children's & Sexual Health

Maternity Directorate

&

Division of Surgery

Obstetric Anaesthesia Guideline

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To be exceptional

Review and Amendment Log

Version	Date	Author	Type of change	Summary of Change(s)
10	August 2024	Jonathan Short	Review & update	Minor updates and clarifications from previous edition. Updated links to Trust policies. Updated references. Version 10.1 includes the introduction of carbetocin into clinical use
9	August 2022	Jonathan Short	Review & update	Minor updates and clarifications from previous edition. Updated links to Trust policies. Updated references. Ratified.
8	August 2020	Jonathan Short Beenu Madhavan	Review & update	As above
7	August 2019	Jonathan Short Beenu Madhavan	Review & update	As above
6	August 2018	Jonathan Short Manju Agarwal	Review & update	As above. Ratified.
5	August 2017	Jonathan Short Manju Agarwal	Review & update	As above.
4	August 2016	Jonathan Short Manju Agarwal	Merging similar guideline documents at QEH and UHL into a single Trust-wide document. Includes relevant national guidance and standards	This replaces the LHT document *Obstetric Anaesthesia Guidelines* –dated July 2015, and the SLHT document – *Obstetric Anaesthesia Guidelines* – version 3 dated August 2015
3	August 2015	Jonathan Short	Update to include new combined department procedures	Similar changes made to Lewisham obstetric anaesthesia guidelines to prepare for department merger
2	November 2014	Jonathan Short	Update to include new national guidance; change of Trust logo	Replaced SLHT document (QEH anaesthetic department only)
1	August 2013	Jonathan Short		Anaesthetic department guidelines, replacing old 2005 QEHT version

Dissemination Plan

Audience	Method	Paper or Electronic	Responsible Staff Member
Anaesthetists Obstetricians Midwives	Email Trust Intranet Paper copies on Labour Ward and Theatres	Both	Jonathan Short Beenu Madhavan
Midwives	JT5	Electronic	

Lewisham and Greenwich NHS
NHS Trust

Department of Anaesthesia

Queen Elizabeth Hospital
&
University Hospital Lewisham

Obstetric Anaesthesia Guidelines

Tenth Edition – August 2024

Contents

Glossary

AAGA	Accidental Awareness under General Anaesthesia
AAGBI	Association of Anaesthetists of Great Britain & Ireland
AFE	Amniotic fluid embolism
ALS	Advanced Life Support
APH	Antepartum Haemorrhage
BMI	Body Mass Index
CEMACH	Confidential Enquiries into Maternal and Child Health (2003-2009)
CMACE	Centre for Maternal and Child Enquiries (2009-2012), succeeded by MBRRACE-UK
CPR	Cardiopulmonary resuscitation
CSE	Combined Spinal-Epidural
CSF	Cerebrospinal fluid
CICV	Can't Intubate, Can't Ventilate
CrCl	Creatinine Clearance
CTG	Cardiotocograph
CVP	Central venous pressure
DAS	Difficult Airway Society
DDI	Decision to Delivery Interval
DIC	Disseminated intravascular coagulation
DOAC	Direct oral anticoagulant
DREAMY	Direct Reporting of Awareness in Maternity Patients
EPA	Entrustable Professional Activities
ETT	Endotracheal tube
GA	General Anaesthesia
GDM	Gestational diabetes mellitus
HELLP	Haemolysis, Elevated Liver enzymes, Low Platelets (variant of pre-eclampsia)
HUS	Haemolytic Uraemic Syndrome
IACOA	Initial Assessment of Competency in Obstetric Anaesthesia
ITP	Idiopathic Thrombocytopenic Purpura
IUD	Intra-Uterine Death
IUGR	Intra-Uterine Growth Retardation
LA	Local Anaesthesia
LGT	Lewisham & Greenwich NHS Trust
LMWH	Low Molecular weight Heparin
LSCS	Lower Segment Caesarean Section
MAGPIE	Magnesium for Prevention of Eclampsia trial
MBRRACE-UK	Mothers & Babies: Reducing Risk through Audits and Confidential Enquiries across the UK
MEOWS	Modified Early Obstetric Warning Score
MOH	Major Obstetric Haemorrhage
MROP	Manual Removal of Placenta
NICE	National Institute for Health and Care Excellence
NSAID	Non-Steroidal Anti-Inflammatory Drug
OAA	Obstetric Anaesthetists' Association

PCA	Patient Controlled Analgesia
PCEA	Patient Controlled Epidural Analgesia
PCR	Protein : Creatinine Ratio
PDPH	Post Dural Puncture Headache
PPH	Postpartum Haemorrhage
QEH	Queen Elizabeth Hospital
RCoA	Royal College of Anaesthetists
SLE	Systemic Lupus Erythematosus
SOFA	Sequential Organ Failure Assessment score
TAP	Transversus Abdominis Plane block
THRIVE	Trans-nasal humified rapid-insufflation ventilatory exchange
TTP	Thrombotic Thrombocytopenic Purpura
UHL	University Hospital Lewisham
VBAC	Vaginal Birth after Caesarean section
VTE	Venous Thromboembolism
WOMAN	World Maternal Antifibrinolytic Trial

1. Obstetric Anaesthesia at Lewisham & Greenwich NHS Trust

Introduction

These guidelines are intended to assist you in your role as an obstetric anaesthetist at University Hospital Lewisham and/or Queen Elizabeth Hospital. We aim to promote the highest standards of anaesthetic care in what can be a very demanding environment. These guidelines provide information to enable you to orientate yourself and give advice on how to manage specific situations. They have been developed from national recommendations and evidence review, and represent a consensus of opinion on good practice in obstetric anaesthesia. They are not necessarily comprehensive, but provide a framework on which you should develop your practice in obstetric anaesthesia.

Each patient will require an individual approach to their clinical care, which should be based on the information in these guidelines, discussion with the woman and her midwife, advice from senior colleagues, and your own clinical training. In any case where you are unsure as to the safe and effective way to proceed, please seek advice at any time from a more senior and experienced member of staff.

All trainee grade, specialty grade, and consultant anaesthetists should read through these guidelines before starting work on Labour Ward, and will receive an electronic copy before their induction. Paper copies are distributed on the Labour Wards and obstetric theatres annually. Any significant deviation from these guidelines in your practice should be discussed with a consultant anaesthetist. Any suggestions for improving the next annual edition of these guidelines are gratefully received.

Delivery Rate

In 2023 at Queen Elizabeth Hospital:

Total number of women delivered	=	3656
Caesarean section rate	=	1499 (41.0%) Elective 567 / Emergency 932
Epidural rate	=	1265 (34.6%)

At UHL (2023):

Total number of women delivered	=	3007

Caesarean section rate = 1339 (44.5%) Elective 517 / Emergency 821

Epidural rate = 1049 (34.9%)

QEH	FY2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Births	4912	4720	4474	4200	4538	4651	4536	4508
CS rate	26.2%	27.2%	27.4%	24.9%	25.1%	28.8%	29.3%	29.3%
UHL								
Births				3951	3966	3847	3892	3647
CS rate				27.3%	26.0%	30.4%	30.2%	33.0%

Consultants

Queen Elizabeth Hospital

There are currently seven consultant obstetric anaesthetists at QEH:

Dr Ahmad Ben Tareef - Lead Obstetric Anaesthetist (QEH)

Dr Asootosh Barry

Dr Keshava Chenna

Dr Marcin Malek

Dr Vishal Salota

Dr Hans Sauer

Dr Jonathan Short

These consultants provide daytime cover for Labour Ward and for elective Caesarean section lists from Monday to Friday. Other consultants are also often rostered to weekday Labour Ward session to ensure full daytime consultant cover. In addition, the weekly antenatal anaesthetic assessment clinic on Thursday afternoons is run by a consultant obstetric anaesthetist.

University Hospital Lewisham

There are currently nine consultant obstetric anaesthetists who provide cover for Labour Ward and elective Caesarean sections at UHL:

Dr Beenu Madhavan – Clinical Director

Dr Krish Srinivas – Lead Obstetric Anaesthetist (UHL)

Dr Manju Agarwal

Dr Iram Ahmed

Dr Bryony Davy

Dr Ben Eden-Green
Dr Silvia Leonardi
Dr Claudie Sellers
Dr Amit Soodan
Dr Vilma Uzkalniene

If a consultant obstetric anaesthetist is not available during the weekday, please refer any issues or concerns to the duty "starred" consultant. At other times, out-of-hours and weekends, consultant cover is provided by the on-call Consultant Anaesthetist.

Required Competencies

CT1: Training in obstetric anaesthesia will start after approximately 9 months once you have sufficient experience of neuraxial anaesthesia in main theatres. This will initially be on elective Caesarean section lists under direct consultant supervision. Your first few labour epidurals should be directly supervised and taught by a consultant anaesthetist; competent specialty grade anaesthetists may also supervise you. Once your clinical supervisor is confident that you are competent with obstetric patients, you may do labour epidurals with less direct support, but you should have a senior anaesthetist present in theatre for all surgical procedures.

CT2: Trainees undergoing their module in obstetric anaesthesia should aim to complete the Initial Assessment of Competence in Obstetric Anaesthesia (IACOA). **CT2 trainees will <u>not</u> be expected to hold the bleep unsupervised at any time.** It is very important that all necessary supervised learning events (SLE's) and a comprehensive logbook of obstetric cases are completed in good time in order for the IACOA to be signed off. The IACOA consists of Entrustable Professional Activities (EPA) 3 & 4 being signed off as competent at supervision level 3 (supervisor on call from home for queries, able to provide direction by phone or non-urgent attendance) See www.rcoa.ac.uk/sites/default/files/documents/2021-06/EPA-3and4-workbook.pdf for an example IACOA (EPA 3 (Administration of pain relief in labour) & EPA 4 (Anaesthesia for obstetric operative procedures)) from the RCoA 2021 curriculum. A CT2 trainee post IACOA may rarely be asked to hold the bleep during the weekday daytime under direct consultant supervision, but will not be asked to go on call for obstetrics out of hours.

ST3 and more senior trainees, who have achieved their IACOA, and staff grades may be rostered to cover Labour Ward without immediate direct consultant supervision. During the week, we aim to have a consultant anaesthetist rostered to Labour Ward cover from 8am-

6pm; rarely, this will not be possible. In that event, any problems can be referred either to the consultant anaesthetist covering the elective Caesarean section list and/or the duty on-call consultant.

Trainees with a particular interest in obstetric anaesthesia may wish to join the Obstetric Anaesthetists' Association (OAA; www.oaa-anaes.ac.uk).

Duties of the on-call Obstetric Anaesthetist

- Take handover from the outgoing on-call anaesthetist at the Labour Ward whiteboard at 8 am / 8 pm. This includes ongoing labour analgesia, high risk and critical care patients, and any problems or complications from the previous shift. Take charge of the 6611 (QEH) / 5014 (UHL) bleep.

- Check the anaesthetic machine, and check the emergency and general anaesthesia drug trays in the fridge in the emergency obstetric theatre.

- Pre-filled 10ml syringes of phenylephrine 50 micrograms/ml are available, but occasionally may be out of stock. If so, prepare a phenylephrine infusion by drawing up a 20 ml ampoule of phenylephrine 100 micrograms/ml and diluting with a further 20 ml 0.9% saline, to make a 40 ml solution of phenylephrine 50 micrograms/ml. Label clearly with an infusion label.

- Oxytocin 5 units should be diluted to a concentration of 1 unit/ml with 0.9% sodium chloride in a 5 ml syringe. The anaesthetic nurse/ODP may prepare the drugs for you, but it is your responsibility to check them.

- The Obstetric Emergency GA Drug Tray should contain:
    - Thiopentone (1 x 500mg powder vial, unopened), water for injection (1 x 20mL, unopened), one pre-labelled 20mL syringe with filter needle attached.
        - Do not draw up thiopentone until it is needed.
    - Propofol (1x 200mg ampoule, unopened), one pre-labelled 20mL syringe with filter needle attached.
    - Rocuronium (2 x 50mg in 5ml ampoule, unopened), one pre-labelled 10ml syringe with filter needle attached.
    - Suxamethonium (2 x 100mg in 2ml ampoule, unopened), one pre-labelled 5ml syringe with filter needle attached.

  - No other drugs are to be kept in the tray.
    - *Standard Operating Procedure: Obstetric Emergency GA Drug Tray v2.0 (Oct 2023) SOP0218*

- The Obstetric Emergency Drug tray should contain:
  - Ephedrine - prefilled syringe: 10ml of 3mg/ml concentration
  - Phenylephrine - prefilled syringe: 10ml of 50 micrograms/ml concentration
  - Atropine - prepare 1mL neat at 600micrograms/mL in a 2mL syringe (Draw-up optional)
  - Glycopyrronium - prepare 3mL neat at 200micrograms/mL in a 5mL syringe (Draw-up optional)
    - *Standard Operating Procedure: Emergency Anaesthetic Drugs in Adult, Paediatric and Obstetric Theatres v2.0 (Sept 2023) SOP0217*

- Check the epidural trolleys are fully stocked. A laminated checklist is kept in the top drawer of the trolleys. The midwives should restock the trolleys, but it is your responsibility to check them, and highlight any missing stock to the Labour Ward lead midwife.

- Attend the Labour Ward board rounds with the obstetric team and the anaesthetic consultant covering Labour Ward at 8:30 am, and where possible accompany them on their ward round to review high-risk cases that need anaesthetic input.

  - Remember to sign in to the daily ward round register – attendance is recorded and audited

- Review any obstetric patients in Critical Care at least daily, and on their discharge back to Labour Ward.

- Review all postnatal women who had an anaesthetic procedure in the previous day, and review existing patients with problems needing ongoing anaesthetic input. The names of patients to be followed up are in the follow-up folder, which is kept in the anaesthetic room of Theatre 7 (QEH), and in the Labour Ward treatment room (UHL). Any patients with anaesthetic complications should be followed up at least daily until their discharge from hospital. Any problems (e.g. post-dural puncture headache, awareness under GA, nerve palsies) should be discussed with the duty consultant.

- All patients should have their follow-up clearly documented on iCare. A iCare anaesthetic follow-up form has been generated and must be completed for all obstetric patients once online from July 2024.

- Insertion and maintenance of lumbar epidurals for labour analgesia. The aim is for the response time to be less than 30 minutes (a standard for audit). You remain responsible for the epidural analgesia for the duration of labour, and should revisit regularly to ensure it is still working appropriately. Handover all running epidurals to the next shift, highlighting any problems arising.

- Provision of regional and/or general anaesthesia for emergency (Category 1-3) operative delivery, and for other obstetric-related surgery. MROP / 3rd degree tear repairs may be performed in the emergency obstetric theatre, but are otherwise often performed in the CEPOD theatre.

- See antenatal patients where there is potential high-risk anaesthetic concern; seek consultant opinion if required and document legibly in the maternity notes and on iCare.

- Documentation is extremely important. Whenever you explain something, perform a procedure, or identify problems or complications, clearly document it on the anaesthetic chart and/or on iCare, and write your name, grade, date and time.

- If you have any concerns about the anaesthetic management of obstetric patients, please discuss with one of the consultant obstetric anaesthetists, or the on-call consultant out of hours.

Antenatal Anaesthetic Clinic

The anaesthetic antenatal clinic is run weekly on both sites. Referral to this clinic is made by the booking midwife or the obstetricians.

The following list of suggested conditions for referral is not exhaustive. If there is any doubt about the appropriateness of a referral, please discuss the case with one of the consultant obstetric anaesthetists.

- Past history of, or potential for, problems with anaesthesia: Difficult or failed intubation, anaphylaxis, suxamethonium apnoea, malignant hyperthermia, porphyria.
- Complications following previous central neuraxial block
- Problems or complaints after anaesthesia
- Obstetric problems: Placenta accreta, increta or percreta
- Spine problems: Previous back surgery e.g. Harrington rods, discectomy, decompressive laminectomy, congenital abnormalities e.g. kyphoscoliosis, spina bifida, myelomeningocoele
- Concerns about back pain and regional anaesthesia; please note that regional anaesthesia will not worsen musculoskeletal back pain per se. It is not necessary to refer all women with simple back pain unless they specifically wish to see an anaesthetist
- Cardiac disease: all cardiac conditions (except benign murmurs associated with a completely normal echocardiogram)
- Respiratory disease: pulmonary hypertension, cystic fibrosis, bronchiectasis, severe asthma, restrictive lung disease
- Neurological disease: multiple sclerosis, myasthenia gravis, muscular dystrophy, spinal cord injury, arterio-venous malformations, intracranial aneurysms, raised intracranial pressure
- Haematological disease: Bleeding abnormalities, Von Willebrand's disease, haemophilia or other inherited coagulation disorders, thrombocytopenia (platelets < 100 x 10^9/L) or platelet dysfunction, sickle cell anaemia (*not* trait), hereditary haemorrhagic telangiectasia
- Endocrine disease (e.g. acromegaly, Addison's disease, phaeochromocytoma)
- Autoimmune disease: systemic lupus erythematosus, rheumatoid arthritis, systemic sclerosis (scleroderma)
- Obesity - BMI ≥ 45 kg/m^2 (or ≥ 40 kg/m^2 with other significant co-morbidity).

2. Analgesia for labour

Indications for epidural analgesia

- Maternal request for analgesia in labour
    - including for intrauterine death if requested
- Anticipated need for regional analgesic block for augmentation of labour with oxytocin infusion, or anticipated instrumental delivery / Caesarean section, or where premature pushing is causing cervical oedema
- Medical maternal indications (e.g. cardiac/respiratory disease, pre-eclampsia)
- Foetal indications (e.g. IUGR / multiple birth, malpresentation)

Contra-indications

Absolute

- Maternal refusal
- Clotting abnormalities and thrombocytopenia *(see below)*
- Local infection at site of lumbar epidural
- Lack of midwifery staff to ensure one-to-one care
- Allergy to amide local anaesthetics

Relative

- Sepsis
    - Mild pyrexia is common in labour. However, as a rule of thumb, a patient with a temperature of >38°C and/or WCC >25, or overt signs of sepsis should not have an epidural. If in doubt, seek senior advice
- Hypovolaemia / haemorrhage
- Raised intracranial pressure
- Gross spinal deformities
- Pre-existing neurological conditions
    - For example, in progressive multiple sclerosis, current neurological status should be carefully documented before proceeding; if in doubt about proceeding, discuss with the duty consultant

Thrombocytopenia / clotting disorders

Platelets

Mild gestational thrombocytopenia is relatively common. A platelet count above 75 x 10^9/L is acceptable for administering a regional block when there are no risk factors and the platelet count is not falling.

It is not necessary to check the intrapartum platelet count - a recent 28/40 antenatal FBC with a platelet count >150 x 10^9/L is sufficient ***(1)*** - unless there is reason to suspect the platelet count is low or falling (e.g. pre-eclampsia, sepsis, stillbirth); in that case, the platelet count must have been checked in the previous 6 hours.

A platelet count between 75 - 100 x 10^9/L is safe in a healthy woman, providing the clotting screen is normal. However, in pre-eclampsia, the platelet function can be disturbed, even if the count is relatively normal. A coagulation screen and a repeat platelet count should be performed in women with pre-eclampsia within six hours of a request for an epidural. If the platelet count is 75-100 x 10^9/L and the coagulation screen is normal, it is acceptable to insert an epidural catheter.

If the platelet count is between 50 - 75 x 10^9/L, neuraxial anaesthesia should only be sited by an experienced obstetric anaesthetist, depending on individual risk assessment (there may be very good reasons for avoiding GA). The woman must be carefully monitored for any signs of a developing epidural haematoma (e.g. paraplegia, sensory loss, bladder/bowel dysfunction, severe back pain). ***(2)***

A platelet count below 50 x 10^9/L is an <u>absolute contra-indication</u> to neuraxial anaesthesia

Haematological disorders

Von Willebrand's disease and other clotting disorders (e.g. Factor V Leiden, protein C or S deficiency) are relatively common co-morbidities in pregnant women. These patients will usually be under joint care with a haematology team, and a plan for delivery should be in the notes. If in doubt about the management of these patients, please refer to one of the obstetric anaesthetic consultants and to the haematology team.

Low Molecular Weight Heparin (LMWH) and DOAC's

All women should have a documented VTE risk assessment performed in early pregnancy. Risk assessment should be repeated if the woman is admitted to hospital for any reason or develops other antenatal problems.

LMWH should be considered for antenatal women at high risk of VTE (e.g. thrombophilia, antiphospholipid syndrome, SLE) ***(3)***, and these women should be managed in a joint obstetric/haematology clinic. Both unfractionated heparin and LMWH are safe in pregnancy as they do not cross the placenta. The risk of epidural haematoma in this group is unknown but very rare. A routine clotting screen (PT, APTT) will not pick up LMWH activity. Monitoring the anti-Xa level is not recommended, as it is not predictive of bleeding risk. Published AAGBI guidelines give recommendations on timing of neuraxial anaesthesia in patients receiving anticoagulation. ***(4,5)***

Prophylactic LMWH: Epidural insertion / removal – wait for at least 12 hours after last prophylactic LMWH dose. Wait at least 4 hours after catheter insertion or removal before giving the next prophylactic dose of LMWH. ***(5)***
This interval should be increased to 8 hours if the catheter placement was difficult or required multiple attempts. Longer intervals may be required in high dose prophylactic regimes (e.g. BD dosing in obese patients), and in women with impaired renal function.

Therapeutic LMWH (1 mg/kg BD antenatal; 1.5 mg/kg OD postnatal): Wait at least 24 hours before inserting or removing an epidural catheter. Wait at least 4 hours after catheter insertion or removal before giving the next dose of LMWH ***(5)***

Unfractionated heparin: Wait 4 hours after stopping heparin before inserting or removing an epidural catheter. After insertion, heparin can be restarted after one hour.

Direct oral anticoagulants (DOACs): may be used for pregnant women who have had a VTE. Current AAGBI recommendations ***(5)*** state that DOAC's such as rivaroxaban, dabigatran & apixaban should be stopped for at least 48 hours before neuraxial procedures such as lumbar epidurals are performed. DOAC's should not be restarted for at least 6 hours after such procedures. Women with impaired renal function (CrCl <30 ml/min) will require a longer period of time for DOAC clearance.

Consent for epidural analgesia / anaesthesia

The time from being informed of the request to attending the woman should ideally not exceed 30 minutes unless in exceptional circumstances ***(6,7)***. At QEH, if the 6611 bleepholder is busy in theatre, then the 6316 bleepholder should attend if available. At UHL if the 5014 bleepholder is busy, then the 5000 bleepholder should attend if available. If both are busy, and there is a significant delay >60 minutes, please escalate to the duty consultant. We aim to achieve >80% attendance within 30 minutes of a request for an epidural, and >90% within 60 minutes ***(7)***.

Introduce yourself to the patient and the midwife, explain the procedure and the important complications, and obtain verbal consent. Although signed written consent is not needed, your explanation should be documented on the epidural booklet, since it is not uncommon for women to subsequently deny that they were warned about a specific complication. Do not trivialise important complications or dismiss them as irrelevant; the aim is to be frank and factual without being unnecessarily alarming. Women suffering a particularly painful labour, or under the influence of nitrous oxide / pethidine may not be amenable to prolonged explanations; in that case, record the circumstances in the notes, and have a full discussion once analgesia is established. Always offer women the opportunity to ask questions and give honest answers.
When an epidural is requested, ask the midwife to ensure that the woman is given a copy of the OAA Epidural Information Card (which can be downloaded and printed in numerous languages from the www.labourpains.org website – see Appendix 3) and the information sheet on mobile epidurals. Laminated copies are kept on the epidural trolleys.

You must tell (and document on the chart) the woman about:

- Potential failure to achieve good analgesia – about 1:8 of cases
- Possible need to re-site the catheter – about 5% of cases
- Post-dural puncture headache – about 1:100-200 incidence
- Weak legs from motor block; she must have assistance if attempting to stand/walk. Note that standing/walking is contra-indicated if any subjective or objective motor block is present
- Hypotension, and the need for regular BP measurement
- Risk of haematoma / infection
    - Temporary nerve damage – altered sensation / weakness 1:1000
    - Permanent harm including meningitis, paralysis or death <1:100000 (NAP3) ***(8)***

In addition, consider:

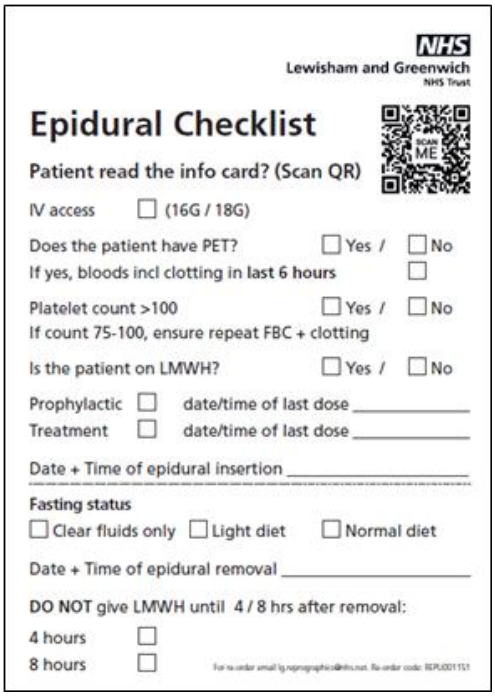
- Nausea / vomiting
- Pruritus
- Requirement for urinary catheter
- Bruising and localised tenderness
- Long-term backache is ***not*** caused by regional analgesia ***(9)***

Epidural Checklist

The epidural checklist was developed in response to a near-miss incident involving the mistiming of LMWH and epidural insertion/removal.

The epidural checklist should be initiated by the midwife before calling the anaesthetist to site the epidural.

The QR code on the checklist links directly to the 'Epidural Information Card' on the OAA Labour Pains website. This should be scanned by the patient and their partner and ideally read ahead of the anaesthetist's arrival. Laminated translations are kept on the epidural trolleys.



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Epidural Checklist

Patient read the info card? (Scan QR)

IV access ☐ (16G / 18G)

Does the patient have PET? ☐ Yes / ☐ No
If yes, bloods incl clotting in last 6 hours ☐

Platelet count >100 ☐ Yes / ☐ No
If count 75-100, ensure repeat FBC + clotting

Is the patient on LMWH? ☐ Yes / ☐ No

Prophylactic ☐ date/time of last dose _____
Treatment ☐ date/time of last dose _____

Date + Time of epidural insertion _____

Fasting status
☐ Clear fluids only ☐ Light diet ☐ Normal diet

Date + Time of epidural removal _____

DO NOT give LMWH until 4 / 8 hrs after removal:
4 hours ☐
8 hours ☐

When contacted to site an epidural, please confirm that the midwife has completed the first part of the checklist before attending. This will help to ensure that the patient is prepared for the epidural, minimise delays and provide an additional safety net to check whether the patient has received LMWH in the peri-natal period.

After siting an epidural, please complete the date and time of epidural insertion and indicate the most appropriate fasting status for the patient. Removal of the epidural and earliest time for LMWH dose should also be recorded on the checklist.

Alongside this, please log all epidural insertions and removals on iCare under 'Assessments/Fluid Balance ® Adult Lines - Devices ® Epidural'. All epidural documentation is transferring to iCare in August 2024 and this links with the electronic drug chart to minimise risk of LMWH errors. An iCare epidural insertion form has been generated, and once active on iCare, completion of this form will be mandatory. The epidural checklist, completed by the midwife, will also be on iCare so the hardcopy checklist will no longer be required.

Procedure

- Do not perform the procedure unless a midwife is in the room
- A baseline BP should be measured, and fetal CTG monitoring should be established prior to positioning
- A 16G IV cannula should be inserted, and blood sent for FBC and Group & Save if not already done; a Hartmann's infusion should be immediately available, but there is no need to give a pre-load
- Ephedrine should be readily available
- The woman should be positioned in the left lateral or sitting position, depending on patient co-operation, CTG monitoring, and anaesthetist experience
- A pre-emptive ultrasound scan using a curvilinear probe can be considered, whenever expertise is available, before attempting epidural labour analgesia in potentially difficult cases e.g. obesity, spinal deformity, previous difficulty
- Maintain strict asepsis – this is vitally important
    - Wear a fresh **mask** for each neuraxial procedure ***(10)***
    - Surgical scrub, hat, gown, gloves
    - (QEH) 0.5% chlorhexidine spray (Hydrex) and allow it to completely dry, and sterile drapes
    - (UHL) 2% chlorhexidine sticks (Chloraprep) and allow to dry, and sterile drapes
- Aim to site at the L3-L4 interspace
- Infiltrate the skin and subcutaneous tissue with 1% lidocaine
- We use 16G NRFit Tuohy (Pajunk) epidural kits; 18G Tuohy needles are also available
- Insert the Tuohy needle into the interspace. Once it has entered the supraspinous ligament, withdraw the stylet and attach a 'loss-of-resistance' syringe filled with 10ml sterile 0.9% saline. The use of air is potentially associated

with a higher dural tap rate, and complications such as pneumocephalus and venous air embolism ***(11)***

- Draw saline up in advance into the loss-of-resistance syringe. It is not acceptable to use a gallipot to contain saline, particularly if there is a risk of inadvertent contamination with chlorhexidine. ***(12)***
- Advance until loss of resistance occurs, identifying the epidural space. Inject a few ml saline to distend the epidural space in order to reduce the incidence of intravascular catheter placement ***(13)***
- The catheter should be threaded through the Tuohy needle, leaving 4-5 cm in the epidural space. Leave 5-6 cm in obese patients.
- If there is difficulty introducing the catheter, **never** withdraw it through the needle as it can shear off or damage the tip so that it breaks subsequently. If the catheter has to be withdrawn, withdraw the needle as well and start again
- Aspirate, making sure there is no blood in the catheter and it is not intrathecal; if blood is aspirated, flush the catheter with saline and withdraw 1cm before aspirating again. If blood is still aspirated, remove the catheter and start again.
- Firmly secure the epidural catheter with a LockIt Plus™ catheter securement device ***(14)*** (or alternative if not available), Bioclusive transparent dressing and Mefix dressing

Test dose

- Give 15 ml of low-dose mixture (0.1% levo-bupivacaine with 2 micrograms/ml fentanyl), drawn from the pre-mixed bag or administered via the Bodyguard pump
- This is both a test dose and a loading dose; give slowly and incrementally (3ml, 6ml, 6ml – 3 mins apart with the first dose (3ml) being the test dose), and check the block and BP for at least 10 minutes before leaving the room.
- It should not lead to sudden motor block unless the catheter is intrathecal, and accidental intravenous administration will not cause local anaesthetic toxicity (nor will it produce analgesia).
- ***Do not use 0.25% or 0.5% bupivacaine as a test dose for labour epidurals***
- Check BP at 5 minutes intervals for 20 minutes; the midwife must remain continuously in the room during this period
- Sudden hypotension should raise concern of intrathecal/subdural placement – consider removing the catheter and re-siting, or seeking senior advice

- Pain relief should be achieved within 15 minutes; check and document the block height

Maintenance infusion

- Programme the Bodyguard (CME Medical) pump
    - Level 1 code 611
    - Use the pre-set protocol for UHL or QEH
    - PCEA with 8ml (UHL) or 10ml (QEH) bolus at 20 minute interval lockout; **no** background infusion, maximum 120 ml / 4 hours
- Pre-mixed 250ml bags of the low-dose mixture are stored in the controlled drugs cupboard; insert into the pump holder and prime the giving set *before* connecting to the epidural catheter
- Please remember to sign the Controlled Drugs book
- Document the epidural insertion on iCare as an *ad hoc* recording form – *maternity folder - obs anaesthetics – epidural insertion*
- The midwife must be present for at least 20 minutes after each epidural top-up, to monitor maternal blood pressure at 5 minute intervals and fetal heart rate.
- If maternal systolic BP falls <90 mmHg, turn the mother on her side and give IV fluids; the anaesthetist should be called to review, and give vasopressors as required
- If analgesia is inadequate after 2 top-up doses, the anaesthetist should be called to assess the block

Mobilisation

- After an uncomplicated epidural insertion and initial loading dose, if observations are stable and the CTG normal after 20 minutes, and if there is no motor block (able to straight leg raise against resistance), the mother can sit out cautiously on the edge of the bed with the midwife in front of her to prevent falling, before attempting to stand. If leg weakness is felt, the mother should be assisted back into a seated position. Once standing, ask her to stand on her toes briefly, and then attempt to squat. If she can do these safely, she can then mobilise around the room accompanied at all times by the midwife or a trained support worker; she must return to bed before any subsequent top-up is given. CTG monitoring should take

place for a minimum of 15 minutes in each hour. Consider use of telemetric CTG monitoring.
    - If an abnormal CTG requires continuous monitoring, a woman may still be able to mobilise within the limits of the monitoring e.g. stand by the bed, sit in a chair.
    - Contra-indications to mobilisation include obesity (BMI>40), severe pre-eclampsia, and significant maternal cardiac, respiratory or neurological disease
    - In low-risk cases, a urinary catheter should not be routinely inserted; if mobilising, the woman can go to the toilet
    - A woman with an epidural should always have a patent intravenous cannula, but intravenous fluids should only be attached where there is a specific indication; intravenous fluids can be disconnected if mobilising

- Second stage labour can last for several hours; top-ups should continue to be given during this period. **Analgesia should NOT be allowed to wear off during second stage labour – do not disconnect the epidural pump**
- After delivery, the epidural catheter should be removed by the midwife who should check the black catheter tip is present and intact, and document it
    - If it is difficult to remove the catheter or the tip is sheared off, refer to the duty anaesthetic consultant for advice and imaging; neurosurgical referral may be required
- A yellow wristband bracelet should be applied to all women who have received epidural labour analgesia, with the time of the last dose administered plus 4 hours written. At this time, all women who have had epidural analgesia should be able to straight-leg raise; the anaesthetist should be called to review if the patient is unable to do so
- Follow up all women who had a labour epidural the next day
- In QEH, after insertion, the follow-up audit sheet should be placed in the follow-up folder which is kept in Theatre 7 anaesthetic room. At UHL, once an epidural has been inserted, the audit form should be placed in the follow up folder kept on the epidural trolley.
- After follow-up and discharge from anaesthetic care, the information should be entered onto iCare for each patient (*ad hoc – maternity folder – obs anaesthetics – postnatal audit / follow up*)

Combined spinal-epidural analgesia

- In circumstances where immediate pain relief is required (usually for a woman in extreme pain where time of onset from epidural bolus would take too long, or to facilitate positioning for a subsequent epidural, it is acceptable to do an intrathecal injection with 3 ml from the epidural bag using a 25G NRFit Sprotte, and then perform an epidural when the woman is more settled. These are two separate procedures (not needle through needle).
- Document your actions clearly on the epidural chart, and inform the midwife. Monitor the BP carefully for a minimum of 20 minutes after the spinal injection. Be aware that the epidural test dose will not detect an accidental intrathecal catheter.

Troubleshooting

Inadequate analgesia

- Check the catheter site and the block height with a CoolStick or ethyl chloride spray
- If the upper level of block is inadequate (below T10), give an extra top-up of 10-15 ml low-dose mixture and re-assess after 20 minutes. If successful, consider increasing the bolus dose to 15 ml
- Consider use of a 'one off' 6 – 8ml bolus 0.25% levobupivacaine in advanced labour i.e. cervical dilatation > 6 cm
- If the top-up does not work, consider re-siting the epidural. Don't persist with a poorly working epidural – if it is not functioning properly for analgesia, it will not work for emergency anaesthesia for LSCS
- **Do <u>not</u> use 0.5% levobupivacaine as a top-up for inadequate analgesia**

Missed segment / unilateral block

- Should be considered if there is persistent pain in one place or on one side
- Usually due to catheter migration or dislodgement; occasionally due to the position of the baby
- Inspect the epidural site and check the block level with a CoolStick or ethyl chloride spray; bilateral warm feet implies sympathetic block on both sides
- Lie the woman on her unblocked side and give 10ml top-up low dose mixture
- If it does not resolve, consider withdrawing the catheter by 1-2 cm and resecure, then give a further bolus dose
- If still unsuccessful, offer to re-site the epidural

- Document your findings in the notes and on the follow-up audit sheet

Perineal / suprapubic pain

- Often due to an occipito-posterior position of the baby
- If associated with an adequate upper level of block (up to T8), then consider a stronger top-up with an opioid
- Give up to 10ml 0.25% levo-bupivacaine, with 50 micrograms fentanyl added.
- Sit the mother up to a 45° upright position
- If still inadequate, discuss with the duty consultant

NB: 0.5% levobupivacaine should not be used as a top-up solution for labour analgesia

Epidural accidental disconnections

If the epidural is discovered disconnected distal to the filter (i.e. the filter is still connected safely to the catheter), then it is safe to reconnect after flushing the giving set to ensure there is no air bubble. Do not use alcohol or chlorhexidine swabs to clean the epidural or filter.

If the epidural is discovered to be disconnected proximal to the bacterial filter, then it must be presumed to be contaminated, and the epidural catheter should be removed, and a re-site of a fresh epidural should be offered to the patient. However, if the disconnection was witnessed, and the end of the epidural is kept clean in sterile gauze, it is appropriate to cut 10cm from the end of the catheter with sterile scissors and gloves before reconnecting the bacterial filter. Flush the giving set and filter with the epidural solution before reconnecting.

Complications

Subdural block

- Occurs due to separation of arachnoid from dura by the catheter
- The subdural space has more potential capacity posteriorly; the anterior nerve roots (which transmit motor and sympathetic fibres) are relatively spared
- In contrast to the extradural space, which terminates at the foramen magnum, the subdural space extends intra-cranially
- Presents as a patchy sensory block, often with missed segments and persisting pain; motor block is often minimal
- An unexpectedly high block can develop slowly up to cervical dermatomes over 10-20 minutes; can have an associated Horner's syndrome
- Relative sacral sparing due to predominantly cranial spread
- Blood pressure can be well maintained
- Thought to occur in approximately 0.8% of epidural injections ***(15)***

Management

- A subdural catheter may rupture through the arachnoid following a bolus dose, converting the block from subdural to subarachnoid, with a potential total spinal. In addition, post-dural puncture headache can follow. Therefore, once recognised, the catheter should **not** be left in situ
- Remove the catheter and re-site at a different level
- If surgical anaesthesia is required, consider a combined spinal-epidural technique at another level; a small subarachnoid anaesthetic dose can be supplemented by incremental epidural doses as necessary. If delivery is urgent, general anaesthesia is indicated.

High / Total Spinal

- Usually results from an unrecognised dural tap, or less commonly from migration of an existing epidural catheter
- A high / total spinal presents with severe hypotension, bradycardia, nausea, agitation, upper limb paralysis, and respiratory distress which may progress to sudden apnoea and loss of consciousness

Management

- Call for help. May require immediate intubation and ventilation; perform a rapid sequence induction to protect the airway from aspiration. Reduced anaesthetic doses may be required. Ventilate with 100% oxygen
- Reduce aorto-caval compression with left lateral tilt / wedge; give intravenous fluids and vasopressors as required to maintain BP
- If bradycardia occurs, administer atropine; if *severe* haemodynamic instability occurs, consider IV adrenaline in 25-50 microgram increments
- Fetal distress may require emergency Caesarean section
- The block takes about 2 hours to regress; maintain heavy sedation during this period; transfer to Theatre / PACU (ideally not ICU) under the care of the duty anaesthetist; call for assistance if required and inform the on call consultant
- The event should be fully documented on iCare and a clinical incident form completed online on Ulysses
- The consultant on call should be informed as soon as possible, and the mother should be followed up the next day by an obstetric anaesthetic consultant to discuss the event and answer any questions

3-11 High central neuraxial block v.1

- Can occur with deliberate or accidental injection of local anaesthetic drugs into the subarachnoid space.
- Symptoms are – in sequence – hypotension and bradycardia – difficulty breathing – paralysis of the arms – impaired consciousness – apnoea and unconsciousness.
- Progression through this sequence can be slow or fast.

START

1. Reassure the patient – remember that they may be fully aware.
   - Plan to ensure hypnosis as soon as clinical situation permits.
2. Call for help and inform theatre team of the problem.
3. Treat airway and breathing:
   - Give 100% oxygen.
   - Chin lift / jaw thrust may suffice.
   - Consider supraglottic airway or tracheal intubation (Box A).
4. Treat circulatory insufficiency:
   - Give i.v. fluid by rapid infusion.
   - Elevate the legs. Do not use head-down tilt.
   - In obstetrics, relieve aorto-caval compression.
   - Bradycardia: give atropine or glycopyrrolate (Box B).
   - Hypotension: give metaraminol, phenylephrine or ephedrine (Box B).
   - CPR may be necessary to circulate drugs.
5. If the case is obstetric, consider expedited delivery of the baby to manage:
   - Risk to mother of unrelieved aorto-caval compression
   - Risk to fetus of impaired feto-placental oxygen delivery
6. Consider other causes that may mimic signs and symptoms, including (Box C):
   - Obstetric aorto-caval compression.
   - Local anaesthetic toxicity.
   - Embolism.
   - Vasovagal event.
   - Haemorrhage.
7. Plan ongoing care in a suitable location.

Box A: INDUCING ANAESTHESIA

- Consider reduced dose of hypnotic drug to avoid further hypotension. A full induction dose will not be necessary if the patient's consciousness is already impaired.
- Neuromuscular blockade may not be necessary for tracheal intubation if the patient is unconscious, paralysed and apnoeic.

Box B: DRUG DOSES

Bradycardia:

- Atropine: 0.6-1.2 mg
- Glycopyrrolate: 0.2-0.4 mg

Hypotension:

- Metaraminol: 1-2 mg boluses repeated
- Phenylephrine: 50-100 µg boluses repeated or by infusion
- Ephedrine: 6-12 mg boluses repeated up to max 30 mg (tachyphylaxis limits further usefulness)

Box C: CRITICAL CHANGES

- Cardiac arrest → **2-1**
- Hypotension → **2-4**
- Bradycardia → **2-6**
- Local anaesthetic toxicity → **3-10**

Signs of severe toxicity

- Sudden alteration in mental status, severe agitation or loss of consciousness, with or without tonic-clonic convulsions
- Cardiovascular collapse: sinus bradycardia, conduction blocks, asystole and ventricular tachyarrhythmias may all occur

Immediate management

- Stop injecting the LA; stop any infusion pumps
- Call for help, the cardiac arrest trolley and the Intralipid
- Maintain the airway and, if necessary, give GA and intubate
- Give 100% oxygen and ensure adequate lung ventilation (hyperventilation may help to avoid hypercarbia and increase plasma pH in the presence of metabolic acidosis)
- Confirm or establish intravenous access
- Control seizures: give a benzodiazepine, thiopentone or propofol in small incremental doses; consider neuromuscular blockade if seizures cannot be controlled

Management of cardiac arrest associated with LA injection

- Start CPR using standard ALS protocols ***WITH UTERINE DISPLACEMENT***
- Manage arrhythmias using ALS protocols, but remember that they may be very refractory to treatment.
- Do **NOT** use IV lidocaine!
- Prolonged resuscitation may be necessary
- Give treatment with lipid emulsion (Intralipid)
- Perform a perimortem section, to be started at the 4th minute of maternal cardiac arrest with delivery of the fetus by the 5th minute if the gestational age is >20 weeks

Intralipid protocol

Treatment of severe local anaesthetic-induced cardiovascular toxicity with lipid emulsion (Intralipid 20% ®) – *(adapted from Association of Anaesthetists Quick Reference Handbook 2023)*

If the patient does not respond rapidly to standard procedures, 20% lipid emulsion (*Intralipid)* should be given.

- Give an initial IV bolus injection of 20% lipid emulsion *(Intralipid*) 1.5 ml/kg over 2-3 minutes
- Continue CPR
- Start an IV infusion of Intralipid at 15 ml/kg/hr; use booking weight
- At 5 and 10 minutes, if spontaneous circulation has not returned or is deteriorating, give a maximum of two further bolus doses of 1.5 ml/kg over 1 minute, 5 minutes apart
- If a repeat bolus is given, double the infusion rate to 30 ml/kg/hr
- Continue infusion until cardiovascular stability and adequate circulation are restored, or the maximum cumulative dose of Intralipid has been given
- Do not exceed the maximum cumulative dose of **12 ml/kg** *(840 ml for a 70kg adult)*

Remember

- Recovery from LA-induced cardiac arrest may take >1 hour; CPR should be continued until spontaneous circulation is restored
- Propofol is **NOT** a suitable substitute for Intralipid
- Replace the supply of Intralipid 20% after use (inform LW midwife in charge / Pharmacy)

Follow-up action

- Transfer to ICU for further cardiac monitoring
- Exclude pancreatitis by regular clinical review and daily amylase or lipase levels
- Complete a clinical incident reporting form on Ulysses, and inform the lead consultant obstetric anaesthetist and the Clinical Director for Anaesthetics; if Intralipid has been used, report to the international registry at www.lipidrescue.org

Your nearest bag of Intralipid® is kept in:

QEH - Main Theatre PACU / Labour Ward CD cupboard

UHL - on the IV fluid trolley in Labour Ward theatre anaesthetic room / Pharmacy cupboard between Ravensbourne NB Theatres 3 & 4; also kept in Riverside theatres pharmacy cupboard

3-10 Local anaesthetic toxicity v.2

Signs of severe toxicity:
- Sudden alteration in mental status, severe agitation or loss of consciousness, with or without tonic-clonic convulsions.
- Cardiovascular collapse: sinus bradycardia, conduction blocks, asystole and ventricular tachyarrhythmias may all occur.
- Local anaesthetic toxicity may occur some time after an initial injection.

START

❶ Stop injecting the local anaesthetic (remember infusion pumps).

❷ Call for help and inform immediate clinical team of problem.

❸ Call for cardiac arrest trolley and lipid rescue pack.

❹ Give 100% oxygen and ensure adequate lung ventilation:

- Maintain the airway and if necessary secure it with a tracheal tube.
- Avoid hypercarbia – consider mild hyperventilation.

❺ Confirm or establish intravenous access.

❻ **If circulatory arrest:**

- Start continuous CPR using standard protocols (→ **2-1**) **but**:
- **Give** intravenous lipid emulsion (Box A).
- **Use smaller adrenaline dose** (**≤ 1µg.kg^{-1}** instead of 1 mg)
- Avoid vasopressin.
- Recovery may take >1 hour.
- Consider the use of cardiopulmonary bypass if available.

If no circulatory arrest:

- Conventional therapies to treat hypotension, brady- and tachyarrhythmia.
- **Consider** intravenous lipid emulsion (Box A).

❼ Control seizures:

- Small incremental dose of benzodiazepine is drug of choice.
- Thiopental or propofol can be used, but beware negative inotropic effect.
- Consider neuromuscular blockade if seizures cannot be controlled.

Box A: LIPID EMULSION REGIME

USE 20% Intralipid® (propofol is not a suitable substitute)

Immediately
- Give an initial i.v. bolus of lipid emulsion 1.5 ml.kg^{-1} over 2-3 min (~100 ml for a 70 kg adult)
- Start an i.v. infusion of lipid emulsion at 15 ml.kg^{-1}.h^{-1} (17.5 ml.min^{-1} for a 70 kg adult)

At 5 and 10 minutes:
- Give a repeat bolus (same dose) if:
  - cardiovascular stability has not been restored or
  - an adequate circulation deteriorates

At any time after 5 minutes:
- Double the rate to 30 ml.kg^{-1}.h^{-1} if:
  - cardiovascular stability has not been restored or
  - an adequate circulation deteriorates

Do not exceed maximum cumulative dose 12 ml.kg^{-1} (70 kg: 840 ml)

Box B: CRITICAL CHANGES

Cardiac arrest → Check already done ❶ to ❺, then → ❻

Box C: AFTER THE EVENT

Arrange safe transfer to appropriate clinical area
Exclude pancreatitis: regular clinical review, daily amylase or lipase
Report case on your local critical incident system and to the relevant national system (these vary between each devolved nation and in Ireland)

Obstetric Cardiac Arrest

Resuscitation Council UK

MBRRACE-UK

Alterations in maternal physiology and exacerbations of pregnancy related pathologies must be considered. Priorities include calling the appropriate team members, relieving aortocaval compression, effective cardiopulmonary resuscitation (CPR), consideration of causes and performing a timely emergency hysterotomy (perimortem caesarean section) when ≥ 20 weeks.

START

1. **Confirm cardiac arrest** and **call for help. Declare 'Obstetric cardiac arrest'**
   - Team for mother and team for neonate if > 20 weeks
2. **Lie flat, apply manual uterine displacement to the left**
   - Or left lateral tilt (from head to toe at an angle of 15–30° on a firm surface)
3. **Commence CPR** and request **cardiac arrest trolley**
   - Standard CPR ratios and hand position apply
   - **Evaluate potential causes (Box A)**
4. **Identify team leader, allocate roles including scribe**
   - Note time
5. **Apply defibrillation pads and check cardiac rhythm** (defibrillation is safe in pregnancy and no changes to standard shock energies are required))
   - if VF / pulseless VT → defibrillation and first adrenaline and amiodarone after 3rd shock
   - If PEA / asystole → resume CPR and give first adrenaline immediately
   - Check rhythm and pulse every 2 minutes
   - Repeat adrenaline every 3-5 minutes
6. **Maintain airway and ventilation**
   - Give 100% oxygen using bag-valve-mask device
   - Insert supraglottic airway with drain port –*or*– tracheal tube if trained to do so (intubation may be difficult, and airway pressures may be higher)
   - Apply waveform capnography monitoring to airway
   - If expired CO_2 is absent, presume oesophageal intubation until absolutely excluded
7. **Circulation**
   - I.V. access above the diaphragm, if fails or impossible use upper limb intraosseous (IO)
   - See **Box B** for reminders about drugs
   - Consider extracorporeal CPR (ECPR) if available
8. **Emergency hysterotomy (perimortem caesarean section)**
   - Perform if ≥ 20 weeks gestation, to improve maternal outcome
   - Perform immediately if maternal fatal injuries or prolonged pre-hospital arrest
   - Perform by 5 minutes if no return of spontaneous circulation
9. **Post resuscitation from haemorrhage - activate Massive Haemorrhage Protocol**
   Consider uterotonic drugs, fibrinogen and tranexamic acid
   Uterine tamponage / sutures, aortic compression, hysterectomy

Version 1.1

Box A: POTENTIAL CAUSES *4H's and 4T's* (specific to obstetrics)	
Hypoxia	Respiratory – Pulmonary embolus (PE), Failed intubation, aspiration Heart failure Anaphylaxis Eclampsia / PET – pulmonary oedema, seizure
Hypovolaemia	Haemorrhage – obstetric (remember concealed), abnormal placentation, uterine rupture, atony, splenic artery/hepatic rupture, aneurysm rupture Cardiac – arrhythmia, myocardial infarction (MI) Distributive – sepsis, high regional block, anaphylaxis
Hypo/hyperkalaemia	Also consider blood sugar, sodium, calcium and magnesium levels
Hypothermia	
Tamponade	Aortic dissection, peripartum cardiomyopathy, trauma
Thrombosis	Amniotic fluid embolus, PE, MI, air embolism
Toxins	Local anaesthetic, magnesium, illicit drugs
Tension pneumothorax	Entonox in pre-existing pneumothorax, trauma

Box B: IV DRUGS FOR USE DURING CARDIAC ARREST	
Fluids	**500 mL IV** crystalloid bolus
Adrenaline	**1 mg IV** every 3-5 minutes in non-shockable or after 3rd shock
Amiodarone	**300 mg IV** after 3rd shock
Atropine	**0.5-1 mg IV** up to 3 mg if vagal tone likely cause
Calcium chloride	**10% 10 mL** IV for Mg overdose, low calcium or hyperkalaemia
Magnesium	**2 g IV** for polymorphic VT / hypomagnesaemia, **4 g IV** for eclampsia
Thrombolysis/PCI	For suspected massive pulmonary embolus / MI
Tranexamic acid	**1 g** if haemorrhage
Intralipid	**1.5 mL kg^{-1} IV** bolus and **15 mL kg^{-1} hr^{-1} IV** infusion

Obstetric Anaesthetists' Association

GUIDELINES 2021

Accidental dural puncture

- Occurs in approximately 1.5% of epidural insertions ***(16)***
- May occur with the Tuohy needle, or CSF can be aspirated from the epidural catheter
- If there is any doubt whether fluid is CSF or saline, test for presence of glucose/protein with urine dipstick

Management

- *Option A – Remove Tuohy needle*
  - Should be done in most cases
  - Site epidural catheter at another lumbar interspace, preferably one space higher
  - Give a test dose (3 ml 0.1% levobupivacaine with 2 microgram/ml fentanyl initially). If observations remain stable and there is no evidence of intrathecal spread, a further 12 ml can be given incrementally after 10 minutes. Check the level of the block before leaving the patient
  - If the block is acceptable after 20 minutes (i.e. no significant motor block, and sensory block no higher than T8), then commence PCEA standard protocol with no background infusion
  - The anaesthetist remains fully responsible for the epidural following an accidental dural puncture, and must regularly check to ensure there has been no intrathecal spread of the local anaesthetic
  - The midwife should be continuously present and monitor the level of sensory block and any motor block every 30 minutes, and inform the anaesthetist urgently if the block is increasing, if hypotension occurs, or if the mother complains of breathing difficulties
  - Delivery can proceed as normal. Prolonged pushing should be avoided if possible.
  - If the mother needs a Caesarean section, extreme caution is required when giving a concentrated top-up – give slowly and incrementally with careful checking of the block height
  - Following delivery, prescribe regular oral analgesia and encourage fluid intake. Lactulose should also be given to limit constipation and straining

- The epidural catheter should be removed after delivery, and not used for post-delivery analgesia

➢ *<u>Option B</u> – Do not remove Tuohy needle*

- In obese patients or when the risk of a repeat tap is high, it may be appropriate to thread an intrathecal catheter for analgesia / anaesthesia in these circumstances
- Thread 3-4 cm epidural catheter into the subarachnoid space and secure firmly
- Label the catheter clearly as a spinal catheter
- For labour analgesia, the first dose should be 2.5ml of the standard pre-mixed 'low-dose' epidural bag - 0.1% levobupivacaine (2.5mg), with 2 micrograms/ml fentanyl (5 micrograms), followed with a 0.9% sodium chloride flush of 2ml (remember the 1-2ml dead space of the catheter and filter)
- Further doses should be 2ml of the standard epidural mixture (0.1% levobupivacaine with 2 microgram/ml fentanyl). **All doses should be given by the anaesthetist only, who must remain in the labour room for ten minutes after each dose**
- For Caesarean section, check the upper level of the block. Give a single intrathecal dose of 200 micrograms diamorphine, followed by 0.5 ml incremental doses of 0.5% hyperbaric bupivacaine (2.5mg) until the block height reaches T4
- The catheter should be removed by the anaesthetist following delivery; it must *not* be left in situ. Safe removal should be documented on iCare.

<u>In all cases:</u>

- Inform the duty consultant anaesthetist, obstetricians and midwives of what has happened, and the management plan
- Explain what has happened and the management plan to the woman and her partner
- Document clearly in the maternity notes / on iCare and on the follow-up audit form, and write 'Dural Tap' on the labour ward board
- Ensure that the case is discussed at the next handover, and at subsequent shift changes; use the specific dural puncture follow-up sheet
- Follow up for at least 72 hours to monitor for development of a post-dural puncture headache (PDPH); if the mother is discharged home, she should be

given clear written instructions to return if she subsequently develops a headache

Post dural puncture headache (PDPH)

The incidence of PDPH after accidental dural puncture with a 16G Tuohy needle is >50% **(16).** Headache usually develops within 48 hours but can be delayed for up to seven days or more. It is commonly in a frontal-occipital distribution, extending to the neck and shoulders, and is classically worse on sitting up or standing, and relieved by lying flat. Associated symptoms include nausea, vomiting, visual symptoms (diplopia, blurred vision, photophobia, 6th nerve palsy), neck stiffness, tinnitus. It is often severe and incapacitating, preventing the mother from caring for her baby and causing delayed discharge. It usually lasts for 5-10 days, but can occasionally persist for weeks.

A full history and neurological examination must be taken to establish the diagnosis and exclude other potential causes of postnatal headache. Other causes of postpartum headache include:

- Fatigue / tension headache
- Migraine
- Infection, including meningitis / encephalitis
- Pre-eclampsia
- Intracranial pathology, including idiopathic intracranial hypertension, tumour, intracranial or subarachnoid haemorrhage, and cortical vein thrombosis

Management

- Assess the woman for symptoms and severity of headache
    - Examine for neck stiffness, rash, photophobia; check for pyrexia
    - Perform neurological examination, including cranial nerves and document fully in notes
    - Inform the duty consultant anaesthetist, and discuss your findings and the management plan; document on the dural puncture sheet kept in the follow-up folder
    - Explain the situation to the woman and her partner; discuss treatment options with her, and advise that an epidural blood patch will be offered after 48 hours

- Inform the obstetricians and midwives; ensure regular review and handover at each shift change
- Refer to the neurologists if concerned, or if uncertain of diagnosis and you cannot exclude other causes

- **If PDPH is suspected:**
- Encourage oral fluid intake including caffeinated drinks; over-hydration is not necessary
- Prescribe regular oral analgesia: paracetamol 1g QDS, and ibuprofen 400mg TDS (if not contra-indicated)
- If headache is severe, consider dihydrocodeine 30mg every four hours orally (maximum of 180mg in 24 hours)
- Prescribe antiemetics if vomiting
- Prescribe lactulose 15ml BD orally to prevent constipation (especially if requiring dihydrocodeine)
- Repeat FBC, U&E, clotting
- Regular observations by midwives (temperature, BP, HR); the woman should be reviewed every 6-8 hrs by the anaesthetic team (and documented)
- If 48 hours after the dural tap, the headache is still significant, an epidural blood patch should be offered. If there are signs of cranial nerve involvement, then an epidural blood patch may be offered sooner.

Epidural Blood Patch

- This procedure should be performed by (or with) an obstetric or on-call consultant anaesthetist
- All blood patches should be performed in theatre using a strict aseptic technique
- Give a full explanation to the patient and obtain written consent.
    - Complete and permanent relief of symptoms following an epidural blood patch occurs in only one third of cases, and it is common for the blood patch to be repeated. Partial relief may be achieved in a further third of patients.
    - The woman may experience back pain, or pain referred to her hips/leg during or immediately after the procedure (approx. 50% incidence).

  - She will need to lie supine for two hours afterwards, before mobilising cautiously.
  - The OAA information leaflet “Headache after an epidural or spinal injection” can be used to aid the consent process; translations are available from labourpains.org
- The patient must be apyrexial <37.5°C, with no red or amber flags of sepsis – otherwise do *not* perform the blood patch
- Perform the procedure in theatre under strict aseptic technique; both operators should be scrubbed, masked and gowned; both the epidural site and venepuncture site should be cleaned with 0.5% chlorhexidine spray, which is allowed to dry, and prepared with a sterile drape
- The Tuohy needle should be inserted in the same interspace as the original puncture site or one level below (MRI scans have demonstrated that a blood patch spreads over 7-10 vertebral levels with mainly cephalad flow) ***(17)***
- Once the epiduralist has entered the epidural space, the venepuncturist should take 20 ml of blood aseptically and pass the syringe to the epiduralist.
- The blood should be injected slowly through the Tuohy needle. Back or leg pain due to arachnoid irritation can occur and may worsen with increasing volume injected; however, the larger the volume injected, the better the result. If pain occurs, slow down or pause the injection.
- Flush the Tuohy needle with 2 ml 0.9% sodium chloride prior to removal. Apply Opsite spray and an adhesive dressing.
- Ask the patient to lie flat for at least two hours, with observations every 30 mins before cautiously mobilising
- Prescribe lactulose 15ml BD orally; advise the woman to avoid straining and heavy lifting

- The patient should be reviewed by the duty anaesthetist after 4 hours, and then 12 hourly until discharge; document on iCare and on the follow-up audit sheet
- On discharge, the woman should be given the telephone details for Labour Ward triage to contact the on-call anaesthetist by Labour Ward in case of symptom recurrence or any other complications
- If the headache does not fully resolve, or recurs after an initial successful blood patch, a second epidural blood patch can be attempted.

- If this is still not successful, or if the neurological presentation changes, an urgent neurology referral and MRI scan are indicated to exclude other causes of headache.

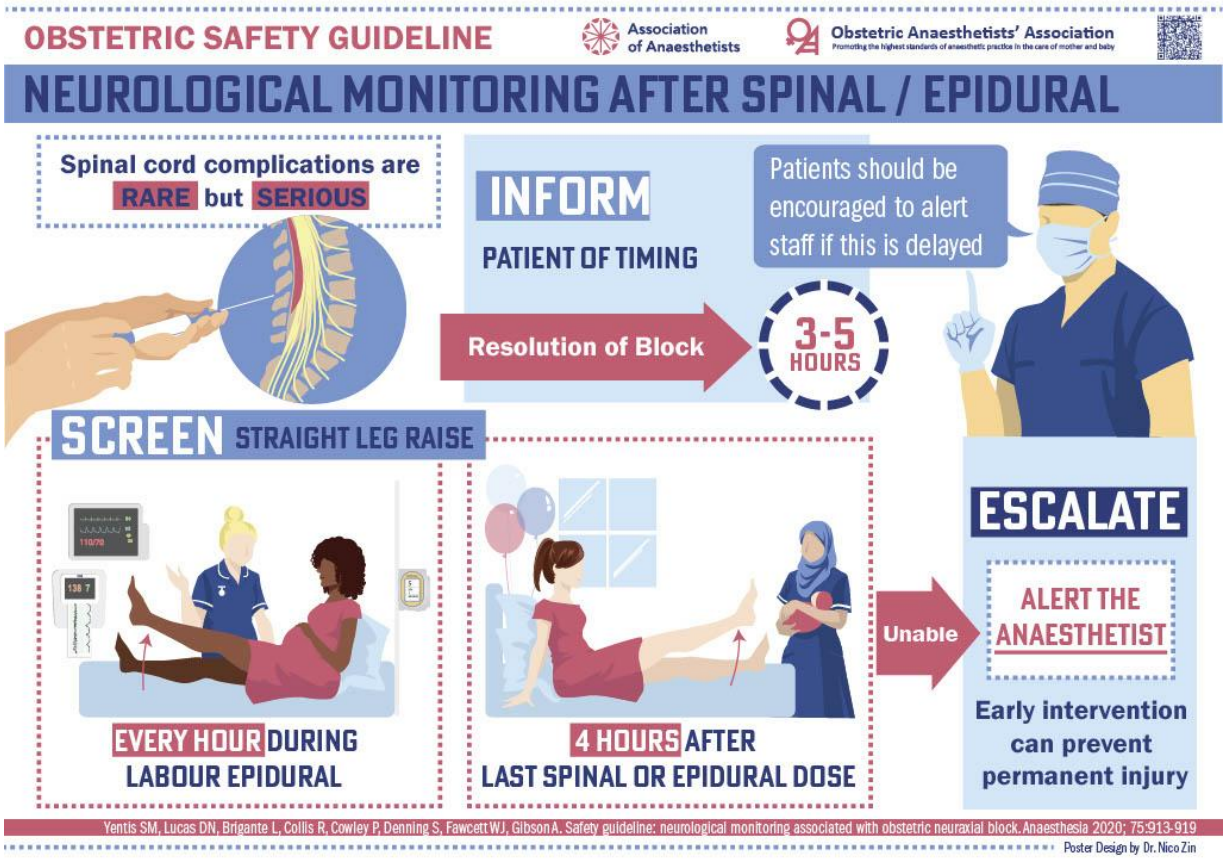
- Following the MBRRACE-UK 2015 report in which two deaths following accidental dural puncture were described, all patients with a recognised dural puncture should have routine follow-up ***(18).*** Please ensure an appointment is arranged in the anaesthetic antenatal clinic within six weeks – this request can be emailed to the lead consultant obstetric anaesthetist.

- The use of an epidural blood patch may be acceptable to some Jehovah's Witnesses, but not all. Clear written consent and documentation is essential in such patients ***(19)***

- The use of a blood patch does not affect the success of subsequent epidural blocks

Management of Prolonged Neurological Deficits

A woman should be able to straight-leg raise at four hours from her last dose of epidural or spinal anaesthetic drugs. Neurological injury following delivery has long been recognised and can been catastrophic; its causes may be intrinsic to the process of labour and delivery, or the result of obstetric or anaesthetic intervention. Fortunately the incidence of injury resulting in persistent neurological deficit is very low ***(8)***, but it remains a feared complication with potential medicolegal ramifications. The temporal association between neuraxial procedures for obstetric anaesthesia and the onset of neurological symptoms means that the anaesthetist is often the first port of call when a woman complains of neurological problems after delivery. Therefore, despite the majority of nerve injuries being related to factors other than neuraxial procedures, it is vital for anaesthetists to have a good knowledge of the diagnosis, investigation and management of potential neurological injuries. ***(20)***



- Types of neurological deficits which may present include:
  - Central compressive neuropathy
    - Epidural haematoma or abscess
    - Cauda equina syndrome
  - Peripheral nerve injuries
    - Associated with obstructed labour / instrumental delivery, usually affecting lumbo-sacral trunk, obturator nerve, or lateral cutaneous nerve of the thigh
  - Arachnoiditis
  - Meningitis
  - Ischaemic injury
- Clinical signs of central pathology include:
  - Acute onset back and neuropathic leg pain
  - Leg weakness and numbness
  - Urinary and anal dysfunction
  - Localised tenderness
  - Fever, headache, neck stiffness; raised WCC & CRP

Suspicions of a vertebral canal haematoma should prompt an emergency MRI request – management is time-critical. Adverse neurological outcome is directly related to the time interval from haematoma formation to surgical decompression, with an interval >8 hours uniformly associated with permanent neurological injury. Out of hours, as MRI cannot be easily accessed locally, the patient should be referred urgently to a tertiary centre (the neurosurgeons at King's College Hospital is the first port of call).

Symptoms of abscess formation may not present until 4-10 days postpartum, but should be rapidly treated with antibiotics on suspicion and referral for neurosurgical drainage.

Peripheral nerve injury most commonly presents as postpartum foot drop, lateral femoral cutaneous neuropathy, or obturator nerve injury. Risk factors include prolonged second stage, and prolonged lithotomy position. Neuraxial anaesthesia may indirectly contribute as women with sensory blockade from labour analgesia may not be aware of nerve compression symptoms or may not be able to change their body position in a timely manner.

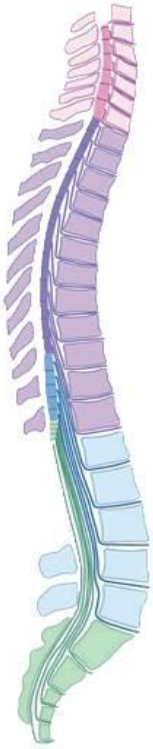
IDENTIFY

HISTORY & EXAMINATION

DISCUSS WITH CONSULTANT

PROVISIONAL DIAGNOSIS

TAKE APPROPRIATE ACTION



Potential neurological deficit identified to anaesthetist by patient / midwife / obstetrician

History: neurological symptoms, drugs, labour, anaesthetic technique

Examination: full neurological examination, including sensory mapping

In hours: Discuss with consultant obstetric anaesthetist or duty consultant

Out of hours: Discuss with on call consultant anaesthetist (urgent if evidence of central pathology - otherwise next morning)

Clinical Diagnosis suggestive of...

Central Pathology

1. Urgent consultant review
2. Referral for urgent MRI
3. Inform obstetricians
4. Early liaison with neurosurgeons at King's
5. Critical incident report

Peripheral Nerve Injury

1. Discuss finding with patient
2. If significant motor block - urgent MRI +/- nerve conduction studies, with Neurology referral
3. Inform obstetricians, and document carefully; daily follow-up until discharged
4. Refer to physio; may need ankle splint prior to discharge
5. Arrange follow-up at 6 weeks; telephone follow-up and earlier review if required

No evidence of neurological deficit

1. Reassure patient of clinical findings
2. Daily anaesthetic follow-up until discharge, using follow-up data sheets
3. Carefully document all findings in notes

Remifentanil PCA

Currently this technique is only available at UHL – depending on results it may be extended to QEH in 2024/5 once the necessary training and equipment purchase have been achieved. Please refer to the Trust intranet for further details, and for the patient information sheet in the Remifentanil Patient Controlled Analgesia guideline.
Remifentanil is an effective analgesic option for use in the intrapartum period. It acts within 1-2 minutes and suited to patient-controlled analgesia (PCA), and offers another analgesia choice for women in labour. However, it does come with a risk of respiratory depression and oxygen desaturation, and requires continuous and careful monitoring. ***(21)***

Indications

Remifentanil PCA provides alternative analgesia in patients who do not want, or cannot have an epidural. It may be used when epidural analgesia is contraindicated and other forms of analgesia are ineffective.

Examples of scenarios when it might be appropriate to use a remifentanil PCA include:
· Coagulopathy, thrombocytopenia orl anticoagulation
· Metalwork in the lumbar spine
· Other contra-indications for epidural analgesia
· Sepsis
· Multiple failed attempts at epidural
· Patient refusing/declining epidural; patient request

Criteria for use

Remifentanil must be prescribed by an anaesthetist before setting up. A midwife, who has attended a remifentanil PCA training session and passed a competency test in the use of remifentanil, should be assigned to give continuous uninterrupted one-to-one care. The patient should **not** under any circumstances have access to the PCA unless the midwife is present.

Establish SpO_2 monitoring before the patient begins to use the PCA and monitor continuously whilst the remifentanil PCA is in use. Call obstetric anaesthetist if $SpO_2 \leq 94\%$ on oxygen 2L/min via nasal specs or respiratory rate < 8/min at any point during PCA use.

Entonox (50:50 oxygen: nitrous oxide mix) is frequently required in addition to remifentanil.

Midwifery staff should complete the remifentanil PCA Observation Chart while the PCA is in use. This should include respiratory rate, pain score, oxygen saturation and sedation score.

Contraindications

Absolute

- Allergy to remifentanil
- No midwife that is trained and certified as competent in the observation of patients receiving remifentanil PCA is available to provide one-to-one care to the patient
- Drug dependency due to unpredictable effects
- Intrauterine death – specifically contraindicated following case reports of cardiac arrest, and there is no clear advantage of remifentanil PCA over morphine PCA in these cases
- Pethidine or other parenteral opioid administration within preceding four hours

Cautions for use of remifentanil PCA

- Discuss with senior obstetrician, consultant anaesthetist, and midwife in charge, and document in notes:
    - Severe cardiac or respiratory disease
    - Pre-eclampsia
    - Gestational age < 36 weeks
    - Non-reassuring CTG trace
    - BMI > 40
    - Learning difficulty

Preparation and management of PCA

Confirm with the midwife in charge that there is a midwife available to provide one-to-one care to the patient being considered for a remifentanil PCA. Discuss with the consultant anaesthetist on call if remifentanil PCA is being considered

If the patient is not yet in established labour and requesting analgesia but is expected to be many hours before delivery, then consider a small dose of pethidine first e.g. 25-50mg IM. It is difficult for the patient to anticipate the next contraction and press the PCA button early enough when the pains are irregular. This would require intense concentration with no possibility of sleep. After hours of this the patient would be unable to concentrate at the time when she really needs to do so in advanced labour. A small dose of pethidine may allow the patient to get some rest before she is established in labour.

Give the patient the remifentanil PCA patient information leaflet and ensure she has had the opportunity to discuss and ask questions. Inform the patient of the possible side-effects of remifentanil, including drowsiness, itching, nausea and dizziness, and in particular that at least 10% using remifentanil PCA will experience transient lowered oxygen saturation levels requiring the administration of additional oxygen via nasal specs.

Ensure that a **dedicated separate** intravenous cannula is in place. Any other intravenous cannulas on the same arm should have an anti-reflux valve and any infusions delivered via a volumetric pump.

Once the patient has consented to the use of a PCA and it has been set up, show the patient how to use the PCA and how to press the button just before the start of a contraction.

A pulse oximeter probe must be attached to the patient before the PCA is started and remain continuously in place during the use of the PCA.

Equipment needed

- 50 ml bag 0.9% sodium chloride
- 50 ml syringe (Luer lock)
- One 2mg ampoule of remifentanil (checked and signed for by two health professionals from the following list: registered midwives, anaesthetist or operating department practitioner)
- Dedicated remifentanil PCA pump (plugged on to mains and charging) set to deliver 0.4 ml (20 microgram) or 0.8 ml (40 microgram) bolus over 15 seconds with a 3 min lockout (see below in prescription)
- Anti-syphon extension set
- Dedicated pink (20G) IV cannula sited as proximally as possible (to reduce arm-brain circulation time)

- Nasal O2 cannula 'specs'
- Naloxone 400 micrograms

Prescription

Anaesthetist to prescribe on iCare drug chart via “Remifentanil Patient Controlled Analgesia (PCA) Inpatient Protocol – Adult”: ·

- Remifentanil PCA: 2 mg remifentanil in 40 ml sodium chloride 0.9% PCA 40ml

  Maximum bolus dose of 0.8 ml (i.e. 40 micrograms) over 15 seconds with a lock out interval of 3 minutes

  In general, commence PCA with bolus dose setting of 0.4 ml i.e. 20 micrograms and increase to 40 microgram bolus if required because of inadequate analgesia.

  Replace every 24 hours

- Ondansetron 4 mg IV every eight hours PRN for nausea/vomiting

- Chlorphenamine 10 mg IV injection three times a day PRN for allergy symptoms

- Naloxone 100 – 400 microgram increments IV as needed for reversal of opiate if the patient is unresponsive or has a prolonged apnoea (call the anaesthetist on bleep 5014 (UHL), bleep 6611 (QEH) if apnoea persists for more than 20 seconds or the patient needs verbal encouragement to breathe on 2 or more occasions)

Syringe preparation

Reconstitute one 2 mg vial with 1ml of 0.9% sodium chloride
Remifentanil solution for PCA to be made up by an appropriately trained anaesthetist or midwife: mix 2 mg of remifentanil solution with 39 ml 0.9% sodium chloride to make a 40 ml solution of concentration 50 microgram/ml remifentanil.

N.B. Remifentanil when diluted should be used immediately. Remifentanil is stable for 24 hours at room temperature after reconstitution.

Dose and Administration

Dedicated remifentanil PCA pump set initially to deliver 0.4 ml (20 microgram) bolus over 15 seconds with a 3 minute lockout with each button press. Increase to maximum 0.8 ml (40 microgram) bolus if required because analgesia is inadequate.

Monitoring

- Midwife to complete remifentanil PCA Observation Chart for all women using remifentanil.
- Record baseline observation parameters
- Anaesthetist must assess patient for 20 minutes or 5 contractions after start of PCA and ensure pain relief is adequate before handing over care to midwife.
- Continue to record observations every 30 minutes documenting the time, pain score, sedation score, respiratory rate and SpO_2
- Continuous SpO_2 monitoring must be established prior to starting PCA and recorded on observation sheet
- Commence oxygen via nasal specs if SpO_2 below 95% (max 2L/min)
- Cardiotocograph (CTG) monitoring is not required unless otherwise indicated
- Care should be taken that the syringe is not allowed to run out; the anaesthetist should be notified when 15 mls of remifentanil solution remains in the syringe pump to allow adequate time for it to be replaced without interruption to analgesia.

Criteria for contacting the labour ward anaesthetist and stopping remifentanil PCA until reviewed

- Sedation score of 3 (unconscious/difficult to wake)
- Respiratory rate of less than 8 breaths per minute
- SpO_2 remaining below 94% despite oxygen via nasal specs (max 2L/min)
- Pump alarming e.g. raised pressure (midwife should **not** flush line as this may flush additional bolus of remifentanil into patient)
- Ineffective pain relief (contact anaesthetist but **do not** stop the remifentanil PCA)

Management of inadequate pain relief

If analgesia is inadequate:

- Check that the patient is pressing the button as early as possible in the contraction
- When the patient's cervix is fully dilated and she is pushing, her PCA requirements will usually be less. If she is very drowsy between contractions or finding it difficult to co-operate, call anaesthetist to consider reducing bolus dose

- Inadequate analgesia, followed by drowsiness between contractions, suggests either that the patient is pressing the button too late, or that the cannula needs to be re-sited more proximally.
- The midwife should initially encourage the patient to press the button a little earlier.
- If this is ineffective the midwife should call the anaesthetist to assess and decide whether a more proximal cannula would be helpful
- If the bolus dose is still at 0.4 ml (20 microgram) the anaesthetist should consider increasing to maximum bolus of 0.8 ml (40 microgram)

Points of safety

- **Always** use a **dedicated** cannula (do not use Y connectors or three way taps)
- Do not give any other drugs via the PCA cannula
- Only the patient is to use the PCA button - the PCA button is **not** to be pressed by midwifery staff or the patient's birth partners
- The PCA can be used during delivery and for the repair of tears and episiotomies
- The remifentanil containing syringe should not be connected to the patient unless it remains fully engaged in the syringe pump
- Remove cannula on completion of the PCA ***without*** flushing the line. If the line is apparently malfunctioning during use, call the anaesthetist
- **A midwife should never flush the line as this may flush additional bolus of remifentanil into the patient causing respiratory depression**

Apnoea

If there is a period of apnoea lasting > 10 seconds or respiratory rate less than 8:
Encourage the patient to breathe, give oxygen and remove the remifentanil bolus control from the patient.
If there is still no respiratory response despite strong verbal encouragement by 20 seconds:

- Pull the emergency buzzer to call for help.
- Lay the patient flat, turning her to the full left lateral position
- Give 100% oxygen via a self-inflating bag, valve, facemask until the patient starts to breathe (or by Hudson mask if making respiratory effort) until the arrival of the emergency team (including anaesthetist) to determine optimal airway management

If the patient needs verbal encouragement to breathe on 2 or more occasions withhold the remifentanil PCA until the patient has been reviewed by the anaesthetist to consider reducing the bolus size or providing alternative pain relief options.

Other care issues

Eating – Eating is not recommended whilst using the remifentanil PCA although the patient may drink clear fluids. Consider prescribing regular omeprazole if the patient is likely to be on remifentanil for more than 4 hours.

Mobility - Patients should be risk assessed as to whether it is appropriate for them to mobilise, turn on all fours etc. Consider waiting for at least 30 minutes after starting remifentanil or, if adding Entonox, to allow a period of adjustment before making any such risk assessment.

Completion of use of remifentanil PCA

On completion of the PCA it is the responsibility of the midwife to dispose of any remaining drug in the syringe as per the Trust Medicines Policy.

The intravenous cannula should be removed and **not** flushed

Complete the audit (service evaluation) follow-up form on iCare

Analgesia for labour after intra-uterine death (IUD)

The Labour Ward anaesthetist may be requested to provide analgesia for women experiencing labour after an IUD. This can occur at various gestational ages from about 18 weeks to full term. The priorities for women during these labours are often very different from those labouring with a live baby. Epidural analgesia is most frequently used in longer, late pregnancy labour. Opioid patient-controlled analgesia is most frequently used in shorter, earlier pregnancy labour.

A morphine IV PCA is routinely used for those women opting for opioid analgesia. An initial bolus dose of morphine can often be sufficient to provide adequate analgesia for shorter labours.

On being asked to see a patient in labour with IUD, epidural and opioid analgesic options should be considered and discussed with the patient. Gestational age, levels of pain, anticipated duration of labour, and the increased potential for sepsis and coagulopathy in these patients should be taken into account.

If opioid analgesia is the preferred option, this should be established immediately by the anaesthetist using IV PCA morphine 1mg/ml as per the standard theatre protocol. The PCA

protocol should be prescribed on iCare by the anaesthetist, and the pump should be set up and programmed by a competent anaesthetic nurse/ODP on request. The anaesthetist should then take the pump to the patient, connect it, and demonstrate to the patient how to use it, before leaving her in the care of her midwife. An initial dose of morphine, either oral Oramorph or intramuscular morphine, should be given. Intravenous antiemetics (regular ondansetron 4mg IV 8 hourly & PRN cyclizine 50mg IV max 8 hourly), and intravenous naloxone 400 micrograms for emergency reversal in case of respiratory depression, should be prescribed on iCare, to be given by the midwife as necessary. Paracetamol and ibuprofen orally should also be used, unless contraindicated.

The use of morphine PCA reflects its ease of administration and familiarity for the midwife. The expectation should be that this provides sufficient analgesia for the remainder of the labour. If this is not the case, epidural analgesia (using the standard protocol) might be a better option. In any event, any patient using a PCA on Labour Ward needs to be regularly reviewed by the anaesthetist, and followed-up post-delivery.

The midwife caring for the woman with a PCA should provide one-to-one care. Continuous oxygen must be available. Observations should include respiratory rate, sedation score, SpO2, and pain scores. The anaesthetist should review regularly to ensure that the PCA is effective and working correctly, and any adverse effects are being appropriately managed.

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3. Anaesthesia for Caesarean delivery

General considerations

The choice of anaesthetic should be discussed between the anaesthetist and obstetrician, having ascertained the woman's preference; if possible a neuraxial block should be encouraged but the final decision rests with the anaesthetist. Good communication with the mother and her partner is essential. They can often be highly anxious, even in the elective setting. We aim to provide a friendly, calm and reassuring environment in which they can enjoy the birth of their baby. Women should be seen and assessed prior to transfer to theatre, and given an opportunity to ask questions. The anaesthetic technique that you will be using should be outlined, with important risks discussed and verbal consent obtained. Check that pre-medication has been given, and that the surgeon is available before starting the anaesthetic. Where there is a significant anaesthetic risk, such as a suspected difficult airway, anticipated major haemorrhage, or significant obesity (BMI>40), a second anaesthetist should be present and the consultant anaesthetist on call should be informed early, and will attend if required. With very obese patients, have the Oxford Help pillow in place before transfer onto the operating table.

For further information, please refer to the Trust guideline for Caesarean Section (2022).

Classification of urgency

A four point system has been adopted nationally to classify the degree of urgency of Caesarean delivery relating to the degree of maternal or foetal compromise ***(1,2).*** A Category 1 has a target 'decision-to-birth interval' (DDI) in most situations of less than 30 minutes, which is accepted practice and can be audited to test the efficiency of the whole delivery team. Certain clinical situations will require a much quicker DDI than 30 minutes; however, this introduces risk, both surgical and anaesthetic, with the potential for harm to mother and neonate. Likewise, Category 2 has a DDI of <75 minutes, but the actual degree of urgency would be expected to be guided by the booking obstetrician; the condition of the mother and fetus should be taken into account when making decisions about rapid birth, which may be harmful in certain circumstances.

Communication is frequently highlighted as an area for improvement in obstetric practice. All members of the team should be informed about the likely need for Caesarean delivery as early

as possible, as well as specific details regarding the urgency of delivery, particular for Category 1 & 2 sections. Categorisation of risk should be reviewed by the multidisciplinary team when the mother arrives in theatre.

Category	Definition	Decision to birth interval	Examples
1	Immediate threat to life of woman or fetus	As soon as safely possible, and in most situations within 30 minutes of decision	Persistent fetal bradycardia, major placental abruption, cord prolapse, FBS pH<7.2 or fetal hypoxia, suspected uterine rupture
2	Maternal or fetal compromise, not immediately life threatening	Ideally in most situations within 75 minutes Obstetrician should give guidance on degree of urgency; be aware rapid birth can be harmful in certain circumstances	Breech presentation with ruptured membranes, failure to progress in labour
3	No maternal or fetal compromise but needs early birth	Within time limit as indicated by condition	
4	Birth timed to suit woman or healthcare provider	Elective	

Fasting & prevention of acid aspiration

Elective CS:

- Omeprazole 40 mg PO at 2200 hrs the night before
- Metoclopramide 10 mg PO on admission to hospital on the morning of surgery
- Food can be eaten until 6 hours prior to surgery
- Clear non-carbonated fluids can be drunk up to 2 hours prior to surgery e.g. water, Ribena (no milk)
- Water can be sipped until sending (up to one glass c.180ml every hour)
- Women having an elective LSCS in the afternoon can have a light breakfast before 0700 hrs

- If GA is planned, then sodium citrate 30 ml PO should be given in theatre just prior to pre-oxygenation

Emergency (Category 1-2) CS:

- Pantoprazole 40 mg IV given over at least 2 minutes and Metoclopramide 10 mg IV as soon as the decision to proceed is made; these can be given in theatre if required
- If for GA, sodium citrate 30 ml PO should be given on arrival in theatre prior to pre-oxygenation

Category 3 CS:

- Omeprazole 40mg (two 20mg capsules) every 12 hours until delivery

In Labour:

- In uncomplicated 'low-risk' labour, light food and drinks are allowed
- However if opioid or epidural analgesia is given, or in complicated 'high-risk' labour, only clear non-carbonated drinks (e.g. isotonic sports drinks such as Lucozade) or still water are allowed
- Those at high risk of surgical intervention (e.g. pre-eclampsia, VBAC, previous poor obstetric history) should receive omeprazole 40 mg orally every 24 hours during labour

Antibiotic prophylaxis for obstetric surgery

The evidence for pre-incision antibiotic prophylaxis is now very strong ***(3)***, and NICE guidelines ***(2)*** recommend that antibiotic prophylaxis is given prior to skin incision.

Unless allergic, all women should be given **1.5g IV Cefuroxime and 500 mg IV Metronidazole *BEFORE* skin incision** as per the Trust policy 'Antimicrobial Treatment and Prophylaxis Guidelines for Obstetrics' (2022) (see Intranet).

Penicillin-allergic women should receive **Clindamycin 600 mg IV** (in 100 ml 0.9% saline, given over 20 minutes) and **Gentamicin 4 mg/kg IV up to a maximum of 400mg** (use 12/40 booking weight; use caution with renal impairment or pre-eclampsia)

For MRSA positive patients, consider adding intravenous vancomycin or contact Microbiology for further advice.

Spinal Anaesthesia for Caesarean section

Preparation

- All patients should have a 14 or 16G IV cannula (insert with local anaesthetic subcutaneous infiltration), with free-running warmed Hartmann's solution attached
- Pre-operative FBC, clotting and Group & Save should be checked
- Cross-matched blood should be arranged for any women at increased risk of major obstetric haemorrhage (e.g. lower segment fibroids, placenta praevia); consider need for cell saver / Belmont rapid infuser
- Check anaesthetic machine, equipment and drugs for intubation
- Prepare antibiotics, oxytocin and emergency drugs, including atropine, ephedrine, and phenylephrine
- Attach monitoring: ECG, SpO_2, NIBP, and measure baseline BP
- IV fluids should be given via a fluid warmer

Technique

- Strict aseptic technique – scrub with chlorhexidine / iodine, and wear a face mask, scrub hat, gown and gloves
- Position sitting or left lateral depending on anaesthetist preference and experience. The sitting position is preferable in obese patients.
- Discuss with the midwife before commencing about the need for continuous fetal monitoring, particularly for emergency CS; allow the midwife to establish a good CTG trace before starting the spinal
- A pre-emptive spinal ultrasound scan using a curvilinear probe can be considered, whenever expertise is available, before attempting neuraxial anaesthesia in potentially difficult cases e.g. obesity, spinal deformity, previous difficulty
- Clean the skin using 0.5% chlorhexidine in 70% alcohol spray (Hydrex), and allow it to completely dry before proceeding. Keep the spinal kit covered, the needle sheathed,

and at least 1.5m away from the spray to avoid inadvertent chlorhexidine contamination; if there is any risk of your gloves having been in contact with chlorhexidine, change to a fresh pair before proceeding. At UHL, current practice is to clean with 2% Chloraprep applicators – again change your gloves if they have come into contact with the chlorhexidine.

- Use a 25G NRFit Sprotte (pencil-point) needle at the L3/4 interspace and advance until free flow of clear CSF is achieved
- 2.0 - 2.5 ml of 0.5% hyperbaric bupivacaine (depending on height of patient) with diamorphine 300-400 micrograms is given intrathecally with aspiration at end of injection to confirm ongoing free flow of CSF. Diamorphine is preferred due to the superior prolonged post-operative analgesia. ***(4)***
- However, if there is a shortage of diamorphine, fentanyl 10-15 micrograms and preservative-free morphine 100 micrograms is an acceptable alternative (OAA commentary 2021). The incidence of pruritus, and nausea / vomiting can be greater with intrathecal morphine, particularly in doses exceeding 100 micrograms; intravenous ondansetron administration is recommended.
- A phenylephrine intravenous infusion at standard concentration should be commenced immediately on insertion of spinal anaesthesia at 40 ml/hr unless contra-indicated
- Put the patient immediately supine after the spinal, with a left lateral tilt of up to 15°to avoid aorto-caval compression. Put side supports on to prevent the legs from sliding off the table. Consider using arm boards and the Oxford Help pillow with obese patients.
- Check the block after 5 minutes, and record the upper and lower levels of sensory block to cold (ethyl chloride / CoolStick) and light touch, and the degree of motor block on the anaesthetic chart. CoolStick is a cheaper and more environmentally sustainable alternative to ethyl chloride. ***(5)***
- A urinary catheter should be inserted by the midwife if not already done
- A bilateral sensory block of T4-S3 is considered acceptable; do <u>not</u> allow surgery to proceed until you are satisfied that the upper and lower limits of the block are adequate
- A yellow wristband must be applied to the patient with the time of spinal / epidural anaesthesia, and the four-hour time at which the patient is expected to be able to straight leg raise.

- Consider a CSE if prolonged surgery is anticipated and in difficult patients (e.g. obesity, very short/tall, 2 or more previous LSCS, placenta praevia); smaller spinal doses are

acceptable in the presence of an epidural catheter; the epidural can be used for postoperative analgesia with diamorphine 3mg.

Conversion of labour epidural for Caesarean section or instrumental delivery

- **Transfer to theatre before administering an epidural top-up for surgery; do *NOT* give the top-up in the Labour Ward room unless you can ensure full AAGBI monitoring and have emergency drugs immediately to hand**

- Check the level and efficacy of the block ***before*** topping up
- Give a 2-3ml **test** dose with the top-up solution and check the response
- If the epidural is patchy or unilateral, or the woman has complained of inadequate pain relief during labour, think before topping up, as the likelihood of inadequate anaesthetic block for LSCS is much higher if the epidural has been inadequate for labour analgesia. It is better under such circumstances to consider removing the epidural catheter and performing a low-dose single-shot spinal anaesthetic instead
- Epidural top-ups can be used for both instrumental delivery and Caesarean section
- When topping up for emergency LSCS, communicate with the obstetricians and midwives as an epidural top-up can take 10-20 minutes to provide surgical anaesthesia; CTG monitoring should be continued during this time.

Top-up solution

- Use 0.5% levobupivacaine up to 20ml, or 0.75% ropivacaine up to 20ml
- If the woman is *not* in pain and has been receiving the standard solution for epidural labour analgesia, it is not necessary to add fentanyl as it significantly increases intra-operative vomiting ***(6)***
- If the woman is in pain, consider adding 50 micrograms fentanyl to the solution

- Use 2-3 ml of top-up solution as an initial **test** dose. Check for negative aspiration before injecting. If there are no problems with hypotension or an unexpected subarachnoid block, the remainder of the epidural solution can be injected slowly in

divided 5ml boluses over the next 5 minutes. Be aware of the maximum safe weight-based dose in smaller women and do not exceed it.

- The addition of adrenaline or bicarbonate is ***not*** recommended, due to the increased time required to prepare the solution and the potential for drug errors when working under pressure or fatigue

- A bilateral sensory block (cold / light touch) from T4-S3, with a dense motor block (unable to lift legs, just able to move toes) and bilateral sympathetic block (warm, dry feet) is required before you can allow surgery to proceed

- If the block is inadequate, consider a further 5 - 10 ml bolus of the solution, and re-assess in 5 minutes; if delivery is urgent, and the block is inadequate, convert to general anaesthesia. Do **NOT** attempt a spinal following a failed epidural top-up.

- After the baby has been delivered, give an epidural dose of diamorphine 3mg, or preservative-free morphine 3mg, before removing the catheter at the end of surgery or in Recovery. If there is a likely risk of returning to theatre, leave the epidural in situ for a few hours and remove on the Labour Ward.

- Flush the catheter with 0.9% saline prior to removal. Always check and document on the chart that the black catheter tip is intact before discarding.
    - If it is difficult to remove the catheter or the tip is sheared off, refer to the duty anaesthetic consultant for advice and imaging; neurosurgical referral may be required

- Occasionally, it may be sensible to keep the epidural catheter in situ for a few hours after delivery, particularly in the event of an MOH or insertion of a Bakri balloon. This provides a means for giving further epidural analgesia if required, or for providing anaesthesia in the event of return to theatre. Instructions for epidural removal on the ward with clear timings for delayed LMWH administration need to be documented both on the anaesthetic chart and on iCare. If significant blood loss or transfusion has occurred, FBC, clotting and fibrinogen results should be checked prior to catheter removal. Catheter removal (with intact black tip) should be documented clearly on iCare.

Management of blood pressure during Caesarean section

There is a high incidence of post-spinal hypotension (50-80%) in women having Caesarean sections resulting in maternal side effects such as nausea and vomiting, while neonatal effects include acidosis and reduced Apgar scores. Therefore it is important to have a proactive approach to preventing spinal hypotension. The aim should be to maintain maternal systolic BP as close to baseline values as possible, ideally >90% of baseline. ***(7)***

Maternal hypotension induced by spinal anaesthesia is mainly caused by peripheral vasodilation and is not usually associated with reduced cardiac output. Consequently, vasopressor agents are used prophylactically, titrated against the blood pressure response. Crystalloid pre-loading is ineffective.

Phenylephrine is currently regarded as the vasopressor of choice in the obstetric setting, as it causes less fetal acidosis and reduced nausea and vomiting compared to ephedrine ***(8, 9)***. Studies have largely been performed on healthy mothers with normal fetuses. Optimal management in cases with feto-maternal compromise is still uncertain. Phenylephrine may be superseded by peripheral noradrenaline in the near future; evidence shows less maternal bradycardia following noradrenaline as compared to phenylephrine.

- Measure the baseline BP before administering the neuraxial anaesthetic
    - The patient may be anxious in the operating theatre; take antenatal BP readings into account

- Phenylephrine can be given as an infusion and this has been shown to be preferable to repeated boluses, with a lower incidence of hypotension, less nausea and reduced maternal tachycardia. ***(10)***

- Pre-filled 10ml syringes of phenylephrine 50 micrograms/ml are available, but occasionally may be out of stock. If so, prepare a phenylephrine infusion by drawing up a 20 ml ampoule of phenylephrine 100 micrograms/ml and diluting with a further 20 ml 0.9% saline, to make a 40 ml solution of phenylephrine 50 micrograms/ml. Label clearly with an infusion label.

- The infusion can be started at 20-40 ml/hr. Use caution in women with pre-existing hypertension

- Measure an accurate baseline blood pressure before siting the spinal anaesthetic

- The infusion should be commenced immediately after the spinal has been sited (or the epidural top-up given) and continued until the baby has been delivered. Check the BP at 2.5 minute intervals, and titrate the infusion accordingly to keep systolic BP >90% of baseline ***(11)***.

- Maternal nausea/vomiting, dizziness or faintness is almost always due to hypotension. Give extra phenylephrine before rechecking maternal BP.

- If the BP decreases 20% below the baseline value, give a bolus of phenylephrine (50-100 micrograms) if maternal HR > 60bpm, and increase the infusion rate. Bradycardia (HR < 60 bpm) can be treated with glycopyrrolate or atropine, supplemented with ephedrine as a second line vasopressor if required.

- After delivery, the phenylephrine infusion can be reduced by half, and then stopped if the BP remains stable. If necessary, continue the infusion into the recovery period.

- In patients with pre-eclampsia, phenylephrine remains the optimal first-line vasopressor to reverse spinal-induced hypotension; the dose required may be lower than in healthy women. A prophylactic infusion may not be required; if used, it should be started at a low dose with the effect on BP carefully monitored. The aim should be to achieve a steady systolic BP, as a sudden reduction risks a decrease in uteroplacental blood flow ***(11)***

Prevention and management of hypothermia or shivering

NICE recommendations include taking measures to prevent shivering and hypothermia in women having a Caesarean birth. This includes the use of warmed IV fluids and irrigation fluids for **all** women having a Caesarean birth.

For women who are shivering, are hypothermic <36°C or who are complaining of feeling cold, a forced air warming blanket (Bair hugger) should be applied. This can be taken to PACU post-operatively for continued warming if required.

Although pethidine is effective at reducing shivering, its use for this purpose is no longer recommended due to the possible adverse effects on breastfeeding.

Inadequate analgesia during Caesarean section under RA

Causes

- Inadequate level of block (T4 to cold / T5 to light touch) prior to the start of surgery is the commonest cause for inadequate analgesia during Caesarean section

- Bowel / peritoneal handling; uterine traction / exteriorisation

- Prolonged surgery

Management

- If the mother complains of pain during the operation, believe her.

- Ask the obstetricians to pause

- If the patient has an epidural catheter, a further top-up (up to 10ml 2% lidocaine + 50 micrograms fentanyl) can be given; wait for it to take effect

- Offer GA, and convert to GA if the patient accepts it

- Give rescue analgesia, such as:
    - Alfentanil 200 microgram increments up to 1mg or Fentanyl 20 microgram increments up to 100 micrograms IV (tell the paediatricians if prior to delivery)
    - Ketamine 10-20 mg IV
    - Nitrous oxide in oxygen (50:50)

- If pain occurs towards the end of surgery during skin closure, LA infiltration can be used

- Do not allow the obstetricians to proceed until the patient is pain-free, and ask them to proceed gently

- Clearly document the events, location and cause of pain, your interventions and discussions with precise timing; document any acceptance / refusal of GA

- On follow-up, discuss the events with the patient and document the conversation. Offer a follow-up appointment at 6/52 in the anaesthetic clinic for review for chronic pain or post-traumatic stress.

DO NOT use benzodiazepines to treat pain during Caesarean section

General anaesthesia for Caesarean section

Indications

- Category 1 CS for acute severe fetal distress
- Regional anaesthesia contraindicated
  - Maternal refusal
  - Maternal coagulopathy
  - Haemodynamic instability
  - Maternal sepsis / localised infection
- Regional anaesthesia inadequate for surgery

Preparation

Ensure that you are familiar with the intubating trolley in the obstetric theatre. This contains a variety of laryngoscope blades (long blade, short handled, McCoy), bougies, airway adjuncts including LMAs, and a range of ETT sizes. The Difficult Airway Trolley and the Storz C-MAC / GlideScope videolaryngoscopes are kept in the PACU (QEH), and in NB theatres (UHL) with a videolaryngoscope in the Labour Ward theatre at UHL.

NB. Don’t use an unfamiliar device for the first time in a crisis!

The anaesthetic machine, airway trolley and GA drugs in the fridge should be checked by the obstetric anaesthetic registrar on call at the start of every shift. If the GA drugs are used, they should be immediately replaced. Do not keep GA drugs on the anaesthetic machine.

The Obstetric Emergency GA Drug Tray should contain:

- Thiopentone (1 x 500mg powder vial, unopened), 20 ml sterile water for injection, one pre-labelled 20ml syringe with filter needle attached
- Propofol (1 x 200mg ampoule, unopened), one pre-labelled 20ml syringe with filter needle attached.

- Suxamethonium (2 x 100mg in 2ml ampoule, unopened), one pre-labelled 5ml syringe with filter needle attached.
- Rocuronium (2 x 50mg in 5ml ampoule, unopened), one pre-labelled 10ml syringe with filter needle attached.
- No other drugs are to be kept in the tray.
- For further details, see *Standard Operating Procedure: Obstetric Emergency General Anaesthesia Drug Tray* policy on the Trust intranet.

If you have any concern at all that an obstetric patient has a potentially difficult airway and is presenting for a general anaesthetic, call for extra assistance and have the Difficult Airway Trolley with you in theatre prior to induction. Do not be pressured into proceeding with induction until you are happy to do so.

Pre-operative visit

A normal anaesthetic history and examination should be performed with particular attention to the airway (failed intubation 1:224 versus 1:2000 in normal population) ***(12)***. Rapid sequence induction should be explained, including the risk of awareness. If you anticipate difficulty, call for help before starting.

Induction

- Always perform in theatre, with the anaesthetic nurse/ODP present
- Give 30ml oral sodium citrate
- Ensure a free-running infusion of Hartmann's solution via a 14-16G IV cannula
- A urinary catheter should be inserted prior to induction
- Position the mother supine on the table with a 15° left lateral tilt, with leg supports
- Have both arms out on arm supports which optimises IV access and NIBP measurement, and allows the breasts to fall to the sides
- Optimise the head and neck for intubation – ramped position with the Oxford Help pillow for obese women
- Establish standard monitoring as per AAGBI guidelines
- Suction should be switched on and accessible

- **Pre-oxygenation:** give 100% O_2 via a close-fitting facemask, at sufficient flow to prevent rebreathing. Ensure the gas analyser is switched on and the sampling line is connected. Pre-oxygenate for three minutes or until the end-tidal oxygen concentration reaches >90%.

  - Consider using THRIVE, particularly in patients with a high BMI

- When the surgeon is scrubbed and ready, instruct the anaesthetic assistant to apply cricoid pressure. Ensure that pressure is being applied correctly and that the head and neck are optimally positioned for intubation.

- **Induction drugs:**
  - **Thiopentone 5 - 7 mg kg^{-1} or Propofol**
    - Either induction agent is acceptable – use the agent with which you are most familiar in obstetric patients. There is no evidence of clear benefits or risks to distinguish between them in terms of neonatal outcomes or maternal haemodynamics.
  - **Rocuronium 1mg kg^{-1} or Suxamethonium 1 - 1.5 mg kg^{-1}**
    - Draw up two 100mg ampoules of suxamethonium for women who weigh > 65kg
    - If using rocuronium, ensure that enough sugammadex vials are immediately available to be able to give a 16 mg kg^{-1} dose for emergency reversal
  - **Opioids** – for mothers with pre-eclampsia, or pre-existing cardiac or cerebrovascular disease, a short acting opioid e.g. fentanyl / alfentanil, can be used to obtund the hypertensive response to intubation.
    - If used, inform the neonatal team.

- **Intubation:** when the jaw is fully relaxed, intubate and inflate the cuff. Attach the breathing system, still delivering 100% O_2, and inflate the lungs, auscultate for bilateral breath sounds and check the E_TCO_2 trace before removing cricoid pressure.

Maintenance and reversal

- After induction, ventilate with 33-50% O_2 with N_20 and sevoflurane, to keep MAC > 1.0. Use N_2O for second gas effect and analgesia.
- Aim to keep E_TCO_2 4.0-4.5 kPa; do not hyperventilate the mother as this can lead to a decrease in placental perfusion and fetal oxygenation.
- Allow the obstetrician to make the skin incision only when you are satisfied that the patient is sufficiently anaesthetised.

- Remember the possibility of awareness and do not hesitate to increase the volatile agent if needed. The incidence of accidental awareness under general anaesthesia (AAGA) during Caesarean section is considerably greater than in the general population (NAP5 estimated the incidence of AAGA for obstetric patients to be 1:670 versus 1:19000 for general patients) ***(13)***. Further evidence in support of this came from the multi-centre DREAMY study, which included LGT. The effect upon uterine contractility of 15 minutes exposure to 1.5 MAC is minimal, and is rapidly reversed when the volatile agent is discontinued.
- If AAGA is subsequently reported, ensure that a consultant anaesthetist reviews the patient at the earliest opportunity, and that appropriate follow-up and psychological support is arranged.
- Give antibiotics as per Trust protocol.
- A non-depolarising muscle relaxant can be given before suxamethonium wears off. It is often not required.

- Once the baby is delivered, give oxytocin (discussed below) and IV morphine 10-15 mg, with anti-emetics. Paracetamol 1g IV should also be administered. Give a 100mg diclofenac suppository to the scrub nurse to be inserted PR at the end of surgery, if consent was obtained beforehand and there are no contra-indications to NSAIDs.
- Transversus abdominis plane (TAP) blocks can be used bilaterally, if the patient was pre-operatively consented for them, with 20 ml each side of 0.25% levobupivacaine (max 2 mg kg^{-1}) under ultrasound guidance ***(14)***. Otherwise, if not consented for TAP blocks, ask the surgeon to infiltrate the wound with local anaesthetic**.**
- If there is a working epidural in situ, give a top-up with 10 ml 0.25% levo-bupivacaine and 3 mg diamorphine (or preservative-free morphine 3 mg).

- Extubation should occur when fully reversed with return of airway reflexes and awake in the left lateral position or sitting up
    - Suction secretions prior to extubation to prevent aspiration
    - If high dose rocuronium has been used, then use an appropriate dose of sugammadex for reversal, according to DAS guidelines.
    - In obese women, consider the risk of obstructive sleep apnoea (OSA), and whether CPAP may be required in Recovery; keep under close observation

Difficult / Failed Intubation in Obstetrics

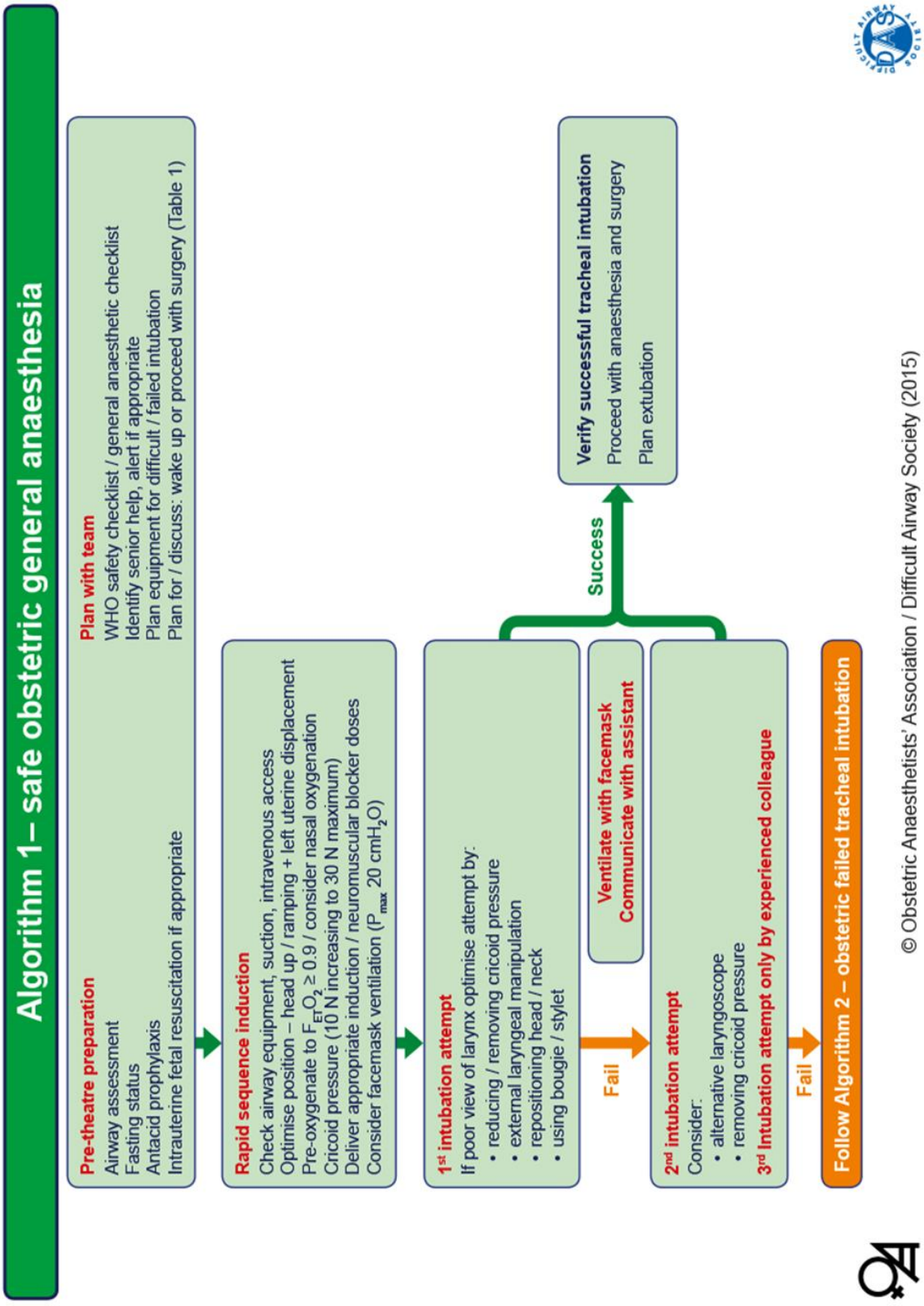
MATERNAL WELFARE IS PARAMOUNT AND MUST TAKE PRIORITY

PATIENTS DO NOT DIE FROM FAILURE TO INTUBATE BUT FROM FAILURE TO OXYGENATE: IF IN DOUBT, TAKE IT OUT

FOLLOW THE FAILED INTUBATION DRILL
(DAS/OAA guidelines 2015) *(15)*

- Use a smaller ETT than usual – especially if there is a history of URTI or pre-eclampsia, both of which pre-dispose to laryngeal oedema – size 6.0 and 5.0 ETTs must be available on the intubation trolley ***(16)***
- Consider a pre-stiffened ETT with a stylet, or use a gum elastic bougie; a McCoy blade may help in a Grade 3 view; use Storz C-MAC or GlideScope videolaryngoscope if competent
- Re-assess head and neck position; careful re-adjustment of cricoid pressure can transform the view
- If large breasts are obstructing insertion of the laryngoscope, use a short-handled blade and ask the midwife to apply downward traction to the breasts
- **CALL FOR HELP!**
- DO **NOT** GIVE A SECOND DOSE OF SUXAMETHONIUM
- If intubation is not possible, try to ventilate using a LMA or mask with a Guedel airway
- Reduce and if necessary release the cricoid pressure
- If you still cannot ventilate, follow the CICV drill ***(15)***
- Cricothyroidotomy can have major complications (e.g. haemorrhage, surgical emphysema) and should be used only in life-threatening situations
- When ventilation is achieved, decide whether surgery has to continue immediately
- If surgery can be delayed, wake the patient up and consider regional anaesthesia or an awake fibreoptic intubation
- If surgery does have to proceed and cannot be delayed, and you are able to ventilate using a face mask or an LMA, continue with a spontaneously breathing anaesthetic with sevoflurane. Maintain cricoid pressure if possible.
    - See DAS/OAA decision table for factors affecting the decision whether to proceed or to delay and wake

OAA/DAS algorithms



'Reproduced from Mushambi MC , Kinsella SM, Popat M, Swales H, Ramaswamy KK, Winton AL, Quinn AC. Obstetric Anaesthetists' Association and Difficult Airway Society guidelines for the management of difficult and failed tracheal intubation in obstetrics. Anaesthesia 2015; 70: 1286 – 1306, with permission from Obstetric Anaesthetists' Association / Difficult Airway Society'

Algorithm 2 – obstetric failed tracheal intubation
Declare failed intubation
Theatre team to call for help
Priority is to maintain oxygenation
Facemask +/- oropharyngeal airway
Consider:
• 2-person facemask technique
• Reducing / removing cricoid pressure
Supraglottic airway device
(2nd generation preferable)
Remove cricoid pressure during insertion
(maximum 2 attempts)
Is adequate oxygenation possible?
Yes
No
Follow Algorithm 3
Can't intubate, can't oxygenate
Is it essential / safe to proceed with surgery immediately?*
Yes
No
Proceed with surgery§
Wake§
*See Table 1, §See Table 2
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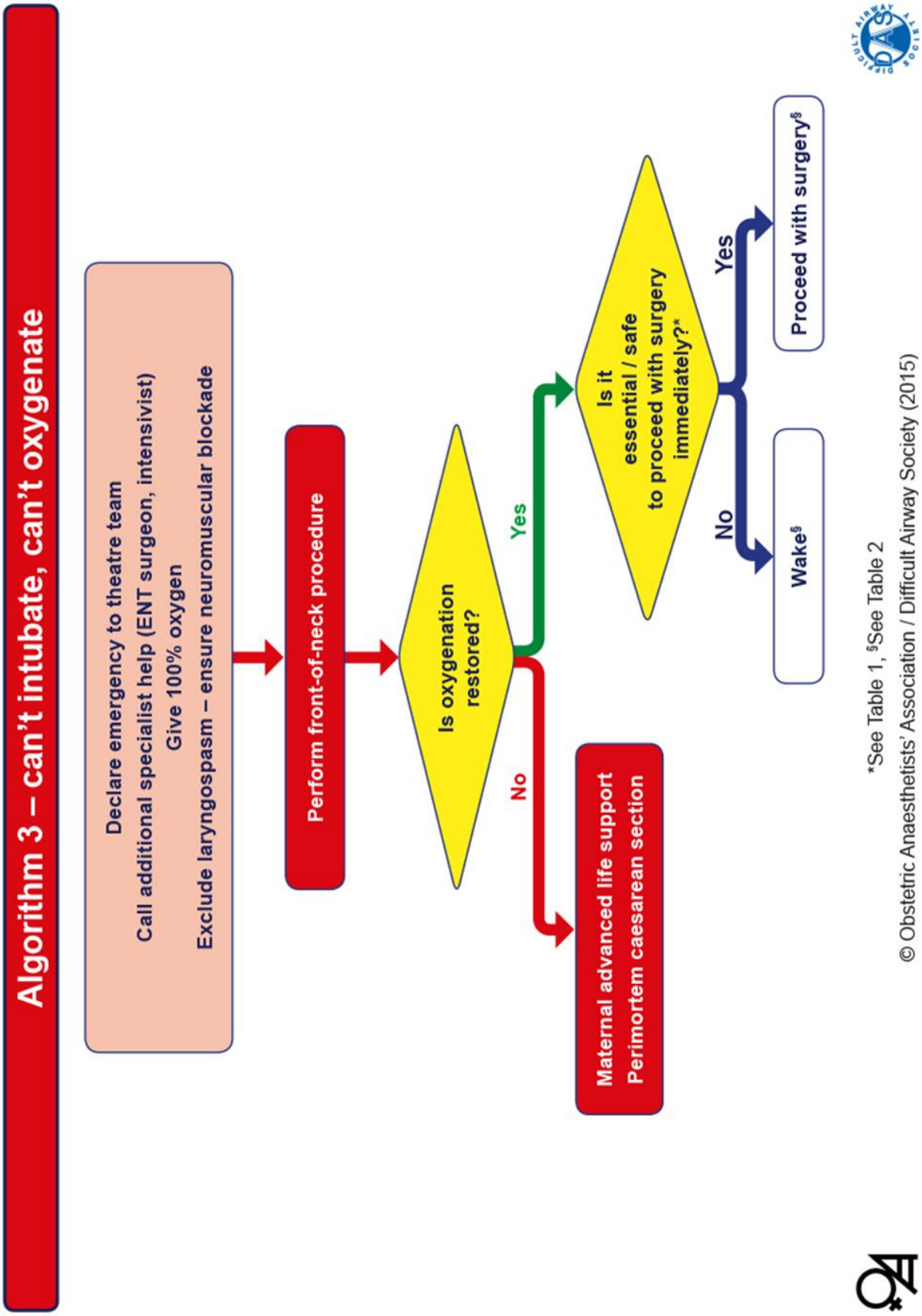
Algorithm 3 – can't intubate, can't oxygenate
Declare emergency to theatre team
Call additional specialist help (ENT surgeon, intensivist)
Give 100% oxygen
Exclude laryngospasm – ensure neuromuscular blockade
Perform front-of-neck procedure
Is oxygenation restored?
Yes
No
Maternal advanced life support
Perimortem caesarean section
Is it essential / safe to proceed with surgery immediately?*
Yes
No
Proceed with surgery§
Wake§
*See Table 1, §See Table 2
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Table 1 – proceed with surgery?

	Factors to consider	WAKE	←	→	PROCEED
Before induction	**Maternal condition**	• No compromise	• Mild acute compromise	• Haemorrhage responsive to resuscitation	• Hypovolaemia requiring corrective surgery • Critical cardiac or respiratory compromise, cardiac arrest
	Fetal condition	• No compromise	• Compromise corrected with intrauterine resuscitation, pH < 7.2 but > 7.15	• Continuing fetal heart rate abnormality despite intrauterine resuscitation, pH < 7.15	• Sustained bradycardia • Fetal haemorrhage • Suspected uterine rupture
	Anaesthetist	• Novice	• Junior trainee	• Senior trainee	• Consultant / specialist
	Obesity	• Supermorbid	• Morbid	• Obese	• Normal
	Surgical factors	• Complex surgery or major haemorrhage anticipated	• Multiple uterine scars • Some surgical difficulties expected	• Single uterine scar	• No risk factors
	Aspiration risk	• Recent food	• No recent food • In labour • Opioids given • Antacids not given	• No recent food • In labour • Opioids not given • Antacids given	• Fasted • Not in labour • Antacids given
	Alternative anaesthesia • **regional** • **securing airway awake**	• No anticipated difficulty	• Predicted difficulty	• Relatively contraindicated	• Absolutely contraindicated or has failed • Surgery started
After failed intubation	**Airway device / ventilation**	• Difficult facemask ventilation • Front-of-neck	• Adequate facemask ventilation	• First generation supraglottic airway device	• Second generation supraglottic airway device
	Airway hazards	• Laryngeal oedema • Stridor	• Bleeding • Trauma	• Secretions	• None evident

Criteria to be used in the decision to wake or proceed following failed tracheal intubation. In any individual patient, some factors may suggest waking and others proceeding. The final decision will depend on the anaesthetist's clinical judgement.

Table 2 – management after failed tracheal intubation

Wake

- Maintain oxygenation
- Maintain cricoid pressure if not impeding ventilation
- Either maintain head-up position or turn left lateral recumbent
- If rocuronium used, reverse with sugammadex
- Assess neuromuscular blockade and manage awareness if paralysis is prolonged
- Anticipate laryngospasm / can't intubate, can't oxygenate

After waking

- Review urgency of surgery with obstetric team
- Intrauterine fetal resuscitation as appropriate
- For repeat anaesthesia, manage with two anaesthetists
- Anaesthetic options:
  - Regional anaesthesia preferably inserted in lateral position
  - Secure airway awake before repeat general anaesthesia

Proceed with surgery

- Maintain anaesthesia
- Maintain ventilation - consider merits of:
  - controlled or spontaneous ventilation
  - paralysis with rocuronium if sugammadex available
- Anticipate laryngospasm / can't intubate, can't oxygenate
- Minimise aspiration risk:
  - maintain cricoid pressure until delivery (if not impeding ventilation)
  - after delivery maintain vigilance and reapply cricoid pressure if signs of regurgitation
  - empty stomach with gastric drain tube if using second-generation supraglottic airway device
  - minimise fundal pressure
  - administer H_2 receptor blocker i.v. if not already given
- Senior obstetrician to operate
- Inform neonatal team about failed intubation
- Consider total intravenous anaesthesia

Oxytocin (Syntocinon) & Carbetocin

Oxytocin is used in labour as a low dose infusion to augment uterine contractions, and as the first line drug following Caesarean delivery to restore uterine tone and minimize postpartum haemorrhage. However its use is associated with significant maternal adverse effects, including hypotension, arrhythmias, myocardial ischaemia, hyponatraemia, flushing, and nausea & vomiting. The 1997-1999 triennial CEMACH report described the deaths of two women from cardiovascular instability following an IV bolus of oxytocin 10 units. Even a 5 unit bolus dose of oxytocin can cause significant adverse effects.

In elective Caesarean deliveries, evidence suggest that good uterine tone can be achieved with an ED90 bolus oxytocin dose as low as 0.35 units ***(17)***. A 2 unit bolus of oxytocin has been shown to produce less haemodynamic effects and less nausea than a 5 unit bolus, with no difference in the need for additional uterotonics ***(18)***. The routine use of a 5 unit bolus of oxytocin during elective Caesarean section is no longer recommended, as good uterine contraction can be achieved with significantly lower doses ***(19)***. Even in emergency Caesarean sections, where an oxytocin infusion has been running during labour, with resultant oxytocin receptor desensitization, the ED90 bolus dose has been shown to be <3 units ***(20).***

In 2019, an international consensus statement on the use of uterotonics was published ***(21)***, which has been adapted for Trust guidelines. This supersedes outdated NICE 2004 and RCOG guidelines on uterotonics ***(22)***. This statement recommends a significant reduction in the dose of oxytocin required to prevent uterine atony in both elective and intrapartum Caesarean deliveries.

A National Patient Safety Alert issued in September 2024 ***(23)*** has described a series of incidents in which pre-prepared high-dose oxytocin infusions were administered in error before delivery, with potential for significant risk to babies. Actions required include that ‘the postpartum oxytocin infusion should be prepared at the time of birth and not before’. **Do not connect the oxytocin infusion to the patient’s cannula until after delivery.**

Carbetocin is being introduced into clinical practice as the first-line uterotonic in Caesarean sections and will be placed on the Trust formulary in 2025. The NICE guideline on Intrapartum Care (NG235) published in 2023 recommends that for women who have had a Caesarean birth, carbetocin should be given by slow intravenous injection over at least 30 seconds for the prevention of postpartum haemorrhage.

Carbetocin is a longer-acting synthetic analogue of oxytocin, with a similar mechanism of action and adverse effects profile. The prolonged duration of action of 5 hours (compared to 1.5 hours for oxytocin) negates the requirement for an infusion after the initial dose, and therefore avoids the risk outlined in the National Patient Safety Alert.

Once introduced, carbetocin is to be administered as the first-line uterotonic in a dose of 100mcg by slow intravenous infusion over at least 30 seconds as soon as possible after delivery and cord-clamping, and preferably before removal of the placenta. It is contra-indicated in patients with epilepsy, and should be used with caution in those with severe asthma, cardiovascular disease, hyponatraemia, and those who suffer with migraines. Do not exceed a dose of 100mcg; if uterine atony persists, move to a second-line uterotonic.

Elective Caesarean section:

- Prepare 40 units oxytocin in 40 ml 0.9% sodium chloride in an infusion pump; it should not be attached to the patient's cannula until after delivery of the baby
- Prepare 5 units oxytocin diluted in 5 ml 0.9% sodium chloride in a labelled 5 ml syringe
- After delivery, give a 1 unit bolus of oxytocin intravenously, slowly over at least 30 seconds; alternatively administer 1 ml via the infusion pump
- Start the infusion pump at 5 ml / hour
- After 2 minutes, ask the obstetricians if they are satisfied with the uterine tone. If the uterus is insufficiently contracted, give a further 2 unit oxytocin bolus over at least 30 seconds. If the uterus remains atonic after this dose, consider second-line uterotonics.

Emergency / intrapartum Caesarean section:

- Prepare 40 units oxytocin in 40 ml 0.9% sodium chloride; it should not be attached to the patient's cannula until after delivery of the baby
- Prepare 5 units oxytocin diluted in 5 ml 0.9% sodium chloride in a labelled 5 ml syringe
- After delivery, give a 3 unit bolus of oxytocin intravenously, slowly over at least 30 seconds; alternatively administer 3 ml via the infusion pump
- Start the infusion pump at 10 ml / hour
- After 2 minutes, ask the obstetricians if they are satisfied with the uterine tone. If the uterus is insufficiently contracted, give a further 2 unit oxytocin bolus over at least 30 seconds. If the uterus remains atonic after this dose, consider second-line uterotonics.

- Use ***extreme caution*** when giving oxytocin or carbetocin to women with cardiac pathology and long QT syndrome
- Be aware of the risk of hypotension following an oxytocin or carbetocin bolus, and be prepared to give vasopressors.

Further uterotonic drugs

Ergometrine

A naturally occurring alkaloid which is a second-line uterotonic for uterine atony which persists despite oxytocin administration.

- If the obstetricians request ergometrine, and if there are no contra-indications, administer 250 micrograms IM
- In extreme circumstances, dilute 500 micrograms in 10ml 0.9% saline and give intravenously slowly in 50 microgram increments over several mins titrating to effect.
- Adverse effects include nausea, vomiting, and vasoconstriction causing a marked rise in BP and CVP.
- There are reported cases of coronary artery spasm. Contra-indications therefore include cardiac disease and pre-eclampsia.
- A high incidence of 46% of nausea or vomiting has been reported with ergometrine use; always give an anti-emetic when giving ergometrine. ***(24)***

Carboprost (Hemabate)

A prostaglandin $F_{2\alpha}$ analogue used as a second-line agent for atonic PPH.

- If requested, and if there are no contra-indications, give as a 250 micrograms IM injection, which can be repeated as required at 15 minute intervals up to a maximum dose of 2 mg (eight doses). It may be given intramyometrially by the obstetricians (not licensed). ***(22)***
- Adverse effects include vomiting, diarrhoea, and bronchospasm.
- Contra-indicated in asthmatics

Uterine Relaxants

Hypertonic contractions can occur in response to oxytocin infusions during labour, leading to possible fetal hypoxia and a rapidly deteriorating CTG trace. Uterine relaxation may promote fetal oxygenation in certain clinical situations, and can help to avoid an emergency Caesarean delivery. The obstetricians, when in theatre for an instrumental delivery, may sometimes ask for the administration of terbutaline to reduce hyperstimulation of the uterus.

- Stop oxytocin infusion if in progress
- Give oxygen by face mask, and turn the mother into the left lateral position to minimise aortocaval compression
- Give an IV fluid bolus 250-500ml, and vasopressors as required to maintain maternal BP
- Administer terbutaline 250 micrograms subcutaneously; can be repeated if required
- If terbutaline is not immediately available, give salbutamol by inhaler (2-4 metered doses (100 micrograms/puff)) to relax the uterus
- Side effects include transient maternal tachycardia
- Avoid uterine relaxants in cases where there has been significant antepartum haemorrhage

Post-operative Care

Recovery following Caesarean section

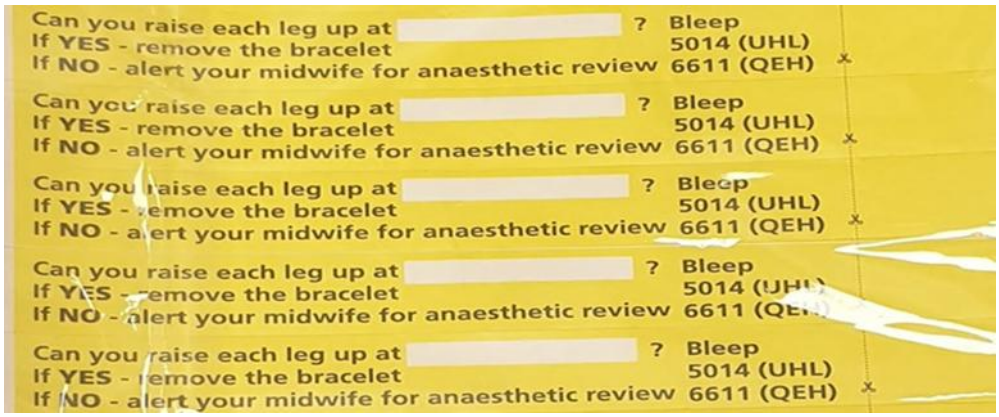
All patients who have undergone a Caesarean section must remain fully supervised with AAGBI standard monitoring in the PACU for at least 30 minutes and until discharge criteria (see below) have been met. The anaesthetist must handover care to the PACU nurse and remain available during this period. Patients should be cared for on a one-to-one basis by a PACU nurse, and observations (including block height) should be completed on the recovery page of the anaesthetic chart.

For further details, please refer to Trust policies "*Recovery of Women following Surgery or Anaesthesia (2022)*" and "*Neurological Monitoring following Obstetric Central Neuraxial Block (2022)*".

- After neuraxial anaesthesia – ensure that BP is stable in PACU; continue phenylephrine infusion if required. If in doubt recheck the level of block before discharge. Remember that a previously stable block can rise when the patient is moved.
- After general anaesthesia – supplemental oxygen should be given until fully awake; give extra analgesia / anti-emetics as required; consider PCA morphine
- Continue oxytocin infusion if started in theatre
- Before discharge, ensure the following:
    - The patient is fully conscious, is able to maintain a clear airway and has protective airway reflexes
    - Respiratory rate and SpO_2 must be normal
    - The cardiovascular system must be stable with no persistent bleeding; BP and heart rate should approximate to pre-operative levels or to parameters set by the anaesthetist. Phenylephrine infusions should no longer be required.
    - For patients under neuraxial anaesthesia (spinal/epidural), the sensory block should be shown to have regressed to T7 or lower
    - A yellow wristband must be applied with the time of four hours after spinal anaesthesia written, at which point the patient should be able to raise each leg or require an anaesthetic review
    - Pain and emesis controlled; if intravenous opioids given, the patient should remain in the PACU for at least 30 mins in case of respiratory depression
    - Normothermia (core temperature 36.0 – 37.5 °C)
    - Oxygen, intravenous fluids, post-operative analgesia, anti-emetics and LMWH are prescribed as appropriate
    - All surgical drains, dressing and catheters should be checked
    - Intravenous cannulae should be flushed with 0.9% saline to ensure patency
    - All charts should be complete; surgical/midwifery notes and iCare up to date
    - Handover to midwife regarding post-operative observations and any restrictions on further opioid administration

If these criteria are not met, the patient must remain in the PACU and the anaesthetist informed. If there are any problems in the recovery period the patient should be assessed by the anaesthetist, and the obstetrician where appropriate (e.g. heavy lochia, excessive wound leakage).

All patients who have received neuraxial anaesthesia should have a yellow wristband applied with the time four hours after their last dose of anaesthetic documented, at which time the patient should be able to raise each leg without weakness.



Lewisham and Greenwich NHS Trust

Regional anaesthetic alert bracelet
on the Postnatal ward

1

Is your patient wearing a yellow alert bracelet?

2

Can she raise her legs at her 4 hour time?

YES > **Success** Discard Bracelet

NO > **Alert** Anaesthetist for review

No patient should be wearing an alert bracelet beyond her 4 hour time, unless awaiting an anaesthetic review.

The ability to straight-leg raise at 4 hours after the last spinal / epidural dose must be documented by the midwife; if the woman is unable to straight-leg raise at this time and there is evidence of delayed motor block resolution, the anaesthetist must be contacted for urgent assessment.

Post-operative analgesia / anti-emetics following Caesarean section

Pain during and after Caesarean section is the most significant fear expressed by pregnant women ***(25).*** There is substantial evidence that suggests that acute severe pain after Caesarean delivery can progress to chronic pain and postpartum depression, and therefore requires effective early management ***(26)***. The incidence of chronic pain post-Caesarean, affecting daily activity, has been estimated as 8 – 19% ***(27).***

- If there is an epidural in situ, consider giving 3 mg epidural diamorphine after delivery, with a 0.9% sodium chloride flush, prior to removal of the epidural catheter
- An epidural may be continued in rare circumstances – for example, a woman with severe PET being managed postpartum on Labour Ward
- Diclofenac 100mg PR, unless contraindicated, should be given at the end of surgery, with the patient's consent
- Paracetamol 1g IV should be given after delivery
- Anti-emetics should be given routinely with ondansetron 4-8mg IV and dexamethasone 6.6mg IV. Dual agent therapy has been shown to be superior to monotherapy in preventing PONV associated with neuraxial opioids after Caesarean section. Dexamethasone can also contribute to prolonged postoperative analgesia ***(28, 29)***.

- Regular oral prescriptions, unless contraindicated, for post-operative analgesia, should be written on iCare (type 'C-Section Medication Inpatient Protocol'):
    - Paracetamol 1g 6 hourly
    - Ibuprofen 400mg 8 hourly after food
        - Contraindications to use of NSAIDs include:
            - Severe asthma
            - Known hypersensitivity to NSAIDs
            - Severe pre-eclampsia, until condition is resolving and there is good urine output
            - Platelet count <75 x 10^9 / L

    - Severe PPH until haemodynamically stable
    - Renal impairment
  - Morphine sulphate Modified Release 10mg BD orally for 1st 24 hours (two doses only), starting 6-10 hours post intrathecal diamorphine / morphine

- As required prescriptions on iCare:
  - Morphine sulphate Immediate Release 10-20 mg PO, max frequency 4 hourly
    - IM morphine may be considered if the woman is unable to take oral medication
  - Cyclizine 50 mg PO TDS
  - Ondansetron 4 mg IV TDS
  - Chlorphenamine 4 mg PO QDS for pruritus
  - Naloxone 25 micrograms SC hourly, max three doses, for opioid-induced pruritus

- For Caesarean sections under GA, consider a post-operative morphine PCA if the woman did not receive bilateral TAP blocks; do not prescribe opioids by any other route while the patient is on PCA
- Pain scores on movement should be recorded on the observation charts at least twice daily
- Midwives should offer additional analgesia on request, and to any women scoring more than mild pain (>3/10) on movement; contact the duty anaesthetist if severe pain persists
- For severe pruritus not responding to treatment with chlorphenamine, administer naloxone 25 micrograms subcutaneously. Reassess after one hour and repeat if necessary, up to three doses.
  - Use a solution of naloxone 100 micrograms/ml by adding 1ml naloxone 400 micrograms to 3ml 0.9% sodium chloride, making a total volume of 4 ml then withdraw 0.25ml (25 micrograms) of this reconstituted solution.

Thromboprophylaxis

There was a significant reduction in maternal mortality due to thromboembolism in the 2006-08 CMACE report ***(30).*** This follows the RCOG guidelines published in 2004, updated in 2015 ***(31)***, and the widespread introduction of routine thromboprophylaxis. For full details, please

refer to the Trust policy "G2015: Venous Thromboprophylaxis in Pregnancy and the Puerperium Maternity Guideline (2022)".

- All women should be assessed for risk factors (e.g. Previous VTE, thrombophilia, age >35, parity >3, BMI >40 kg/m^2, smoking) for VTE in early pregnancy. This should be repeated if the woman is admitted to hospital during pregnancy, and on admission in labour, using the maternity risk assessment form on iCare
- All women must be re-assessed for VTE risk after delivery

- Intermediate-risk women with 2 or more risk factors should be considered for LMWH for at least 10 days post-delivery.
- High-risk women with 3 or more risk factors should be considered for prophylactic LMWH from 28/40 (bleeding risk should be assessed), and will usually require prophylactic LMWH for at least 6/52 post-natally. They should be managed in the joint obstetric/haematology clinic, and must be referred to the anaesthetic antenatal clinic for assessment

- **All women with BMI > 40kg/m^2, should be considered for prophylactic LMWH for 10 days after delivery, in a dose appropriate for their weight**
- **All women who have an emergency CS should have prophylactic LMWH for 10 days after delivery**
- All women who have an elective CS with one risk factor should have LMWH for 10 days after delivery.
- LMWH must not be given for 4 hours after spinal anaesthesia / removal of epidural catheter

Enoxaparin (Clexane) should be dosed on booking weight:

Suggested thromboprophylactic doses for antenatal and postnatal LMWH ***(31)***

Weight at booking	Enoxaparin dose
< 50 kg	20 mg daily
50–90 kg	40 mg daily
91–130 kg	60 mg daily*

131–170 kg	80 mg daily*
> 170 kg	0.6 mg/kg/day*
High prophylactic dose for women weighing 50–90 kg	40 mg 12 hourly

*may be given in two divided doses

- Cautions/contra-indications to LMWH use include
    - Known bleeding disorder
    - Active antenatal or postpartum haemorrhage
    - Increased risk of major obstetric haemorrhage (e.g. placenta praevia)
    - Thrombocytopenia (platelet count <75 x 10^9/L)
    - Acute stroke (ischaemic or haemorrhagic, within 4/52)
    - Severe renal / liver disease
    - Uncontrolled hypertension (sBP>200 or dBP >120 mmHg)

- The anaesthetist is jointly responsible for ensuring that the appropriate dose of enoxaparin is prescribed on iCare for all women undergoing LSCS.

Patient follow-up

All women who have had an anaesthetic procedure should be followed up on the day after the procedure (sometimes earlier where management has been complicated).

The anaesthetist who performed the procedure should complete the post-op summary on iCare. Document all relevant patient details, along with any problems or critical incidents during the procedure.

The duty anaesthetists covering Labour Ward the next morning should follow up all patients from the previous day, and document the outcome on the postnatal audit / follow up page on iCare (*ad hoc tab – maternity folder – obs anaesthetics – postnatal audit / follow up*). Daily follow-up should be continued until the patient is mobilising safely and the urinary catheter has been removed, and if no complications of anaesthesia have arisen.

Any complications, such as PDPH or neurological deficits, should be described along with a management plan, documented on iCare as an Anaesthetic Ward Round note.

Patients who need further follow-up or intervention, e.g. for neurological deficit or headache, should be discussed with the duty anaesthetic consultant covering Labour Ward.

Please ensure that follow-up occurs daily without fail, including at weekends and Bank holidays.

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4. Obstetric Emergencies

Hypertensive disorders of pregnancy

This covers a spectrum of disease from hypertension alone to eclampsia with seizures, renal failure and pulmonary oedema. It remains a significant direct cause of maternal mortality. ***(1)***

Commonest errors leading to poor outcome are:

- Failure to recognise the severity of the situation
- Failure to involve early senior help
- Delays in decision-making
- Inadequate control of hypertension
- Poor fluid management leading to overload and pulmonary oedema

Management of these women should involve senior obstetric and anaesthetic staff.

Definitions

- **Chronic hypertension** is essential hypertension that is present at the booking visit or before 20 weeks, or if the woman is already taking antihypertensive medications when referred to maternity services. It can be primary or secondary in aetiology
- **Pregnancy-induced hypertension** is *new* hypertension presenting *after* 20 weeks without significant proteinuria (less than 30mg/mmol in urine PCR)
- **Pre-eclampsia** is new onset hypertension presenting after 20 weeks *with* significant proteinuria and/or any other signs of systemic disease
- **Eclampsia** is a convulsive condition associated with severe pre-eclampsia
- **HELLP syndrome** is a variant of severe pre-eclampsia, characterised by haemolysis, elevated liver enzymes and low platelets

Pre-eclampsia

Pre-eclampsia is a multi-system disorder arising after 20 weeks gestation. The main features are hypertension and proteinuria. It complicates 5-8% of pregnancies, and increases the morbidity and mortality risk in both mother and fetus. Although mortality figures have improved, it remains a leading direct cause of maternal death in the UK ***(1)***. Diagnostic criteria were described in 2013 ***(2).***

Diagnostic criteria

Moderate pre-eclampsia

- Systolic BP ≥140mmHg or diastolic BP >90 mmHg
    - On two occasions at least 4 hours apart
- Proteinuria ≥300 mg/L (1+) in 24 hr collection, or >1 g/L (2+) in two random dipstick samples taken 4 hours apart, or protein-creatinine ratio (PCR) ≥30
- In the absence of proteinuria, new onset of associated features (see below)

Severe pre-eclampsia

- Systolic BP >160 mmHg or diastolic BP >110 mmHg
    - 3 readings over a 15 minute period
- Proteinuria is no longer considered a reliable marker for severe pre-eclampsia

Associated features:

- Headache, frontal, persistent, not relieved by simple analgesia
- Visual disturbance, such as blurring or flashing
- Vomiting
- Epigastric / right upper quadrant pain
- Ankle clonus >3 beats
- Papilloedema
- Oliguria <0.5 ml/kg/hr, or <100 ml / 4 hours
- Pulmonary oedema
- Thrombocytopenia (platelets <100 x 10^9/L)
- Uric acid >0.4 mmol/L
- Creatinine >100
- HELLP syndrome

- Haemolysis (plasma haptoglobin <0.04g/L), elevated liver enzymes (AST >70 IU/L), low platelets <100 x 10^9/L

Management of Pre-eclampsia

Please refer for full details to the Trust Intranet guideline on the management of hypertension in pregnancy, pre-eclampsia and eclampsia.

Women should be managed in a quiet, well-lit room with high dependency care facilities, and have 1:1 care with a midwife trained in the care of the critically ill woman. The consultant obstetrician and duty consultant anaesthetist should be informed about the woman's condition, and be involved in her management.

Antihypertensive treatment

Blood pressure and heart rate should initially be measured every 15 minutes and recorded on a MEOWS chart. Fluid balance should be strictly monitored and recorded hourly.

Aim to keep systolic BP <160 mmHg, and reduce diastolic BP <105 mmHg. Care should be taken to avoid precipitous fall in BP, as this will further compromise placental perfusion. **The aim of antihypertensive treatment in this situation is to lower the BP to a MAP of <125 mmHg, NOT to achieve normotension.**

- **Labetalol:**
  - Give 200 mg orally initially. Repeat after 30 minutes if necessary. Around 50% of women requiring antihypertensive therapy can be controlled with oral treatment.
  - If oral treatment is ineffective or not tolerated, consider giving a 50 mg intravenous bolus over 2 minutes, which should have an effect within 5 minutes. This bolus dose can be repeated at five minute intervals up to a maximum of 200mg. The maternal heart rate should remain over 60 bpm.
  - It should be followed by a maintenance infusion: draw up 300mg labetalol in a 60ml syringe (5mg/ml), and infuse at 20mg (4ml) per hour via a syringe pump. Double the infusion rate every 30 minutes, until BP is controlled or to a maximum of 160 mg/hr (32 ml/hr).

  - Labetalol is *contra-indicated* in asthmatics; hyperglycaemia may also occur and it should be used with care in diabetics (may be associated with neonatal hypoglycaemia). It may be less effective in Afro-Caribbean women.
  - Discontinue by weaning over 1-2 hours when clinically appropriate and when oral antihypertensive treatment has been commenced.

- **Nifedipine MR:**
  - Give 10-20 mg capsule orally; do **not** administer sub-lingually, as this can cause too rapid a fall in BP.
  - Measure BP every 10 minutes for the first 30 minutes after administration as there can be a marked drop in BP and possible rebound hypertension
  - It can be repeated after 30 minutes if required. If still ineffective, switch to hydralazine.
  - If BP is within the threshold, the maintenance dose is 10 mg TDS. This can be changed postpartum to a modified release preparation 20mg BD

- **Hydralazine:**
  - Can be used if labetalol or nifedipine fail to control BP. More effective in Afro-Caribbean women.
  - Each Hydralazine vial contains 20mg Hydralazine as a dry powder.
  - The contents of the vial should be reconstituted by dissolving in 1 ml of Water for Injection, then diluted further with 20ml 0.9% sodium chloride (20mg/20ml)
  - Give as a 5 mg intravenous bolus. It can be repeated every 20 minutes to a maximum of 20 mg. Record BP every 5 minutes during this loading infusion.
  - Subsequently followed by a maintenance infusion (60mg hydralazine in 60ml 0.9% sodium chloride, starting at 5 mg/hour, increasing incrementally by 1mg/hour as necessary every 30 minutes until BP is controlled or to a maximum of 18 mg/hour). Titrate to diastolic BP 90-100 mmHg
  - It can cause tachycardia, and symptoms such as headache, anxiety and hyperreflexia which mimic deteriorating pre-eclampsia.
  - Contra-indicated in women with systemic lupus erythematosus (SLE)

Any anti-hypertensive infusion should continue until the woman is delivered and after delivery for at least 24 hours depending on her response. Oral antihypertensive therapy should be commenced before intravenous treatment is discontinued, so that BP remains well controlled.

Eclampsia

Eclampsia is defined as the presence of new onset grand mal seizures in a woman with pre-eclampsia. It is associated with intracranial haemorrhage, cardiorespiratory arrest and death. It is relatively rare in the UK with 2-3 cases reported per 10,000 births. Eclampsia may occur in the antepartum (45%), intrapartum (19%) or postpartum (36%) period.

20% of women with eclampsia have neither hypertension nor proteinuria prior to the seizure, which may be the first presenting sign. Most women will develop at least one of these after fitting.

Prevention and treatment of eclampsia

The MAGPIE trial demonstrated that magnesium sulphate reduces the risk of eclamptic seizures by 58% with a trend towards reduction in mortality ***(3)***. Women with severe pre-eclampsia or HELLP syndrome should be started on the Magnesium Sulphate protocol (see Trust guideline).

Magnesium sulphate is given as a loading dose followed by a continuous infusion for 24 hours, or until 24 hours after delivery – whichever is the later. Contra-indications include myasthenia gravis, severe cardiac disease and acute renal failure.

- Loading dose
    - Draw up 4g (8ml) magnesium sulphate 50%, and dilute to 20 ml in 0.9% sodium chloride
    - Give intravenously over 20 minutes using a syringe driver (infusion rate 60ml/hour)
    - In eclampsia the bolus can be given over 10 minutes at an infusion rate of 120 ml/hour
- Maintenance infusion
    - Give 1g per hour $MgSO_4$ by intravenous infusion for 24 hours, then review for continuation or cessation; if renal function impaired, consider reduced dose
        - 10g (20ml) 50% $MgSO_4$ in 30ml 0.9% sodium chloride, total volume 50ml, to run at 5ml/hour
- Recurrent seizures

  - Additional dose of 2g $MgSO_4$ 50% (4 ml, diluted to 10ml with 0.9% sodium chloride) given intravenously over 5 minutes using a syringe driver
  - If recurrent seizure are not responding to magnesium, diazepam may be given but only with direct anaesthetist supervision

- Monitoring
  - 1:1 continuous midwifery care with appropriately trained midwife
  - Continuous pulse oximetry and 3 lead ECG monitoring
  - Hourly respiratory rate
  - Hourly urine output
  - Deep tendon reflexes (patellar, biceps) every 4 hours

Magnesium toxicity

The therapeutic range is between 2 – 4 mmol/L. 97% of Mg is excreted in the urine; oliguria can lead to toxic levels, and a reduced infusion dose may be required. Have extra vigilance in women <55kg who may require a reduced dose.

Serum magnesium concentration	**Signs of toxicity**
3 – 5 mmol/L	*Nausea, flushing, loss of deep tendon reflexes, weakness*
5 - 7.5 mmol/L	*Drowsiness, diplopia, muscle paralysis, respiratory failure, ECG changes (prolonged PR interval, widened QRS)*
>7.5 mmol/L	*Complete heart block, cardiac arrest*

If there is loss of patellar reflexes / ECG changes / drowsiness / hypoventilation RR<12 / SpO_2 <94% on room air:

- Stop magnesium infusion
- Administer oxygen
- Send an urgent blood sample (yellow top tube) to laboratory for serum magnesium level
- Withhold magnesium infusion until serum magnesium level known or return of deep tendon reflexes

- Give 10ml 10% calcium gluconate IV slowly over 10 minutes if Mg >5 mmol/L or if the patient is demonstrating signs of magnesium toxicity
- Resume infusion at 1g/hour if levels are normal and recheck serum magnesium level after 1 hour

If in cardiac arrest:

- Stop magnesium infusion
- Commence CPR as per ALS guidelines
- Administer 10 ml 10% calcium gluconate IV over 10 minutes

Anaesthetic considerations

Regional procedures

Epidural analgesia for labour reduces pain-mediated hypertensive responses and improves placental perfusion due to vasodilatation. A platelet count >75 $x10^9$ L^{-1} taken within 6 hours may be considered safe for neuraxial procedures, providing the trend is stable and the clotting screen is normal. If the platelet count has been rapidly falling, recheck before proceeding with a neuraxial anaesthetic. The platelet count must also be >75 $x10^9$ L^{-1} when the epidural is removed.

Caesarean Section

Regional anaesthesia is the preferred choice for delivery by Caesarean section due to the problems associated with general anaesthesia provided there are no other contraindications. Single-shot spinal, combined-spinal epidural and epidural anaesthesia are all effective with no evidence that one technique is more beneficial than the other. Consider invasive arterial blood pressure monitoring.

Hypotension occurring as a result of neuraxial blockade is less common in women with pre-eclampsia. A prophylactic vasopressor infusion is unlikely to be required, and if used, should be started at a very low dose with the effect on BP carefully monitored. Hypotension can be successfully managed using small boluses of IV ephedrine (3 mg) or IV phenylephrine (50 micrograms). Fluid loading should be avoided.

General anaesthesia

Problems associated with general anaesthesia in women with severe pre-eclampsia include an increased risk of difficult airway and cardiovascular instability. An airway assessment should be performed pre-operatively looking for signs of facial oedema, dysphonia and stridor.

Care should be taken to obtund the hypertensive response to laryngoscopy and intubation. Use alfentanil 1 mg IV and/or beta-blockers (e.g. labetalol 50 mg IV). If an opioid is used, the paediatrician must be informed.

Use of Uterotonic Agents

Oxytocin (Syntocinon) is the drug of choice in women with pre-eclampsia, but should be titrated carefully. In fluid-restricted patients, oxytocin infusions can be given as 40 units in 40 ml 0.9% sodium chloride, running at 10 ml/hr.

Ergometrine in pre-eclampsia has been associated with hypertensive crises and death, and should ***not*** be used. Misoprostol may cause increased blood pressure but not to the same degree as ergometrine. Carboprost can cause both systemic and pulmonary hypertension.

Fluid management

Pulmonary oedema is one of the most common causes of death in pre-eclampsia and also a frequent cause of admission to intensive care. It is also more likely to occur than renal failure. Although these women are usually intravascular volume depleted, the combination of reduced colloid oncotic pressure and left ventricular dysfunction in pre-eclampsia predispose to fluid overload. Most women with pre-eclampsia will have post-delivery oliguria. Fluid restriction should be maintained until the natural diuresis occurs around 36-48 hours postpartum.

- Strict fluid balance must be maintained with hourly fluid input and urine output recorded
- The usual maintenance fluid regimen is 1.2 ml/kg/hr; this should take into account all intravenous infusions, such as $MgSO_4$ and oxytocin, as well as oral intake (but *not* epidural infusions)
- IV fluid infusions should be controlled by volumetric pump
- Urine output should be maintained > 0.4 ml/kg/hr; aim > 80 ml urine in 4 hours
- If oliguria persists after 4 hours, consider insertion of CVP line; cautious fluid challenges may be given only after measuring CVP
- Consider ICU referral for invasive monitoring if renal failure develops
- ICU advice should be sought at consultant level for the management of oliguria with an adequate fluid status i.e. CVP measurement 4-8 mmHg
- Monitor for clinical signs of pulmonary oedema at all times. If signs develop, give furosemide 40mg IV and arrange for a chest X-ray; if hypoxic, refer to ICU.

- Remember that the woman may be hypovolaemic due to blood loss; blood needs to be replaced accordingly and is extra to the fluids outlined above

HELLP Syndrome

HELLP syndrome is characterised by:

- **H**aemolysis
- **E**levated **L**iver enzymes
- **L**ow **P**latelets

This is a severe form of pre-eclampsia but can occur occasionally when hypertension and proteinuria are absent or minimal. Incidence is around 0.5 % of all pregnancies with mortality reported to be around 1%. Fetal mortality is between 7 - 34% and is dependent on the gestational age at which HELLP develops.

Clinical features are:

- Epigastric pain
- Right upper quadrant tenderness
- Nausea and vomiting
- Signs and symptoms of pre-eclampsia

The most common complications associated with HELLP syndrome are:

- Disseminated intravascular coagulation
- Placental abruption
- Acute kidney injury
- Pulmonary oedema
- Pleural effusion

A diagnosis can be made when:

- Haemolysis is seen on peripheral blood film
- Serum bilirubin and AST are elevated
- Thrombocytopenia of $< 100 \times 10^9\ L^{-1}$

Management of HELLP syndrome is supportive and must have consultant involvement.

Other less common but serious conditions that may mimic HELLP syndrome include idiopathic thrombocytopenic purpura (ITP), acute fatty liver of pregnancy, haemolytic uraemic syndrome (HUS), thrombotic thrombocytopenic purpura (TTP) and systemic lupus erythromatosus (SLE). These conditions are associated with high maternal mortality and careful diagnostic evaluation must be made, as their treatments are quite different.

Major obstetric haemorrhage

Obstetric haemorrhage remains one of the leading causes of maternal mortality in the UK and worldwide. Significant substandard care has been implicated in 58% of cases ***(4,5)***. It can rapidly become life-threatening, and the emphasis should be on vigilance, clear lines of communication, and the early involvement of senior obstetric, anaesthetic and haematology staff.

Definitions

- ***Antepartum haemorrhage (APH):*** bleeding from the genital tract after the 24th week of pregnancy and before the birth of the baby. Bleeding is usually from the placental site and may be severe enough to cause the death of the woman or fetus.

- ***Postpartum haemorrhage (PPH):***
  - ***Primary PPH:*** blood loss of > 500ml after vaginal delivery, or >1000ml after LSCS, within 24 hours of delivery ***(5)***
  - ***Secondary PPH:*** haemorrhage from the genital tract between 24 hours and 12 weeks postpartum.

Degree of haemorrhage

Minor: 500 – 1000 ml, with no clinical signs of shock

Moderate: 1000 – 1500 ml, with no clinical signs of shock

Severe: More than 1500 ml and continuing, or with clinical signs of shock where resuscitation is required. The Major Obstetric Haemorrhage protocol should be instituted and followed immediately.

NB. In women with lower body weight (<60kg) with haemorrhage, a lower level of blood loss can be clinically significant, and greater awareness of signs of shock is required.

Weight	Total Blood Volume	15% blood volume loss	30% blood volume loss	40% blood volume loss
50kg	5000ml	750ml	1500ml	2000ml
55kg	5500ml	825ml	1650ml	2200ml
60kg	6000ml	900ml	1800ml	2400ml
65kg	6500ml	975ml	1950ml	2600ml
70kg	7000ml	1050ml	2100ml	2800ml

Aetiology

Antepartum haemorrhage

The following causes should be considered in all cases of antepartum haemorrhage:

- Vaginal infection or trauma e.g. chlamydia, candida.
- Cervical abnormalities e.g. polyps, erosions, tumours.
- Placenta praevia, placental abruption, vasa praevia

Placenta praevia exists when the placenta is wholly or partially inserted into the lower segment of the uterus. If it lies over the cervix or within 2 cm of the cervical os, it is considered a major praevia. The classification has evolved from the old classification of Grades I - IV, and diagnosis is established by ultrasound / MRI examination.

Placenta accreta occurs where the placenta is morbidly adherent to the myometrium, rather than being restricted to the decidua basalis. The risk of placenta accreta increases with the number of previous Caesarean sections, as it is often found in the uterine scar. *Placenta increta* (invading into myometrium) and *placenta percreta* (invades through myometrium, and can adhere to other organs e.g. bladder, rectum) are less common but more severe grades of placenta accreta.

Placental Abruption occurs when the placenta partially or totally separates from the uterine wall prior to delivery of the fetus.

Bleeding can present in various ways:

- Revealed bleeding – Occurs when the site of placental detachment is at the margin. The blood trickles down between the membranes and escapes vaginally. The condition of the woman is directly related to the observed blood loss.

- Partially revealed bleeding – Occurs when some of the blood remains in the uterus. The bleeding may exceed that which is visibly lost and the degree of hypovolaemic shock may be greater than expected.

- Concealed bleeding – occurs when the site of detachment is near to the centre of the site of placental attachment. Blood cannot escape and a large retroplacental clot forms. Extravasated blood may also infiltrate the full thickness myometrium making the uterus appear bruised and oedematous. There may be no vaginal blood loss but the pain and shock tend to be severe.

Clinical features of a major placental abruption include:

- Severe abdominal pain
- Tense, tender uterus
- Haemodynamic shock
- Vaginal bleeding in low proportion to the degree of shock
- Fetal distress / intra-uterine death
- DIC

Postpartum haemorrhage

'The Four T's'

1. Tone – 70% of cases i.e. uterine atony
2. Trauma – 20% of cases e.g. vaginal / perineal lacerations, uterine inversion / uterine rupture
3. Tissue – 9% cases e.g. retained placenta, placenta accreta / percreta
4. Thrombin – 1% of cases e.g. pre-existing conditions (ITP, von Willebrand's), gestational thrombocytopenia, HELLP, DIC (sepsis, abruption, AFE)

Management of Major Obstetric Haemorrhage

Please refer for full details to the Trust Intranet guidelines on Major Obstetric Haemorrhage. The Major Obstetric Haemorrhage protocol is initiated when the estimated total blood loss is greater than 1500 ml with ongoing bleeding / haemodynamic shock.

- The emergency bleeps are issued to the Team members which comprise:
    - Labour Ward Co-ordinator
    - Obstetric Registrar ST3+
    - Obstetric SHO CT1-2
    - Anaesthetic Registrars ST3+
    - Transfusion technician consultant
    - Porters
- To alert them to the emergency a second call is automatically put out by Switchboard to:
    - Resus Officer x2
    - Operational Midwifery Manager
    - Haematology Registrar
- Call switchboard on 2222 and clearly state “Major Obstetric Haemorrhage” and the location

Primary PPH involving an estimated blood loss of 500-1000 ml, in the absence of clinical signs of shock, should prompt measures (close monitoring, IV access, FBC, coagulation screen, group & screen) to facilitate resuscitation should it become necessary.

If a woman with primary PPH is continuing to bleed after an estimated blood loss of 1500 ml, or has clinical signs of shock or tachycardia associated with a smaller estimated loss, this should prompt the full MOH protocol of measures to achieve resuscitation and haemostasis.

- The woman must not be left unattended at any time
- Pull emergency bell to summon help
- Call **2222** to summon the Major Obstetric Haemorrhage team (see above)

- **Immediately** call the Blood Bank (QEH: Ext 5719 UHL: Ext 6212) to give the patient details so that they can start cross-matching group-specific blood
- Contact consultant obstetrician and consultant anaesthetist on call
- Midwife in charge co-ordinates the emergency until additional staff arrive

- Check airway, breathing and circulation; give oxygen by face mask
- Position the woman supine
- Secure intravenous access - 2 large bore 14 or 16G cannulae
- Take 20 ml blood for FBC, clotting screen including fibrinogen, U&Es, and cross-match
- Commence infusion with 1L warmed Hartmann's while awaiting blood products
- 2 units of O Rh negative blood are available at all times in the blood bank fridge. Use in cases of torrential haemorrhage; Blood Bank must be informed if taken.
- Allocate a scribe to record events and timings, fluids, blood products, drugs given, and vital signs/clinical observations
- Ensure access to the location for porters and other personnel
- Order at least 4 units of blood (cross-matched type-specific, or O Rhesus negative un-cross matched blood depending on urgency of situation). Order 4 units of FFP.
- Accurately estimate blood loss, and promptly recognise and treat clotting disorders
- Give tranexamic acid 1g IV. The results from the WOMAN trial (2017) showed a significant reduction in death due to bleeding in women given tranexamic acid compared with placebo, with no concomitant increase in the incidence of thromboembolic events ***(6)***. Continue with a further infusion of tranexamic acid 1g over 8 hours.
- Transfuse blood via a fluid warmer; use pressure bags or the Belmont Rapid Infuser RI-2 if needed
- Check serial Hb levels, using Hemacue or ABG machine
- Insert urinary catheter and connect urometer to monitor output hourly.
- Record maternal observations, pulse, BP, temperature, and blood loss every 15 minutes on MEOWS chart if on ward; a fluid balance chart should be strictly maintained
- Obstetric measures depending on timing of haemorrhage include oxytocin, ergometrine, Carboprost, uterine massage and balloon tamponade
- Coordinate with theatres as required
- If bleeding continues, consider invasive monitoring, but this should not interfere with resuscitation; check ABGs and acid base status
- Keep the woman warm - hypothermia will worsen peripheral perfusion, acidosis and coagulopathy

- If platelet count or clotting screen are abnormal, order further FFP and consider cryoprecipitate ***early***. Aim to keep fibrinogen >2.0g/L
- If platelet count is <75, or if >4L blood loss has occurred, order 2 pools of platelets and transfuse when available.
- Intra-operative cell salvage can be used in emergency situations if staff available, even for Jehovah's Witnesses (consent is required) *(see below)*
- Management of persistent hypotension despite fluid / blood replacement may require central intravenous access and inotropic support
- Inform ICU early, and when accepted, transfer once stabilised.

Administration of further oxytocic agents:

- Oxytocin (Syntocinon) (40 units in 40ml 0.9% sodium chloride). This should run over 4 hrs (10 ml/hr). This stimulates the upper uterine segment to contract rhythmically decreasing blood flow to the uterus. At Caesarean section, the bolus dose is up to 3 units given slowly IV titrating to effect. Larger doses are associated with profound hypotension and myocardial ischaemia.

- Ergometrine (500 micrograms IM), which causes generalised smooth muscle contraction in which both the upper and lower segments of the uterus contract tetanically. It is contra-indicated in women with hypertension or cardiac conditions.

- Misoprostol 1000 micrograms (5 x 200 microgram tablets) given rectally can be effective in the management of PPH. Side effects include pyrexia and shivering.

- Carboprost 250 micrograms IM (repeated at intervals of not less than 15 minutes) up to a maximum of eight doses. It should be used with caution in women with pre-eclampsia or cardiac disease, and is contra-indicated in asthmatics. Adverse effects include hypertension, bronchospasm and pulmonary oedema.

If pharmacological measures and bimanual compression fail to control the bleeding, transfer to theatre for surgical haemostasis. Full discussion with the woman and her partner regarding the possible need for emergency hysterectomy should take place if possible before induction of anaesthesia.

- In cases of bleeding from the lower uterine segment, consider using balloon tamponade. Contraindications include cervical bleeding due to trauma, uterine atony, purulent infection, uterine anomalies, arterial bleeding requiring surgical exploration or embolisation

- At Caesarean section, consider the use of the B-Lynch haemostatic suture.

- In cases of life threatening haemorrhage, compress the aorta to reduce blood flow to the pelvis while awaiting help or further intervention

- In the presence of continuous bleeding consider embolisation, arterial ligation, or emergency hysterectomy. Resort to hysterectomy sooner rather than later, particularly in the context of placenta accreta or uterine rupture. A second consultant obstetrician should be involved in this decision, along with the consultant anaesthetist.

Once the 'Major Obstetric Haemorrhage' is resolved, haemostasis achieved and the need for further blood products ends, Blood Bank should be informed to step down. Unused blood products should be returned to the Blood Bank as soon as possible.

A debrief should be offered to all staff involved, and incident reporting, where necessary, should be completed. It is also essential that the patient and family are given the opportunity to go through the events, and be offered an appointment for a debrief with a consultant obstetrician and anaesthetist at the earliest opportunity.

Retained placenta

This is defined as failure to deliver the placenta within 30 minutes of active management of the third stage, or 1 hour with a physiological third stage. Retained placenta occurs in 3% of vaginal deliveries.

- If the uterus is well contracted, the placenta is low in the uterine cavity, and the cervix and lower uterine wall are contracted around it, the placenta is likely to be trapped – firm controlled cord traction often delivers the trapped placenta

- The obstetrician may use 20 units oxytocin in 20ml 0.9% saline and inject into the vein of the maternal umbilical cord to aid delivery (unlicensed indication), which has been shown to reduce the incidence of Manual Removal of Placenta (MROP); if this fails, then MROP

is necessary. Always consider invasive (non-separated) placenta prior to performing MROP.

- Intravenous infusions of oxytocin are ***not*** recommended while the placenta is still in situ

- Ensure adequate analgesia / anaesthesia for the procedure; if not contra-indicated, use spinal or epidural anaesthesia.

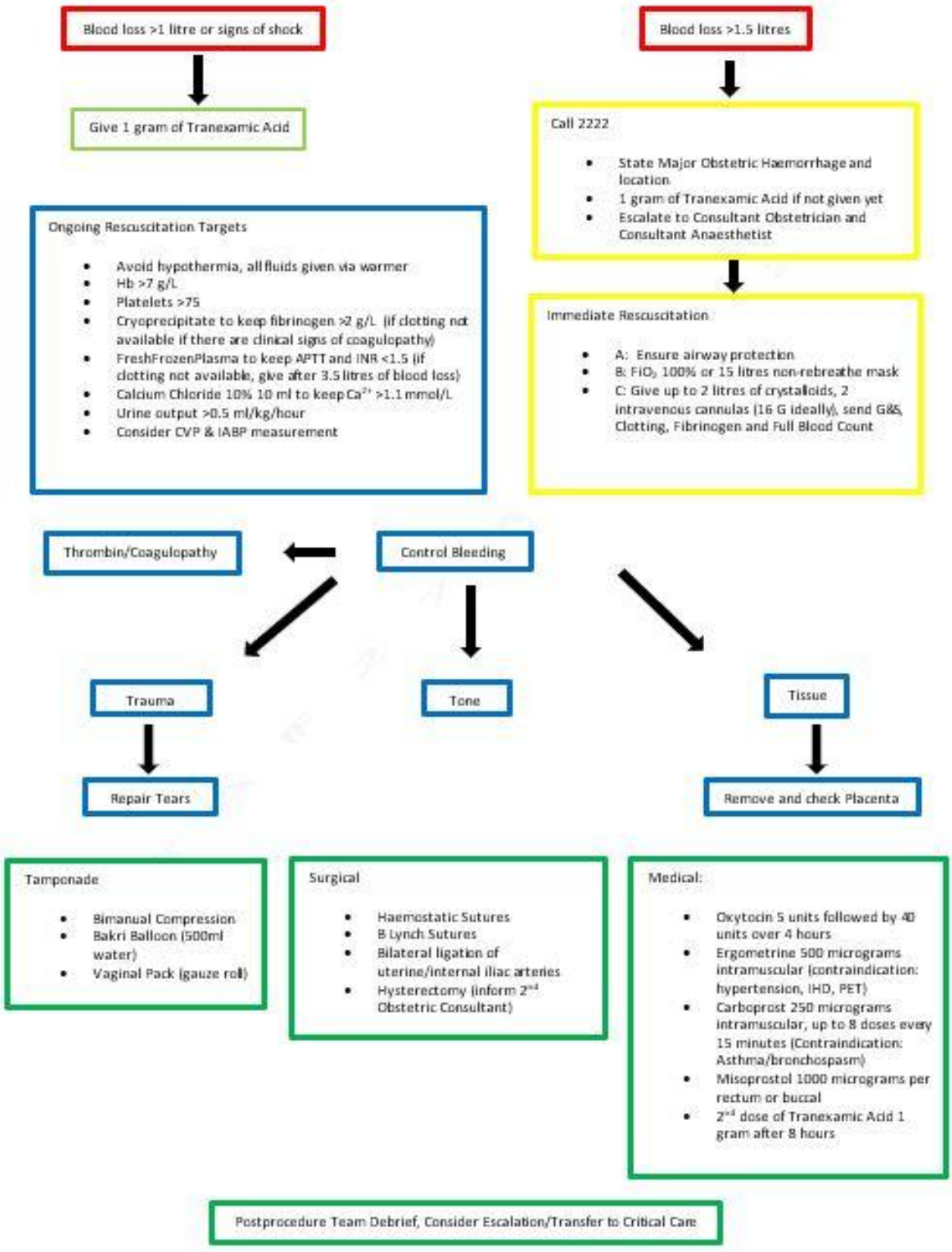
Interventional Radiology in Major Obstetric Haemorrhage

Arterial balloon occlusion and embolisation can reduce major blood loss, reducing the need for blood transfusion and hysterectomy. Interventional radiology can be used as a prophylactic measure when there is known or suspected placenta accreta e.g. previous CS with placenta praevia or placenta accreta diagnosed on colour Doppler.

Balloons are placed in the internal iliac or uterine artery prior to procedure and inflated if there is bleeding. Embolisation can be carried out if bleeding persists.

If an interventional radiologist is not available, then women requiring interventional radiology should be transferred to a tertiary centre once stabilised. Interventional radiology is also useful for the management of PPH which has not responded to conventional measures or for bleeding following hysterectomy. This decision should be made by the consultant obstetrician following discussion with the consultant anaesthetist and the receiving radiologist, as patients can only be transferred if they are relatively stable***.***

Major Obstetric Haemorrhage Management in Theatres



Women who decline blood and blood product transfusion

- Women who decline blood and blood products should be identified early at booking, and referred to a consultant obstetrician before 20 weeks, for review in the joint obstetric/haematology clinic
- These women will have an individual care plan made for maintenance of haemoglobin and ferritin levels in pregnancy; this can include oral iron and erythropoietin to boost haemoglobin levels ***(7)***
- A copy of any written Advance Directive should be kept in both the hand-held notes and the main medical notes
- An individual care plan will be made for delivery, documented in the maternity health record and on iCare
- Intraoperative cell salvage can also be offered if acceptable to the patient
- FFP and platelets are usually not accepted by Jehovah's Witnesses, but cryoprecipitate or fibrinogen concentrate may be acceptable
- Recombinant factor VIIa is a non-human synthetic product and can be used in these women in the event of life-threatening bleeding with their consent as a last resort. However, it is ineffective if fibrinogen is <1 g/L or platelets <20 x 10^9/L
- See Trust Guideline on the Clinical Management of Patients Refusing Blood Component and Blood Product Transfusion for further details

Intraoperative cell salvage

Blood lost in the operative field can be retrieved by an anticoagulated suction apparatus and collected in a reservoir where it is filtered, washed, and pumped into an infusion bag. This salvaged autologous blood can then be transfused back to the patient, reducing the need for donor blood transfusion. Modern leucocyte depletion filters can eliminate most amniotic contamination. There is limited evidence to demonstrate that it reduces donor blood transfusion. There is no current evidence that it increases the risk of amniotic fluid embolism, and no single serious complication leading to poor maternal outcome has been attributed to the use of cell salvage. ***(5,8)***

Indications

- Anticipated blood loss at surgery of >1500ml
- Women who refuse blood products

- No available blood (rare blood types / antibodies)

Contraindications

- Infection in the operative field (caution with blood recovered from the vagina as this will be contaminated by normal flora)
- Malignant tumours in the operative field
- Sickle cell disease

Salvaged blood must be labelled with the patient's name, DOB and hospital number, and must be transfused within 6 hours of the collection time

Cell salvage is most likely to be used under elective circumstances. There are several anaesthetic assistants who can set up the machine and apparatus within a few minutes of request, but there is no guarantee of availability out of hours. Theatre staff should be informed early if there is a case where cell salvage is being considered, to ensure there is an anaesthetic practitioner present who is able to set it up.

For further details, please refer to the Trust Policy P0950 'Intraoperative Call Salvage' (2023).

Recombinant Factor VIIa therapy

Recombinant Factor VIIa (rFVIIa) is an effective treatment for intractable bleeding. It was originally developed for treatment of haemophilia, but has also been to control bleeding in other circumstances, including major obstetric haemorrhage. Some case studies have

suggested benefit but evidence from randomised controlled trials is inconclusive, and rFVIIa remains unlicensed in these circumstances. ***(4,9)***

rFVIIa should be considered only as a last resort in uncontrollable obstetric haemorrhage, and can only be given following consultation with the on-call consultant haematologist. A full adult dose costs £4201 (8mg).

The recommended dose is 90 micrograms/kg by slow IV bolus injection given over 2-5 minutes. Do ***not*** mix with other intravenous solution or administer via a drip. This may be repeated after 2 hours if there is no improvement.

Before considering rFVIIa, ensure that fibrinogen and platelet levels are adequate. rFVIIa will not work if there is no fibrinogen, and will be suboptimal in severe thrombocytopenia (platelet count $<20 \times 10^9$).

Sepsis

Sepsis remains a leading cause of maternal morbidity and mortality, both direct pregnancy-related sepsis (e.g. Group A Streptococcus, E.coli, chorioamnionitis), and indirect sepsis (e.g. Influenza, COVID-19). The 2023 MBRRACE report described 78 women who died from sepsis in 2019-2021, representing 10% of maternal deaths in this period. Recognition and treatment of maternal sepsis is often delayed due to the physiological adaptations of pregnancy, and vague or conflicting presenting clinical signs. Signs and symptoms can be less distinct in pregnant women compared to the non-pregnant population; a high index of suspicion is needed. Early recognition and treatment is vital, especially the rapid initiation of antibiotics.

Sepsis is defined as 'a life-threatening organ dysfunction caused by a dysregulated host response to infection'. SOFA scoring is required for assessment of organ dysfunction; a higher SOFA score is associated with an increased probability of mortality. Septic shock is defined as 'sepsis with persisting hypotension requiring vasopressors to maintain MAP >65 mmHg and having a serum lactate >2 mmol/L in the absence of hypovolaemia'; with these criteria, hospital mortality exceeds 40% ***(10, 11)***.

Risk factors for maternal sepsis include obesity, diabetes (including GDM), age >35 years, pre-eclampsia, prolonged rupture of membranes due to obstructed labour, stillbirth or miscarriage, and those who have had invasive or surgical procedures (e.g. cervical suture, amniocentesis).

The UK Sepsis Trust has produced a specific sepsis toolkit for use in obstetric patients in both hospital and community settings. If any maternal 'Red Flags' are present, such as tachypnoea (RR>25), hypoxia, tachycardia (HR>130), oliguria, non-blanching rash or altered mental state, respond immediately and start the 'Sepsis Six' pathway, and consider early referral to ICU. Inform the duty anaesthetic consultant of women presenting with signs of severe sepsis, and contact the critical care outreach team.

If any maternal 'Amber Flags' are present, a full set of bloods including cultures and lactate should be sent, and an urgent review by a senior registrar or above is required. If antibiotics are needed, they must be administered as soon as the decision is made.

Sepsis Six

Actions to be completed within one hour of diagnosis or suspicion of sepsis:

- Administer oxygen, aiming for SpO_2 >94%

- Send bloods, including cultures. Take swabs or other indicated samples for culture.
- Give IV antibiotics (initially Cefuroxime 1.5g & Metronidazole 500mg (unless penicillin allergic, in which case give Clindamycin 600mg & Gentamicin dosed as per guideline). Contact Microbiology early for onward advice based on culture and sensitivity results.
- Give intravenous fluids, up to 30ml/kg. If hypotensive (sBP <90 mmHg) or if lactate >2mmol/L, give 500ml as a rapid bolus. If no improvement, urgent referral to the critical care team is required.
- Check serial lactate on a hourly basis
- Monitor urine output; may require a urinary catheter. A fluid balance chart should be commenced.

Maternal Sepsis Screening & Action Tool

To be applied to all women who are pregnant adults or up to six weeks post-partum (or after the end of pregnancy if pregnancy did not end in a birth), in acute settings, who have a suspected infection or have clinical observations outside normal limits.

Patient details (affix label):

Staff member completing form:

Date (DD/MM/YY):

Name (print):

Designation:

Signature:

1. Has MEOWS triggered? Tick
OR does woman look sick
OR is baby tachycardic (≥160 bpm)?

N → Low risk of sepsis. Use Standard protocols, consider discharge with safety netting. Consider obstetric needs. Tick

Y

2. Could this be an infection? Tick
- Yes but source unclear at present
- Chorioamnionitis/ endometritis
- Urinary Tract Infection
- Infected caesarean or perineal wound
- Influenza, severe sore throat, or pneumonia
- Abdominal pain or distension
- Breast abscess/ mastitis
- Other (specify):

N

Consider life threatening sepsis mimics (e.g. Asthma, Myocardial infarction, DKA, Pulmonary embolism, etc.)

Y

3. Is ONE maternal Red Flag present? Tick
- Responds only to voice or pain/ unresponsive
- Systolic B.P ≤ 90 mmHg (or drop >40 from normal)
- Heart rate > 130 per minute
- Respiratory rate ≥ 25 per minute
- Needs oxygen to keep SpO_2 ≥92%
- Non-blanching rash, mottled/ ashen/ cyanotic
- Not passed urine in last 8 hours
- Urine output less than 0.5 ml/kg/hr
- Lactate ≥2 mmol/l

(note- lactate may be raised in & immediately after normal labour & delivery)

N

4. Any Maternal Amber Flag criteria? Tick
- Relatives concerned about mental status
- Acute deterioration in functional ability
- Respiratory Rate 21-24 or breathing hard
- Heart Rate 100-130 OR new arrhythmia
- Systolic BP 91-100 mmHg
- Not passed urine in last 6-8 hours
- Temperature < 36ºC
- Temp > 38ºC OR > 37.5ºC on 2 consecutive occasions
- Immunosupressed/ diabetes/ gestational diabetes
- Has had invasive procedure in last 6 weeks (e.g. CS, forceps delivery, ERPC, cerclage, CVs, miscarriage, termination)
- Prolonged rupture of membranes
- Close contact with GAS
- Bleeding/ wound infection/ vaginal discharge
- Non-reassuring CTG/ fetal tachycardia > 160
- CRT > 2 sec

Y

	Time completed	Initials
Send blood *If 2 criteria present, consider if 1 include lactate, FBC, U&Es, CRP, LFTs, clotting*		
Immediate call to ST3+ and Shift leader *for review within 1 hour*		
Time clinician attended		

Y

Is AKI present? (tick) Yes ☐ No ☐

	Time clinician attended	Initials
Clinician to make antimicrobial Prescribing decision within 3h		

Red Flag Sepsis!! Start Sepsis 6 Pathway Now (see overleaf)

This is time critical, immediate action is required.

Sepsis Six Pathway

To be applied to all women who are pregnant adults or up to six weeks post-partum (or after the end of pregnancy if pregnancy did not end in a birth), in acute settings, who have a suspected infection or have clinical observations outside normal limits.

Inform Consultant Obstetrician & Obstetric Anaesthetist; **OR** consider transfer to Obstetric Unit. State patient has Red Flag Sepsis	Time zero	Consultant informed? (tick)	Initials

Action (complete ALL within 1 hour)	Time completed / Initials	Reason not done/variance
1. Administer oxygen Aim to keep saturations > 94%		
2. Take blood cultures At least a set from a peripheral vein. Consider e.g. urine, sputum, vaginal swabs, breast milk culture, throat swabs. Think source control & timing of delivery of baby - start CTG		
3. Give IV antibiotics According to Trust protocol Consider allergies prior to administration		
4. Give IV fluids If hypotensive/lactate >2mmol/l, 500ml stat. (can repeat up to 30ml/kg). Ask doctor regarding fluids if not hypotensive and lactate normal. Ask anaesthetist regarding fluids if patient has pre-eclampsia		
5. Check serial lactates Corroborate high VBG lactate with arterial sample If lactate >4mmol/l, call Critical Care and recheck after each 10ml/kg challenge		Not applicable- initial lactate:
6. Measure urine output May require urinary catheter Ensure fluid balance chart commenced & complete hourly		

If after delivering the Sepsis Six, Patient still has:

- systolic B.P <90 mmhg
- reduced level of consciousness despite resuscitation
- respiratory rate over 25 breaths per minute
- lactate not reducing

Or if patient is clearly critically ill at any time
Then call ICU/CCOT immediately

CONTACT NUMBERS

Queen Elizabeth Hospital
ICU SHO Bleep 6911
CCOT Bleep 6399, 6400

University Hospital London
ICU SHO Bleep 5500
CCOT Bleep 5701, 5702

Inpatient Sepsis Screening & Action Tool and Sepsis Six Pathway, adapted for use at Lewisham and Greenwich NHS Trust

Version 1.1 - March 2019

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Appendix 1: Associated Trust Intranet documents:

- G1984 - Epidural in labour (v.2 2022)
- G2051 - Remifentanil Patient Controlled Analgesia for use in Labour on Labour Ward Clinical Guideline (v.2 2022)
- G2090 - Caesarean Section & Wound Care Guideline (2022); v1.1 (2024) draft
- G1981 - Antimicrobial Treatment and Prophylaxis Guidelines for Obstetrics and Gynaecology (v.2 2022)
- SOP0218 - Standard Operating Procedure: Obstetric Emergency General Anaesthesia Drug Tray (v.2 2023)
- SOP0217 - Standard Operating Procedure: Emergency Anaesthetic Drugs in Adult, Paediatric and Obstetric Theatres (v.2 2023)
- G2109 - Recovery of Women following Surgery or Anaesthesia (v.3 2023)
- G2015 - Venous Thromboprophylaxis in Pregnancy and the Puerperium Maternity Guideline (2022)
- G2310 - Hypertensive Disorders & Proteinuria in Pregnancy & Postpartum Management Guideline (v.2 2024)
- G2234 - Obstetric haemorrhage, including major obstetric haemorrhage (v.2 2023)
- P0950 - Intraoperative Cell Salvage Policy (2023)
- G2093 - Clinical Guideline: Post-Operative Nausea and Vomiting (PONV) Management in Adult Surgical Patients: Prophylaxis and Treatment (v.2 2022)
- G2233 - Guideline on the Clinical Management of Patients Refusing Blood Component and Blood Product Transfusion (including Jehovah's Witness Patients)
- G1957 - Neurological Monitoring following Obstetric Central Neuraxial Block Guideline

10th Edition – August 2024
9th Edition – August 2022
8th Edition – August 2020
7th Edition – August 2019
6th Edition – August 2018
5th Edition – August 2017
4th Edition – August 2016
3rd Edition – August 2015
2nd Edition – November 2014
1st Edition – August 2013

Next Review Date – August 2025

Appendix 2: Posters

CAESAREAN SECTIONS

ANTIBIOTICS

BEFORE INCISION

reduce the rate of post-operative wound complications

Cefuroxime 1.5g IV &

Metronidazole 500mg IV

OR *if allergic to penicillin:*

Clindamycin 600mg IV* &

Gentamicin 4mg/kg IV**

***Clindamycin diluted in 100ml 0.9% saline, given over 20 minutes**

****Use booking weight. Maximum dose of Gentamicin is 400mg. Give slowly over 3 minutes**

NB If known /suspected MRSA, prophylaxis must also include Vancomycin IV

CAESAREAN SECTIONS

ANALGESIA

reduces post-operative pain and improves maternal satisfaction

Prescribe on iCare (C-Section Medication Protocol):

Regular:

- **Paracetamol 1g PO QDS**
- **Ibuprofen 400mg PO TDS ***
- **Morphine MR 10mg PO**

- 2 doses only,12 hours apart, starting 6-10 hrs post-op

*If no contra-indication to NSAIDs

PRN:

- **Morphine IR 10-20mg 4 hourly**
- **Ondansetron 4mg IV, max TDS**
- **Cyclizine 50mg PO or IV, max TDS**
- **Chlorphenamine 4mg PO QDS, 1st line for pruritus**
- **Naloxone 25micrograms SC every hour, up to 3 doses, 2nd line for pruritus**

Check thromboprophylaxis prescription

CAESAREAN SECTIONS

UTEROTONICS

for uterine contraction and to reduce haemorrhage

Elective:

- **Bolus oxytocin 1 unit over > 30 secs**
- **Oxytocin 40 units in 40 ml 0.9% saline infusion**

Start at 5 ml/hr

- **If contraction inadequate after 2 min, give further bolus of 2 units over >30 secs**

Intrapartum / emergency:

- **Bolus oxytocin 3 units over > 30 secs**
- **Oxytocin 40 units in 40 ml 0.9% saline infusion**

Start at 10 ml/hr

- **If contraction inadequate after 2 min, give further bolus of 2 units over >30 secs**

Consider 2nd line agent early if oxytocin inadequate to produce good uterine tone

- **Ergometrine 250 micrograms IM**

Repeat after 2 hrs if required; avoid in cardiac disease & pre-eclampsia

- **Carboprost 250 micrograms IM**

Repeat every 15 min if required, up to 8 doses; avoid in asthmatics

Appendix 3: Epidural Information Card

NB – Labourpains.org is now the correct address for this Epidural Information Card

LabourPains.com
Reliable information from doctors, midwives & mothers on pain relief & anaesthesia choices for your baby's birth

Epidural Information Card

Epidural Information Card

This is a summary. There is fuller information in the Pain Relief in Labour section. Please discuss anything that is not clear with your anaesthetist.

Setting up your epidural

- You will need to have an intravenous cannula and maybe a drip.
- While the epidural injection is being put in, it is important that you keep still and let the anaesthetist know if you are having a contraction.
- Usually takes 20 minutes to set up and 20 minutes to work.
- Some epidurals do not work fully and need to be adjusted or replaced.

Advantages of an epidural

- Usually provides excellent pain relief.
- Sometimes a spinal is given first for a quicker effect.
- The dose or type of local anaesthetic can sometimes be altered to allow you to move around the bed. This is a low-dose (or mobile) epidural.
- In general epidurals do not affect your baby.
- Can be topped up for caesarean section if required.

Possible problems with your epidural

- Repeated top-ups with stronger local anaesthetic may cause temporary leg weakness and increase the risk of forceps or ventouse delivery.
- The epidural may slow down the second stage of labour slightly.
- You may develop low blood pressure, itching or a fever during the epidural.
- The epidural site may be tender but usually only for a few days. Backache is NOT caused by epidurals but is common after any pregnancy.

Risk of having an epidural or spinal to reduce labour pain

Type of risk	How often does this happen?	How common is it?
Significant drop in blood pressure	One in every 50 women	Occasional
Not working well enough to reduce labour pain so you need to use other ways of lessening the pain	One in every 8 women	Common
Not working well enough for a caesarean section so you need to have a general anaesthetic	One in every 20 women	Sometimes
Severe headache	One in every 100 women (epidural) One in every 100-200 women (spinal)*	Uncommon
Nerve damage (numb patch on a leg or foot, or having a weak leg)	Temporary - one in every 1,000 women	Rare
Effects lasting for more than 6 months	Permanent - one in every 13,000 women	Rare
Epidural abscess (infection)	One in every 50,000 women	Very rare
Meningitis	One in every 100,000 women	Very rare
Epidural haematoma (blood clot)	One in every 170,000 women	Very rare
Severe injury, including being paralysed	One in every 250,000 women	Extremely rare

*Subject to individual unit variation

The information available from the published documents does not give accurate figures for all of these risks. The figures shown above are estimates and may be different in different hospitals.

March 2021 Edition

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Appendix 4: Equality Impact Assessment

EQUALITY IMPACT ANALYSIS - PART 1 – INITIAL SCREENING

1. Name of the policy being assessed?	**Obstetric Anaesthesia Guidelines**
2. Names of persons responsible for carrying out the assessment?	Jonathan Short
3. Describe the main aim, objective and intended outcomes of the policy. You should be clear about the policy proposal: what do you hope to achieve by it? Who will benefit from it?	The purpose of this guideline is to provide up-to-date information for anaesthetic and midwifery staff, to ensure the provision of consistent, high quality, evidenced-based care for women presenting for labour and delivery at LGT
4. Who does this policy involve and affect? Consider both the internal and external aspects e.g. who will implement this and who might it affect e.g. patients, users, employees, etc.	Anaesthetists, midwives, obstetricians, theatre staff – for implementation, for the benefit of maternity patients
5. Is there reason to believe that the policy could have a negative impact on a specific group or groups?	NO
6. Which protected characteristic groups may be disadvantaged / experience negative impact? ❑ Age ❑ Disability ❑ Gender Re-assignment ❑ Pregnancy/maternity ❑ Race ❑ Religion/Belief ❑ Sex ❑ Sexual Orientation ❑ Marriage & Civil Partnership ❑ Other (e.g. refugees, behavioural difficulties)	 NO NO NO NO NO NO NO NO NO NO NO
7. What research data / evidence do you have and how has this been collected?	Substantial. Research data and high quality evidence have been referenced throughout the document
8. Have you engaged and consulted those people who might be affected by the policy?	YES
9. If the policy positively promotes equality please explain how	Provides a framework for consistency of care across the Trust
10. From the screening process do you consider the policy will have a positive or negative impact on equality groups? Please rate the level of impact* and summarise the reason for your decision.	Positive: high

Print name: Jonathan Short Date completed: 30th August 2024