Sherwood Forest Hospitals
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Lead Division:	Women and Children
Lead Specialty:	Maternity
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Sponsor:	[redacted] Service Director for Anaesthetics

	Name the documents here or record not applicable
Associated Clinical Policy	Not applicable
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Other associated documents e.g. documentation/ forms	Not applicable

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CONSULTATION DOCUMENT

These Guidelines are intended for the use of Anaesthetics, Obstetric, Midwifery and Nursing staff delivering care to women on Sherwood Birthing Unit

These Guidelines are not to be construed as standards of medical care. Standards of medical care are determined on the basis of all clinical information available for an individual case, and are subject to change as knowledge advances. The ultimate judgement with regard to a particular clinical procedure or treatment plan must be made by the clinician in light of the clinical information presented and the diagnostic and treatment options available.

These guidelines are presented together as Guidelines for Obstetric Anaesthesia. The guidelines were produced in 1997 and reviewed in 2004, 2010 and 2016 by Julie Rutter, Consultant Obstetric Anaesthetist.

Consultation

Consultant Obstetric Anaesthetists
Consultant Obstetricians
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Date Produced: September 1997
Date updated: January 2004; January 2007; and March 2017

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Dr L van der Heyden	Associate Specialist	Dr B Sinkaye Staff Grade
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Dr P De Soysa	Staff Grade	

THE HOSPITAL SWITCHBOARD HOLD HOSPITAL BLEEP, HOME PHONE AND MOBILE PHONE NUMBERS, WHERE APPLICABLE.

Labour Ward Cover.

KM Anaesthetic Department produces a separate weekly rota identifying which Anaesthetist is providing cover for Sherwood Birthing Unit; this is available on the Intranet (type in kww in internet explorer) on the Anaesthetic Department site.

If a second pair of hands is needed out-of-hours contact the on-call SpR.

Consultant Cover

Provided by the General on-call Consultant, identifiable either through switch or on the labour ward anaesthetic rota.

CONSENT

Verbal Consent

This is necessary for regional analgesia in labour or anaesthesia for Caesarean Section. You should make a record of the risks/benefits that you have discussed with the woman. Women in the throes of labour may not be particularly amenable to a detailed discussion, but should be offered the chance to be given information concerning common and serious complications. Keep explanations short and **simple and record the circumstances in the case notes (e.g. "only brief** explanation before epidural as woman too distressed", "patient did not want to know about serious complications"). Any problem regarding consent must be referred to a consultant obstetric anaesthetist, unless prevented by extreme clinical urgency.

Regional Analgesia in Labour – consent

Laminated copies of the OAA epidural information leaflet are available on the delivery suite, translations can be found at **www.labourpains.com**, or via the OAA website.
Pessimistic estimates of permanent damage following obstetric epidural are 1:133,500. (1)

Regional Anaesthesia for Caesarean Section - consent

Risk of temporary neurological damage from obstetric spinal is 1:3,000, and pessimistic estimate of permanent damage is 1:67,000 (1). If a combined-spinal epidural technique is used this risk is 1:25,350. Information leaflets are available in ante-natal clinic and from the OAA website.
Also inform mothers about:

- Hypotension
- Post-dural puncture headache
- Intra-operative sensation, pain and risk of conversion
- Use of PR medication

General Anaesthesia for Caesarean Section – consent

The incidence of accidental awareness associated with obstetric general anaesthesia is about 1:670. [(2)]

Also inform mothers about increased risk of the following compared with regional, however it is unwise to over-emphasize the risks of general anaesthesia as a means to persuade the woman to have regional anaesthesia:

- Neonatal Sedation
- Blood Loss
- Post-operative Pain

The Mother Who Refuses Operative Delivery – consent

- **Best Interests** – in general, medical treatment can be undertaken in an emergency without consent, provided the patient is not competent at the time. The treatment must be a necessity and should do no more than is reasonably required in the 'best interests' of the mother; meaning that the operation or treatment will save life, or ensure improvement in, or prevent deterioration of, physical or mental health.
- **Competent Refusal** – treatment must not be given if the woman refuses treatment and is competent (understands the treatment options and consequences of refusal and can retain the information), or, has previously refused the treatment when competent. A mentally competent parturient has an absolute right to refuse to consent to medical treatment for any reason, rational or irrational, or for no reason at all. This holds true even though the consequence may be her own death, or the death or serious handicap of the child she bears.
- **16-18 years** – between these ages, a person cannot refuse treatment that is in their best interests. They can consent to treatment.
    - **Under 16 years** – anyone under the age of 16, may consent to treatment, as long as you are convinced that they understand the proposed treatment, can weigh up the risks, and can retain the information. They cannot refuse treatment that is in their best interests

THROMBO-PROPHYLAXIS

Thrombo-embolism is a leading cause of maternal death in the UK[ref 3] Please refer to the Obstetric guidelines (intranet/ hard copy on Labour Suite).

Labour

- **High Risk** – the following are indications for antenatal prophylaxis with low molecular weight heparin (LMWH). Women should be advised that when they go into labour, the next dose should be withheld until after regional analgesia has been established.
    - History of Venous Thrombosis
    - Thrombophilia
    - Antiphospholipid Syndrome
    - Protein C or S or Antithrombin III Deficiency
    - Factor V Leiden (activated protein C resistance)
- **Timing** – women advised to have LMWH during labour and the puerperium should undergo epidural analgesia blockade if requested and receive LMWH 8 hours later. The catheter should be removed at least 12 hours after the last dose. LMWH should not be given within 4 hours of removal of the epidural catheter. Those patients, having been anticoagulated using heparin by infusion, must wait until the APTT ratio has returned to normal. Analgesia can be provided by opioid, either as I.V. injection by the anaesthetist, or by PCA .
- **Vertebral Canal Haematoma** – cases of VCH are often associated with technical difficulties during regional blockade. There is less risk of VCH with spinal compared to epidural blocks. After delivery, continued vigilance for signs of VCH is essential. Advise the woman to seek medical help if symptoms of weakness, numbness, unusual back pain, or bowel/bladder dysfunction develop (onset can be delayed beyond 24 hours). Document that you have given this advice. If there is suspicion of a VCH, obtain neurological/neurosurgical input without delay. MRI will be the emergency radiological investigation of choice.

Caesarean Section

- **Enoxaparin** (Clexane®) -
    - Risk assess using RCOG screening tool [4], prescribe after discussion with obstetrician
    - Withhold until 4 hours following spinal anaesthesia or removal of epidural catheter.
- **Women Receiving Regular LMWH –**
    - **Regional Anaesthesia** – is generally not recommended until >12 hrs after the last dose, but discuss individual cases with a consultant obstetric anaesthetist. The risk-benefit analysis may well favour regional block (risk of VCH) over GA (risk of failed intubation etc).
    - **Epidural Catheter Removal** – 12 hours after the last dose of enoxaparin, and > 4 hours before the next dose.
    - **Treatment Doses of Enoxaparin** – ideally, 24 hours should have elapsed before regional anaesthesia is contemplated.

Further Information

Thromboprophylaxis during pregnancy, labour and after delivery. Feb 2011

(Available on Intranet – Maternity Guidelines)

REGIONAL ANAESTHESIA FOR LABOUR

General Principles

- **Antenatal referral for assessment** – It may be appropriate for Consultant Obstetricians and Anaesthetists to discuss the balance between indications and contra-indications of epidural analgesia technique in certain cases. Ideally this should take place before the woman is admitted to Sherwood Birthing Unit. See Anaesthetic Alerts Guideline (**Page 97-100)**

- **Epidural Service** – KMH offers women in labour a 24-hour, on-request epidural service. The time from being informed to attending the mother should not normally exceed 30 min.

- **Approach** – Establish the rationale for the request for a regional block and enquire as to when the woman was last examined by the midwife or obstetrician. Sudden escalation of pain is often symptomatic of imminent delivery (especially in the parous women). If there is a strong likelihood that the woman will procede to an operative delivery, it is worth explaining that her analgesia for labour can be converted to anaesthesia to facilitate forceps or Caesarean delivery.

- **Infusion** – continuous epidural infusion of a low-dose levobupivacaine/ fentanyl mixture is the standard (see below).

- **Combined Spinal-Epidural (CSE)** – this technique may be appropriate for women with unusually intense pain, who require analgesia of particularly rapid onset.

- **Previous Administration of I.M. Opioid** – is not a contra-indication to epidural analgesia, including epidural opioid.

- **Antacids** – Women with can drink clear fluids and should be prescribed oral

ranitidine 150 mg 6-hourly, or lansoprazole 30 mg once daily.

Contra-indications

Absolute

- Maternal refusal
- Inadequate staffing levels to care for woman. (Should be 1:1 ratio of midwife: parturient)
  A trained midwife should provide continuous care and monitoring of woman and fetus for the duration of the block. If adequate midwifery care is unavailable, then epidural block should not be instituted.
- Coagulopathy / Anti-coagulant therapy (see Thromboprophylaxis Guideline (**Page 8**)
- Local sepsis
- Severe uncorrected hypovolaemia
- Known allergy to local anaesthetic agent

Relative

- Poor maternal cooperation / severe maternal distress
- Systemic sepsis – epidural is safe in woman with chorioamnionitis once antibiotic treatment has commenced but should be avoided if signs of untreated sepsis
- Progressive CNS diseases
  - Document neurological findings before performing regional block.
- Gross deformity of maternal spine
- Severe fetal distress

Vaginal Birth After Caesarean Section

Not contra-indication to regional analgesia but be aware that need for frequent epidural top ups may be a sign of impending uterine rupture[5].

Performing an Epidural

a) **Patient Co-operation -** Almost all parturients can sit still enough to enable the epidural to be sited. Explaining why this is necessary is usually all that is

required. If this is proving difficult to achieve and there is a high risk of accidental dural tap consider CSE.

b) **Intravenous Access** –
   - **14 g or 16 g Cannula**
   - **Crystalloid Infusion**
   - **+/- Preload** - high dose epidurals cause maternal hypotension. Low dose epidural studies have been underpowered to identify anything other than large numbers suffering from hypotension. There is also a tendency towards more fetal heart rate abnormalities when no pre-load is given[6,7]. Therefore a crystalloid preload may be given, if desired.

c) **Full Blood Count & Coagulation Studies** – an FBC is required if there is evidence of pre-eclampsia, HELLP syndrome, Fatty Liver of Pregnancy, ante-partum bleeding has occurred, or thrombocytopenia is suspected. If the platelet count is normal, a coagulation screen is not necessary in mild pre-eclampsia. Consider FBC and Coagulation Study if prolonged intra-uterine death (> 2 weeks or unknown duration)
   - Platelets > 100 x 10^9 .L^{-1} then proceed
   - Platelets 80 – 100 x 10^9 .L^{-1} perform a coagulation screen unless isolated thromboctytopenic disorder
   - Platelets 50 – 80 x 10^9 .L^{-1} discuss with consultant; would need very strong indication to do epidural.
   - Platelets < 50 x 10^9 .L^{-1} then absolute contra-indication.

   If uncertain, discuss with consultant anaesthetist

d) **LMWH Thromboprophylaxis** – see **page 8**.

e) **Full Aseptic Precautions** – gown, gloves, hat and mask are strongly recommended.

f) **Loss of Resistance** – loss of resistance to saline for identification of the epidural space is recommended. Use of air is associated with an increased incidence of

dural tap and patchy block.

g) **Catheter Length/ Aspiration** – 3-3.5cm is the optimum length of catheter to leave in the epidural space. Greater lengths have been shown to increase the number of patchy blocks. Following placement of the epidural catheter, aspirate to confirm absence of blood or CSF. If blood is aspirated, flush with saline and withdraw the catheter slightly, repeat if necessary until 2cm is left in the epidural space. Management of accidental dural puncture – **(page 25)**

h) **Filters** – a bacterial filter must always be present at the end of the epidural catheter

i) **Regimens**

- There is no recommended epidural recipe at KMH, any standard regimen would be appropriate.
- The first dose (test dose) should be given by the anaesthetist to detect incorrect placement of the catheter. The remainder of the "top-up" is given by the anaesthetist
- If using 2.5 $mg.mL^{-1}$ levobupivacaine or stronger – inform mother of COMET trial [8]
- Remember every dose injected down an epidural catheter should be regarded as a test dose with the potential for high spread.
- The anaesthetist may authorise the midwife to give further epidural top up injections or start the infusion as prescribed on the epidural forms

j) **Infusion** – consider if labour likely to be prolonged or high risk of Caesarean Section. Following the initial epidural dose, start the pre-mixed infusion of dilute levobupivacaine (1 $mg.mL^{-1}$ + fentanyl (2 $micrograms.mL^{-1}$) at rate of 10ml/hr, prescribe top-ups for breakthrough pain.

The Comparative Obstetric Mobile Epidural Trial (COMET)[8] found that low-dose infusion epidurals and combined spinal epidural analgesia were both associated with

a lower incidence of instrumental vaginal delivery compared with conventional bolus top-up epidurals. However, the low dose systems still showed an increased incidence over no-epidural, for instrumental delivery. The Caesarean section rates were similar in all three groups.

k) **Monitoring**

- A midwife who has completed the Epidural training package and been assessed as competent must be present for at least twenty minutes after each top up
- Electronic fetal monitoring
- Maternal BP, pulse and fetal heart rate should be monitored every five minutes for twenty minutes after each top up and hourly during epidural infusions
- Urine output should be recorded and bladder distension avoided (See Management of the Bladder in pregnancy, labour and post natal period guideline)
- The height of the block should be checked, using ethyl chloride spray.
    - Hourly during epidural infusions
    - Twenty minutes after an epidural is sited
    - If the woman complains of poor analgesia

These findings should be documented on the epidural record

The anaesthetist retains responsibility for the block and should attend regularly throughout the duration of the analgesia to ensure adequate analgesia and assess for complications.

l) **Block Testing** – spread and completeness of the block should be checked with a cold stimulus (ice/ethyl chloride) rather than a needle. However, the best indicator of an adequate block is the smile on the patient's face and her indication that she is satisfied!

m) **Patient Positioning** – the patient must be positioned to avoid aorto-caval compression throughout labour, with the intravenous infusion maintained until

after delivery. If she wishes to lie supine, at least 15 degrees of lateral tilt should be applied by wedging under the hips.

n) **Documentation** – prescribe top ups on pink epidural form, if using infusion complete infusion form.

o) **Removal of epidural catheter** – Epidural catheter can be removed after delivery, once it is ensured the woman is not bleeding and does not require suturing. The catheter should be removed by gentle traction and it should be checked that the blue tip is present, and a dressing applied to the puncture site. If the catheter cannot be removed easily consider getting the patient to flex her spine or contact the anaesthetist.

Performing a Combined Spinal-Epidural

Principles: as for performing an epidural,

a) **Vertebral level** – a CSE should not be undertaken above L2/3 intervertebral space.

b) **Technique** –
- Single shot spinal followed by epidural
- Planned CSE: single space needle through needle, or double space technique

c) **Intrathecal dose** – plain levobupivacaine 2.5 $mg.mL^{-1}$ 1 ml + fentanyl 25 micrograms 0.5 mL is the recommended intrathecal dose. When this begins to wear off, a loading epidural bolus can be administered (by an anaesthetist) from the low dose solution. Subsequently a continuous infusion can be started.
- If insufficient analgesia from the intrathecal injection, then following insertion of the epidural, epidural injection of 5-20mls saline can extend the intrathecal block. (extradural volume enhancement with saline – EVES)

Management of Block

- **Bilateral block to T10** – should relieve the pain of uterine contractions.
- **Block above T6** – stop infusion.
- **Re-starting the Infusion** – infusion should be restarted (at a lower rate than previously) as soon as the block height has regressed to T10 dermatome level (skin over the umbilicus is numb).
- **Block Failing to Relieve Pain** – may be too low, unilateral or has a 'missed segment' and should be treated accordingly. Assess the distribution of the block using ethyl chloride spray or ice and observe the woman during several contractions and try to establish the site and nature of the painful sensations. Many of the problems with an inadequate epidural block are due to there being too much catheter left in the epidural space. Consider withdrawing the catheter until only 3-3.5cm remains in the epidural space before topping up.
    - **Low block** – further top up of levobupivacaine, consider increasing infusion rate

    - **Missed segment** / **Unilateral block** – consider further top up while lying mother on unblocked side. Withdrawing catheter 1cm and then giving further top up is useful. Re-siting the catheter at a different space may help, but the patient should be warned that truly unilateral blocks are sometimes due to epidural membranes and therefore impossible to cure.
    - **Patchy block** – try a stronger dose, as above and consider the possibility of a subdural block **(Page 21)**
    - **Strong perineal pain/ pressure** – can sometimes be helped by 50 micrograms of epidural fentanyl in 5ml of 0.9% saline and/ or by giving the 5-10ml of 2.5 $mg.mL^{-1}$ levobupivacaine as a “top-up” in the sitting position. Finally, 5 $mg.mL^{-1}$ levobupivacaine can be utilised. If using high dose local anaesthetics, discuss increased risk of operative delivery, some mothers may opt to tolerate the pain.
- **Pain breaking through good block** – consider the possibility of uterine scar

dehiscence (risk for women attempting VBAC – Vaginal Birth After Caesarean) and ask for an obstetric review immediately.

- **Itching** – consider using opioid-free top ups, having discussed risks vs benefits of high dose or low dose local anaesthetic. Intractable symptoms can be relieved by i.m. naloxone 0.4 mg, best given after delivery – may reverse opioid analgesia.
- **Intra-uterine death** – in the event of labour induced after intrauterine death, the concentration of fentanyl may be increased if pain is inadequately controlled by the standard regimen. Maternal monitoring must be no less intense just because the fetus is not alive. PCA opioid analgesia is an alternative
- **Caesarean Section** – conversion from analgesia to epidural anaesthesia is required. The infusion should be stopped, capped off and a suitable epidural top-up given, preferably in theatre with full monitoring – increased risk total spinal, or local anaesthetic toxicity. **(page 19, 22-24).** Consider Intra-uterine Fetal Resuscitation **(page 36)**

Important Points

- **Catheter Migration** – remember that the catheter may have worked its way out of the epidural space, especially if the block was previously working well. If in doubt, check catheter marking at the skin, and check the insertion site for evidence of leakage.
- **Parenteral Opioids** – ensure that parenteral opioids are not prescribed in an attempt to improve analgesia when epidural opioids have been administered.
- **Need to Re-site** – if adequate analgesia has not been established within 60 min of attending to troubleshoot persistent pain, consider re-siting the epidural unless delivery is imminent
- **Senior Help** – if the above approaches fail and the woman is still unhappy, seek senior help. Persistent pain should be managed with sympathy and explanation.
- **High Risk Patient** – if a woman labouring with an epidural, is at significant risk of proceeding to Caesarean section, ensure she has a good block to allow

establishment of effective surgical anaesthesia, if required. Poor regional analgesia in labour predicts poor surgical anaesthesia, more than one clinician administered top-up is an independent risk factor for failure to establish surgical anaesthesia [9].

Managing Epidural Complications

1) **Hypotension** – results from peripheral vasodilatation, exacerbated by aorto-caval compression. Maternal systolic blood pressure < 90 mmHg, or fall of 20mmHg below booking BP, if the patient becomes symptomatic (ie dizzy, faint, nauseous) administer O_2, turn the patient on her side and give 500 ml of crystalloid rapidly. If the blood pressure remains low, consider the possibility of a subarachnoid block (see below); vasopressor is preferable to more fluid. Anticipate fetal distress (see SPOILT algorithm for intrauterine resuscitation – **Page 36**.

2) **Fetal Cardiotocographic (CTG) Abnormalities** – (bradycardia, decreased beat-to-beat variability, variable or late decelerations) during epidural analgesia should prompt a recording of the maternal blood pressure. Recognition and correction of hypotension, which may correct CTG abnormalities and can prevent an urgent Caesarean section.

3) **Fainting** – Mother may feel faint during performance of epidural, of so lie down and consider continuing in lateral position. Remember birth partner may also faint therefore encourage to sit down.

4) **Neurological Deficit** – that persists >4 hours after the last top-up, or discontinuation of an infusion, **must** be followed up immediately and reported to a consultant obstetric anaesthetist.

Total Spinal / Unexpectedly High Block

Total spinal anaesthesia is the rapid onset of hypotension and analgesia with widespread paralysis and apnoea due to the effects of the local anaesthetic within the subarachnoid space to a high spinal cord level (C3 for apnoea). It has occurred with the first dose of local anaesthetic when the epidural catheter was wholly or partly intra-thecal, but no CSF was apparent on aspiration. It has also been reported following several uneventful top-ups, several hours after the initiation of the epidural block. Inadvertent subarachnoid block can also occur where the dura has been punctured and the epidural catheter then re-sited at another interspace. It can also occur during normal spinal anaesthesia.

Precautions to Avoid Total Spinal:

- **Test Dose** – a suitable initial 'test' dose of local anaesthetic should be given. Rapid, profound analgesia, hypotension, or evidence of a dense motor block are suggestive of intrathecal injection.

- **Anaesthetist Top-ups** – all top-ups following accidental dural puncture must be administered by an anaesthetist.

Management of a Total Spinal:

- **Call for the resuscitation trolley, anaesthetist and obstetrician**
- **Position the patient to avoid aortocaval compression** – use any of the following; lateral traction on the uterus by an assistant or obstetric wedge or an assistant's knee under the right buttock

- **Oxygenate** – apnoea will be preceded by respiratory distress due to intercostal and phrenic nerve involvement. Administer oxygen and position the woman on her side. If necessary, assist ventilation by bag and mask, with application of cricoid pressure, while preparations are made for tracheal intubation. An induction agent and muscle relaxants may not be required in this situation, but syringes should be drawn up.

- **Correct hypotension** – profound hypotension is treated with generous fluid infusion and intravenous ephedrine or an α agonist (phenylephrine or metaraminol). Atropine or glycopyrronium may be required to treat any bradycardia < 60 b.p.m. Avoid aorto-caval compression. Cardiac massage may be required in extreme cases. An infusion of vasopressors may be required until the block resolves.

- **Obstetric management** – following initial resuscitative measures, further management decisions should be made by senior obstetric and anaesthetic staff. Caesarean section may be indicated, particularly if aorto-caval compression is thought to be interfering with cardiovascular resuscitation.

- **Critical Care** – a total spinal anaesthetic will resolve over a few hours. Cerebral, motor and cardiovascular function will return as long as the respiratory and cardiovascular systems are adequately supported during this period. Even with a decreasing level of block, sedation may occur due to sensory deprivation and therefore Critical Care should be involved with the management of the women until the block has fully receded. Death of mother or fetus due to total spinal anaesthesia should be totally preventable.

- **High block but NOT total spinal** – Mother will be hypotensive, may complain of numbness or tingling in upper limbs, and some difficulty breathing.

    - Treat: fluids and vasopressors, consider oxygen
    - Do NOT position head down, as this will extend the block.

Subdural Block[ref 10]

- Separation of the arachnoid from the dura by the catheter. The subdural space has more potential capacity posteriorly and laterally. Since the arachnoid and dura are attached together on the ventral nerve root, the anterior nerve roots (which transmit motor and sympathetic fibres) are relatively spared. In contrast to

the extra-dural space, which terminates at the foramen magnum, the subdural space extends intracranially. Have a high index of suspicion if an epidural block has a bizarre distribution. Stop the infusion and seek the advice of a consultant.

- **Characteristics**
    - **High Spread** – a block spreading unexpectedly high over 20-30 min, sometimes as high as the cervical dermatomes.
    - **Patchy Sensory Block** – often with missed segments and persisting pain.
    - **Relative Sacral Sparing.**
    - **Minimal Motor Block.**
    - **Nasal Stuffiness**
    - **Horner's Syndrome**.
    - **Blood Pressure** – can be well-maintained (severe hypotension is rare).
    - **Frequent** – more than originally thought (up to 2% of epidural catheterisations).
- **Management** – The arachnoid mater is easily torn, so a subdural catheter may rupture through following a bolus dose, changing the block from a subdural to a subarachnoid block. This may result in a total spinal blockade. In addition, a post-dural puncture headache may occur. Therefore, the catheter should not be left in situ. The catheter should be removed and the epidural re-sited at a different space.

Inadvertent Dural Puncture

See Post Dural Puncture Headache and Blood Patch Guideline (**page25)**

Local Anaesthetic Toxicity(ref 11/12)

- **Aetiology**
    - Inadvertent intravenous injection of Local Anaesthetic
    - Overdosage – max doses:

        - Lidocaine 3mg/kg body weight
        - Lidcaine with Adrenaline 7mg/kg body weight
        - (Levo)Bupivacaine 2mg/kg body weight (with/without adrenaline)
- **Presentation**
    - Early signs: circumoral tingling, ringing in ears, agitation
    - Sudden alteration in mental status, loss of consciousness convulsions
    - Cardiovascular collapse, bradycardia, cardiac conduction defects, tachyarrhythmias
    - LA toxicity may occur sometime after the initial injection.
- **Immediate Management**
    - Early – stop injection
    - **CALL FOR HELP**
    - Maintain the airway – early intubation
    - 100% Oxygen and adequate ventilation (hyperventilation may increase pH in presence of metabolic acidosis)
    - iv access – confirm or establish
    - Control seizures: diazemuls, small doses of propofol
    - Monitor cardiovascular status throughout
- **Management without Circulatory Arrest**
    - Conventional treatment of hypotension, bradycardia, arrhythmias
    - Consider INTRALIPID
    - Lidocaine should not be used as anti-arrhythmic.
- **Management of Cardiac Arrest.**
    - Cardiovascular collapse – resuscitate according to ALSO guidelines
    - Manage arrhythmias using standard ALS protocols except do NOT use lidocaine to manage ventricular arrhythmias, they may be very refractory
    - Resuscitation may need to continue for up to 1 hour.
    - Consider use of INTRALIPID for cardiovascular collapse / severe neurological reactions.
        - iv bolus 1.5ml/kg Intralipid 20% over 1min (100ml – 70kg patient)
        - and start iv infusion 15ml/kg/h (1000ml/hr)
        - Continue CPR
        - Repeat bolus twice at 5min intervals if inadequate circulation

        - After further 5 min increase infusion to 30ml/kg/h (2000ml/hr)
        - Continue infusion until adequate and stable circulation
        - Maximum cumulative dose 12ml/kg (840ml)
- Location of Intralipid – ANAESTHETIC ROOM
- **Follow-up Action**
    - Consider transfer to HDU / ICU
    - Exclude pancreatitis: daily amylase for 2 days
    - Report to National Patient Safety Agency (**www.npsa.nhs.uk**)
    - Report to **www.lipidregistry.org**, if intralipid has been given

POST DURAL PUNCTURE HEADACHE AND EPIDURAL BLOOD PATCH

Aetiology

- Accidental puncture with large gauge Tuohy needle during epidural insertion – "Dural Tap". (Incidence of severe headache 70%)
    - Either the needle or the catheter can breach the meninges. Usually there is obvious CSF leak, however, post-natal headache may be the first manifestation.
- Following spinal anaesthesia with narrow gauge, atraumatic-tipped spinal needles (incidence of headache approximately 1%)

Diagnosis

- CSF leaking from end of needle, if using loss of resistance to saline to locate epidural space, CSF can be distinguished from saline by its glucose content and its temperature
- A positive test dose via an epidural catheter – 2mL to 3mL of solution produces an extensive block within 5 minutes
- An unexpectedly high block after a typical epidural dose (not necessarily the first)
- Delayed onset of characteristic headache after attempted spinal or epidural insertion

Features of PDPH

- Posture-dependent headache: exacerbated by adopting upright position and relieved by lying down. Classically fronto-occipital headache radiating to neck and shoulders
- Neck stiffness
- Nausea, vomiting and dizziness
- Visual disturbances, tinnitus and hearing loss

- Prolonged PDPH has been associated with cranial nerve palsies and sub-dural haematomas

Prevention

- Use of small gauge (25-27G) atraumatic-tipped spinal needles
- Perpendicular orientation of bevel of epidural and spinal needles
- Avoidance of multiple dural punctures during spinal anaesthesia

Management of Suspected Dural Tap during Labour Epidural

- **Needle Tap** – thread the catheter into the sub-arachnoid space by 2-3cm. Do not persist if there is any paraesthesia. Clearly label the catheter and filter as “Spinal/ Subarachnoid Catheter”. Inform the midwife, obstetric staff and the patient and document this in the notes, including a management plan. Ensure handover to the on-coming anaesthetist. Prophylactic blood patch is not recommended
    - The presence of an indwelling intrathecal catheter may reduce the incidence of headache. Following delivery, label the catheter “do not use” or knot it and leave in situ for up to 24 hours.

- **Catheter Tap** – leave the catheter in the CSF and then treat as above (needle tap).

- **Anaesthetist Only Top-ups** – when there is a spinal catheter in-situ, only the anaesthetist should administer top-ups and they should remain with the patient for at least 10 minutes following the top-up to ensure any hypotension is treated promptly.

- **Do Not Use an Infusion**

- **Labour Analgesia** – levobupivacaine 2.5 $mg.mL^{-1}$ 1 mL to 2 mL flushed slowly through with 2 mL 0.9% sodium chloride. 15 to 25 micrograms fentanyl may be

given with the first dose. Expect to repeat the intrathecal local anaesthetic dose 1-2 hourly. Further fentanyl can be given cautiously if required after 6 hours.

- **Caesarean Section** – titrate 0.5 ml increments of 5 $mg.mL^{-1}$ levobupivacaine. Plus intrathecal diamorphine 200 to 500 micrograms.

- **Re-site the Catheter** – if you are not happy to manage a sub-arachnoid catheter, you can re-site the epidural at another intervertebral space. All drugs must be given by the anaesthetist. Remember that in the presence of a meningeal tear the amount of local anaesthetic required for the re-sited epidural may be significantly less than for analgesia with intact meninges. This is particularly important if an epidural is being topped up with large doses of local anaesthetic for Caesarean section. If a further tap occurs, consultant input must be sought.

- **Re-sited Epidural Infusion** – an infusion regimen can be considered after a catheter has been re-sited at another inter-space, only if several bolus top-ups have not exhibited excessively fast onset or unusually extensive block (suggesting tendency of drug to reach CSF)

- **Elective Instrumental Delivery** – there is no evidence that bearing down during second stage of labour increases the risk of headache, so manage normally.

Management Of Post Dural Puncture Headache

85% of PDPH will resolve spontaneously over 6 weeks, but the headaches can be quite disabling and severely impair the mother's ability to care for her baby.

- **Simple Measures**
    - Psychological Support: explanation and reassurance
- **Posture**

- Recumbency – there is no evidence that enforced recumbency (lying flat) is of any use in the prevention of post-dural puncture headache (as opposed to relief of symptoms).
- Woman should be encouraged to adopt comfortable position, but to participate as much as possible in care of baby

- **IV Fluids** – continue intravenous fluids for 24 hours. Aim for total daily fluid input of 3 litres.

- **Review Daily** – ensure that the woman is reviewed on a daily basis. If symptoms develop, explain that they are attributable to the leakage of spinal fluid. Explain that the meningeal tear will heal spontaneously in the majority of patients, but raise the possibility that an epidural blood patch may be required to enable early mobilization.

- **Follow Up –** all women with PDPH should be given an appointment at the anaesthetic clinic approximately 6 weeks postnatal

- **Analgesia** – prescribe Paracetamol + Diclofenac (if not contra-indicated) regularly. A laxative should be prescribed to prevent straining. May need to use stronger analgesics.

- **Epidural Blood Patch** – if a postural headache persists beyond 24 hours (and restricts mobilisation or is delaying discharge from hospital), consider an epidural blood patch (see below).

Other Treatments

- Caffeine
  - CNS stimulant and cerebral vasoconstrictor
  - 300 – 500mg orally / iv once – twice daily
  - one cup of coffee = 50 -100mg
  - No evidence that it produces more than a temporary effect and it has been

associated with CNS toxicity and atrial fibrillation

- Sumatriptan
    - Cerebral vasoconstrictor used in treatment of migraine
    - Case reports showing it to be of use in PDPH, but recent controlled trial showed no evidence of benefit.

Epidural Blood Patch

A blood patch should be considered for any woman with symptoms of a post-dural puncture headache (PDPH). However, all sorts of neurological symptoms have been ascribed to dural taps and cured by blood patching; atypical presentations are well described. Once symptoms have been attributed to CSF leak, current practice is to patch early (48 hours), especially if the symptoms are debilitating or preventing discharge. Success rate after 24 hours is about 90%, but only around 30% when performed earlier **(ref 13)**.

Procedure

- **Informed Consent** – give a full explanation of the cause of the headache and the reasons for performing a blood patch. Explain that it is successful on the first occasion in up to 80% of cases, but that a subsequent procedure may be necessary. Some pain, or pressure symptoms may be referred to the back, hip or leg during or immediately after the procedure, and backache may develop and persist for up to two weeks.

- **No infection** – the woman must be apyrexial and free from other signs of systemic infection, or infection of the skin at the proposed vertebral level. There is no need to do blood cultures routinely when performing a blood patch. (NB WCC normally elevated following delivery)

- **Technique**
    - **Two people** – usually required, both scrubbed and gowned. Blood may taken obstetrician or midwife if no second anaesthetist available.

- **IV access**
- **Vertebral level** – MRI studies have shown that spread of the clot is principally cephalad, therefore identify the epidural space at or below the original puncture site
- **Take 20 ml blood** – aseptically and inject over approximately 1 minute. If back or leg pain (due to arachnoid irritation) or pressure occurs, stop injecting and wait a few seconds. If the pain or pressure symptoms persist, then abandon the procedure.
- **Recumbency** – for 30 minute**s** and then mobilise cautiously.
- **Review** – if the symptoms have not completely resolved, refer to a consultant – a repeat blood patch may be required.
- **Documentation** – record the procedure in the notes and also in the "procedure book"
- **GP Letter** – complete GP letter and send (Appendix A)
- **Follow up** – a woman may be discharged the same day following a successful blood patch but arrange telephone follow up.

Failed Blood Patch

- Definite dural tap – consider repeat patch
- Two failed patches or non-definite diagnosis consider alternative diagnoses, neurological referral or radiological imaging.

Remifentanil Patient-Controlled Analgesia (PCA)

Indications

Epidural contra-indicated – coagulopathy

Anatomical failure to site epidural

Procedure

- Informed consent
    - Explanation of process
    - Stress the need for extra monitoring / supplemental oxygen
    - Need for paediatrician to attend delivery – babies characteristically require a short period of mask IPPV
- Supplementary oxygen via mask or nasal specula.
- Intermittent non-invasive blood pressure (NIBP) + respiratory rate monitoring.
- Continuous pulse oximetry (SpO_2) and Fetal Heart Rate FHR (CTG)monitoring

Regimen

- Graseby Omnifuse Pump (stored either in anaesthetic room on Sherwood Birthing Unit – ODPs have the key)
- Remifentanil 2mg in 50mL 0.9% saline (40micrograms.mL^{-1})
- Initial bolus 20micrograms (pump set at maximum delivery rate)
- Lock out period = 2 minutes
- Bolus increased / decreased in 20 microgram aliquots as required to maintain adequate analgesia – upto maximum of 80 microgram

Bolus (mcg)	mL
20	0.5
40	1.0
60	1.5
80	2.0

Monitoring

- Continuous presence of anaesthetist for first 30 minutes, or for as long as required to optimise bolus dose and ensure patient safety
- Continuous presence of midwife for the duration of PCA use

Observations

- Frequency: 5mins for 30mins, then every 30mins
- Pain Score: none (0), mild (1), moderate (2), severe (3)
- Sedation Score AVPU – inform anaesthetist if responding to pain (P) or

unresponsive (U)

- SpO_2 – contact anaesthetist if < 94% on supplementary oxygen
- Respiratory rate – contact anaesthetist if <8 /min
- Blood pressure
- FHR
- Also note side effects: nausea, vomiting, pruritus
- Note need for supplemental Entonox

Delivery

Presence of Paediatrician – MANDATORY

Typically neonate is conscious but respiration is depressed and will respond to mask IPPV

Umbilical cord gases and Apgar scoring should be recorded for auditing.

CAESAREAN SECTION (CS)

NICE and the National Collaborating Centre for Women and Children's Health have published a guideline for the NHS in England and Wales on Caesarean section: http://www.nice.org.uk/page.aspx?o=113190

The OAA and RCOG categorisation is based on descriptions of urgency as opposed to 'decision-delivery' time intervals. (ref 14)

Grade	Definition (at the time of decision to operate)
Category Red	**Immediate threat to life of woman or fetus**
Category Amber	**Maternal or fetal compromise, not immediately life-threatening**
Category Green	**Needing early delivery but no maternal or fetal compromise**
Category Blue	**At a time to suit the woman and maternity team**

Choice of Anaesthetic

Mode of anaesthesia will be decided by the anaesthetist in consultation with the surgeon, taking the woman's wishes into consideration. The majority of women will receive regional anaesthesia, however all women should be prepared for general anaesthesia and antacids given as below. The Royal College of Anaesthetists (RCOA) standard is for over 95% of elective CS, over 85% of category 1-3 emergency CS and over 50% category 1 CS to be performed under regional anaesthetic. (ref 15)

In an emergency – the obstetrician should state maximum time to delivery and the anaesthetist should use their judgement to determine the most appropriate anaesthetic technique.

Drugs for Caesarean Section – see **page 56-60**

Anaesthesia for Caesarean Section – see **pages 38-55**

Elective Caesarean Section

- **Pre-operative visit** – a normal anaesthetic history and examination should be performed. Take note of the placental site from the scan to ensure that a placenta praevia has not been missed
- **Investigations**
    - **FBC** – pregnant women are often anaemic, because of disproportionately increased plasma volume relative to red cell mass. Pre-operative transfusion should not normally be considered if haemoglobin concentration is greater than 7 $g.dl^{-1}$ in an asymptomatic individual.

    - **Blood Group/Antibody Screen** – do not start an elective case until the group & antibody screen has been confirmed on the computer or by telephoning blood bank. Confirm that the patient's blood does not have any antibodies that would affect crossmatching. If they do have antibodies, blood will have to be sent from the regional transfusion centre in Sheffield. The procedure should be delayed until the blood has arrived in the hospital.

    - **Cross Match** – for cases with a high risk of major haemorrhage, red cells should be cross-matched and delivered to the blood refrigerator before starting anaesthesia. Consider using cell salvage (**page 72-76**).

    - **Urea and Electrolytes** – these are requested only if specifically indicated.

- **Starvation** – no one should be 'nil by mouth' from midnight.
    - **Solid food** – permitted up to 6 hours before theatre.
    - **Pre-load drink** – given with pre-med as part of Enhanced Recovery protocol, may be repeated at anaesthetist's discretion if significant delay to surgery anticipated.
    - **Drinks** – clear fluids permitted up to 2 hours before theatre.
- **Antacid regimen**

- **Ranitidine** – elective surgery; women should have two doses of oral Ranitidine 150 mg, approximately 8 hours apart (22:00 and 08:00 for a.m. cases), or one dose of oral Lansoprazole 30 mg 6 hours before theatre.
- **Metoclopramide** – 10mg orally with morning dose of Ranitidine
- **Sodium Citrate** – do not use routinely before elective spinal CS, consider if increased risk of conversion to general anaesthesia. Dose 30ml 0.3M sodium citrate.

Emergency Caesarean Section

- **Documentation** – it is recommended that the anaesthetist documents the indication, declared urgency, and the time that he/she was notified of every non-elective Caesarean section.
- **Antacid Regimen**
  - **Ranitidine 6 hourly** – identify with the obstetricians/ midwives those women at high risk of operative delivery (maternal disease or acute/ chronic fetal compromise). These women are least likely to have normal deliveries, and should receive regular oral ranitidine 150 mg 6-hourly, or one dose of oral Lansoprazole 30 mg
  - **Sodium Citrate** – 30ml 0.3M Sodium citrate immediately before leaving their delivery room

- **Which Anaesthetic Technique?** – the choice of anaesthetic in the emergency situation is a judgement based on the balance of risk to the mother, or the fetus, or both, from the obstetric condition presenting and the mode of anaesthesia. Usually the choice of anaesthetic will be determined by the urgency of the obstetric problem. Bear in mind that the doctor's duty of care is always to the mother. Generally, the order of rapidity of readiness for surgery is in the order of, general anaesthetic, epidural top-up and then de-novo spinal.

  - **General Anaesthesia** – placental abruption, uterine scar dehiscence and prolonged fetal bradycardia and are indications for immediate, red CS. The vast majority of cases will demand that a general anaesthetic be given.

- **Cord Prolapse** – this is not necessarily a red emergency (i.e. epidural can be topped up), provided the cord is decompressed (someone's hand in the vagina pushing the baby's head up into the uterus) and the fetus is not compromised.

- **Failure to Progress/ Dystocia** – CS for this indication should allow plenty time for an epidural to be topped up or a spinal anaesthetic administered.

Intra-uterine Fetal Resuscitation [ref 16] – in the event of a Red CS, the following measures to improve fetal well-being should be considered in conjunction with the midwifery and obstetric team: **SPOILT**

- **S**yntocinon – switch off infusion pump.
- **P**osition full left lateral, or knee-elbow if cord compression is likely
- **O**xygen – via mask 10-15 $L.min^{-1}$
- **I**.v. – infusion of 1 litre crystalloid (Hartmann's Solution or 0.9% Sodium Chloride)
- **L**ow blood pressure – i.v. vasopressor; Ephedrine 6-12 mg, Phenylephrine 100-200 micrograms
- **T**ocolysis
  - – terbutaline 250 micrograms s.c. repeat after 1 min until contractions stop; max 3 doses.
  - – Glyceryl Trinitrate (GTN)
    - 2 × 400 micrograms puffs (sublingual) or
    - 50-200 micrograms; 1mg.mL solution diluted tenfold and use 0.5 to 2 mL bolus of diluted mixture at 1-2 minute intervals (intravenously),
    - Not if abruption/antepartum haemorrhage

Anaesthesia for Caesarean Section
Single-Shot Spinal Anaesthesia

Compared with epidural anaesthesia, spinal anaesthesia has lower likelihood of intra-operative analgesic supplementation or conversion to GA. Unless there are contra-indications, this should be the technique of choice for most Caesarean sections.

General Principles

- **Needle size** – The smallest available pencil-point (Polymedic or Whitacre) needle should be used, preferably a 27 gauge. The incidence of headache with these needles is far less than with Quincke types**.** Extra long 123 mm 25G and 150 mm 24G Polymedic needles are available

- **Vertebral level** – because it is now appreciated that the conus medullaris can extend lower than previously recognised (and anaesthetists often misjudge the inter-space), spinal needles should not be inserted above L2/3 (ref 17).

- **Paraesthesia** – if there is pain or paraesthesia in association with needle placement, or injection, stop and withdraw the needle.

Principles of Safe Management

- **Antacid regimen** – (**page 35).**

- **Avoid Aorto-caval Compression** – there should be at least 15 degrees of left tilt to the table when the patient is supine. If this is not possible for any reason, then place a wedge under the patient's right buttock.

- **Have Vaso-active Drugs Prepared** – Ephedrine, Metaraminol or Phenylephrine should be drawn up, with drugs for general anaesthesia readily available.

- **Establish I.V. Infusion** – Plasmalyte or 0.9% Sodium Chloride via 14 or 16 g cannula as a minimum. Consider inserting two cannulae if the patient is at higher

risk of heavy bleeding (e.g. placenta. praevia or multiple previous Caesarean sections).

- **Sterility** – a subarachnoid injection is a sterile procedure and gown, gloves and mask are recommended. 0.5% Chlorhexidine is the preferred antiseptic. All drugs that are to be injected into the subarachnoid space must be drawn up through a particulate filter (either integral to a 'drawing-up' needle or a separate item interposed between needle and syringe). This must be done in a sterile manner.

- **Check BP Before Starting** – as a general rule, try to maintain systolic arterial pressure around the pre-operative level (check recent ante-natal records) and definitely above 100 mmHg.

- **Urinary Catheter** – may be inserted after the onset of spinal anaesthesia, when sacral block is present.

- **Fetal Heart Rate Monitoring** –
    - **Elective CS** – check FHR before commencement of surgery
    - **Emergency CS** – monitor until surgical preparation of abdomen.

Intrathecal Drug Doses

Diamorphine is the preferred intra-thecal opioid for CS. It has been shown that patients receiving it have a lower incidence of unpleasant sensations per-operatively when compared to morphine. This is a function of the drugs lipophillicity and thereby the onset of action.

- **Opioids**
    - **Diamorphine 250 – 400 micrograms** - dilute 5 mg powder with 5ml saline to give 1mg/ml. (ref 18)
    - **Morphine 100 micrograms** - this must be preservative-free, available as 'morphine for epidural injection' (2 mg in 10 ml). Use 0.5 ml of this solution.

- **Fentanyl 15-20micrograms** – this drug is preservative free and lasts about 6 hours.

- **Hyperbaric (heavy) Bupivacaine 0.5% -** 2.5 ml is appropriate for most women. Pre-term women (28-35 weeks) have a requirement for more local anaesthetic compared to those at term (>38 weeks), probably because of reduced caval compression and displacement of the dura by engorged epidural veins.(ref 19) There is a tendency for high blocks in the obese subject and following an epidural. Some clinicians will use the same dose but inject very slowly, others will reduce the dose.

- **Intrathecal Injection -** barbotage is not recommended, but it is important to confirm that CSF can be aspirated during and on completion of injection of the solution.

Vasopressors

- **Use of Vasopressors** – maternal hypotension is unpleasant for the women and leads to inadequate placental perfusion.
- **Drug of Choice:**
  - **Ephedrine** 3-6mg bolus
    - Particularly useful when combination of hypotension and bradycardia
  - **Phenylephrine** See **Page 44-46**
  - **Metaraminol** 500 microgram bolus
    - Remember bradycardia produced by a vasoconstrictor is suggestive of excessive vasoconstriction and could potentially affect placental perfusion.

- **Vasopressor Timing** – vasopressors should be administered for recorded hypotension and consideration given for treatment in the following circumstances:
  - **Following Intrathecal injection** – to prevent hypotension

- **Maternal symptoms** – if the mother feels nauseated, faint, dizzy, becomes pale and sweaty or begins to yawn, then they are probably hypotensive, particularly if these symptoms are associated with a tachycardia.
- **Tachycardia** – or a rising heart rate is frequently the first sign of vasodilatation developing. Reversal of the tachycardia is a good sign that the blood pressure is being restored.
- **Oxytocin at delivery** – an α-agonist given 30 seconds before the administration of oxytocin helps minimise the development of a significant tachycardia.
- **Bradycardia & Hypotension**
    - Ephedrine is the drug of choice
    - use of Glycopyrronium to correct bradycardia may be helpful
    - remember that the resting maternal heart rate at term is elevated, so a heart rate <60 is a bradycardia
    - Cardiac sympathetic nerve fibres arise from T1-T4, therefore maybe blocked with slightly high spinal leading to unopposed vagally mediated bradycardia

- **Bezold-Jarisch Reflex** – a paradoxical response to decreased atrial filling from significantly reduced venous return. It can occur rapidly, the BP may not be recordable and the patient is at risk of losing consciousness. Prompt treatment with fluids, ensuring left lateral tilt, vasopressors and possibly an anticholinergic agent must be instituted quickly.

Block Testing

Perception of pain during regional anaesthesia for CS is the commonest cause of complaint in obstetric anaesthesia. It is essential that you check the block to at least two modalities (cold/ motor), and preferably three (+light touch) prior to giving permission for surgery to commence. This should always be documented.

- **Motor Block** – inability to raise the knees or heels from the bed should be confirmed. Movement of the toes is usually the last element to be eliminated and should not prevent surgery from beginning.

- **Adequate sacral block**
    - Can be confirmed by lack of discomfort following insertion of urinary catheter

- **Block to Cold** – using ethyl chloride or ice. Spinal anaesthesia, unlike epidural anaesthesia, virtually guarantees complete sensory loss below the most cephalad level. However there are case reports of patients having dermatomal sparing during spinal anaesthesia and so it is prudent to check the block from S5 to T4 bilaterally.

- **Block to Light touch** – using the drop of the ethyl chloride or the roughness of gauze. If the block to cold is satisfactory then you will only need to check the cephalad extent of this block, which should be to T6 (ref 20) bilaterally. However, it should be borne in mind that a few patients find it hard to differentiate between blocked and unblocked regions using this modality. Therefore, if block of the other two modalities is good, proceed.

- **Inadequate Block** – do not attempt a second intrathecal injection without having sought the advice. Estimation of an appropriate safe dose is difficult. If time permits, site an epidural catheter and top up cautiously with (levo)bupivacaine 5 $mg.mL^{-1}$, or the rapid top-up mixture. In the event of fetal compromise (discuss with obstetrician how much time is available), general anaesthesia may be indicated.

Post Operative Care

- **Feeding**

Allow the woman to eat and drink as soon as she wishes, assuming no surgical

contra-indications such as bleeding.

- **Mobilisation**

Post-operatively, the woman should be mobilised in the usual manner. Bed rest will not prevent the development of a spinal headache. If a headache does develop, manage as a post dural puncture headache (**pages 25-30)**

- **Post-op Opioids**

Complete the Spinal-Opioids section of the Acute Pain Prescription Chart.
Can be administered as and when needed to the woman.

PHENYLEPHRINE TO TREAT SPINAL-INDUCED HYPOTENSION[ref 21-22]

Introduction

Phenylephrine is considered a pure α_1-adrenergic agonist, promoting dose-dependent vasoconstriction. Studies have shown that it produces improved cardiovascular stability, fewer maternal symptoms (of hypotension) and improved fetal outcomes in terms of umbilical cord blood gases.

Dose:

- Phenylephrine **1 mg in a 10 ml ampoule (100 mcg/ ml)**.

Consent to use phenylephrine

- We have sourced a *diluted* solution of this drug to avoid accidental overdose. This is unlicensed. In accordance with Trust policy, **patient consent** is required prior to use.

Contraindications

- Patients on, or within 14 days of ceasing monoamine oxidase inhibitors
- Severe hypertension
- Hyperthyroidism

Precautions

- Care in patients with pre-existing cardiovascular disease, such as ischaemic heart disease, arrhythmias, occlusive vascular disease e.g. arteriosclerosis, hypertension or aneurysms. Anginal pain may be precipitated in patients with angina pectoris.
- Care in patients with diabetes mellitus or closed-angle glaucoma.

Drug interactions

- Phenylephrine may interact with halothane and other halogenated inhalational anaesthetics, to induce ventricular fibrillation.
- Increased risk of arrhythmias may occur in patients on cardiac glycosides, quinidine or tricyclic antidepressants.
- Phenylephrine may increase blood pressure and consequently reverse the action of many antihypertensive agents. Interactions of phenylephrine with alpha and beta receptor blocking drugs may be complex.

- Drugs with effect on α_1 adrenoceptors could potentiate (such as granisetron) or inhibit (such as doxazosin or buspirone) the vasopressive action of phenylephrine.

Recommended infusion regimen

- In the anaesthetic room, allow the woman to rest. Take blood pressures every 1-2 minutes until measurements become consistent (3 successive measurements of systolic blood pressure (SAP) that have a difference of no more than 10%). The baseline SAP and HR is the mean of the three recordings.
- Draw up one ampoule of phenylephrine (1mg in 10ml) in a 10 ml syringe.
- Label the syringe with patient and drug concentration details.
- Use the Alaris Asena® pump, extension line and a Y connector with a one-way-valve to prevent back flow into the fluid arm for the infusion.
- Prime the line with phenylephrine.
- Start the infusion at 40 ml/h immediately after the spinal injection.
- Check the blood pressure every minute and titrate the infusion rate (20 to 40ml/h) to maintain baseline SAP.
- Stop the infusion upon delivery of the baby.

Trouble shooting

- **Bradycardia**
    - If the heart rate drops below 60 beats/ min, titrate the rate of the phenylephrine infusion down, provided the maternal blood pressure is maintained.
    - If the maternal heart rate drops below 50 beats/ min please correct with intravenous Glycopyrronium or Atropine.

- **Severe hypertension and bradycardia**
    - This is probably a consequence of an overdose of phenylephrine. Turn the phenylephrine infusion off and wait.
    - If there is no improvement, consider administration of intravenous glyceryl trinitrate 50-200 micrograms or hydralazine10-20 milligrams.

- **Maternal symptoms**
    - If the mother feels nauseous, faint, dizzy, becomes pale and sweaty or begins to yawn, then she is probably hypotensive, particularly if these symptoms are associated with a tachycardia.
    - Exclude other causes of hypotension (for example positioning or manual distraction of the abdomen to avoid aortocaval compression and haemorrhage.
    - Consider increasing the rate of fluid and phenylephrine infusion.

Anaesthesia for Caesarean Section
Epidural & Combined Spinal-Epidural Anaesthesia

Indications for Epidural

- **Epidural in Situ** – having been successfully established during labour. Remember poor epidural in labour = poor epidural for surgical anaesthesia (ref 9)
- **Failed/ Contra-indicated Spinal** – e.g. in cardiac disease
- **Prolonged Surgery** – when it is thought that surgery may be prolonged, such as in a patient having had multiple laparotomies in the past. CS plus sterilisation is not an indication in most patients.
- **Primary Technique** – CSE's are now sometimes utilised to minimise the initial spinal dose of local anaesthetic to limit BP change (see below).

Epidural Rapid Top-up

- **Mixture** –
    - **Either**
        - **10 mL 0.5% levobupivacaine with 1:200,000 adrenaline**
    - **and**
        - **10 mL 2% lidocaine**
    - **and**
        - **2 mL 8.4% sodium bicarbonate** – add the bicarbonate last or else the mixture will precipitate.
        - These drugs are available on the epidural trolley. 15-20 mL of this solution should be given over 5 minutes. An adequate block for surgery should be obtained in around 7-10 minutes.
    - **Or** - 'rapid top-up' mixture is as follows:
        - **20 mL 0.5% levobupivacaine**
        - **OR 10 mL 0.5% levobupivacaine + 10 mL 2% lidocaine.**

- **Where to Top-up** – in most situations, the top-up should be administered in theatre, with monitoring attached. Administration of the entire dose in the delivery room risks development of a high block and unmonitored hypotension/ fetal

distress whilst in transit to theatre. This is unlikely if the epidural has been working satisfactorily and recently been assessed. Monitoring does include clinical assessment of the conscious level and the patient's pulse during transit, which is likely to be under 2 minutes if the indication is so dire. This practice would probably be indefensible should a major problem arise.

- **IV Fluids** – as the block is established, 500 ml Hartmann's solution should be infused through a 14 or 16 g cannula (not in pre-eclampsia). If hypotension develops, and in women with pre-eclampsia, use vasopressors rather than resort to colloid substitutes such as Gelofusine®.

- **Block Testing** – be aware that epidural anaesthesia may leave normal sensation in the most caudal (sacral) dermatomes. Block of the sacral roots is important to prevent pain during visceral traction and pressure on the vagina. All dermatomes from S5-T4 should be tested on both sides, and the upper and lower limits of the block (and any missed segments) documented. The zone of differential sensitivity to touch and cold may be two to four dermatomes wide.

- **Epidural Opioids** – improve the quality of the block during surgery. Epidural fentanyl in labour does not preclude a further peri-operative dose up to 100 micrograms. Alternatively, 3 mg of diamorphine or 2 mg epidural morphine can be given, which will prolong the post-operative analgesia.

- **Breakthrough Pain** – surgeons do not always warn of their delivery of the uterus through the abdominal wound, which can cause sudden extreme discomfort. Enquire as to the necessity of the manoeuvre and request that they replace the uterus as soon as possible.

    - **Alfentanil** – 250 to 500 microgram increments can be used to control any breakthrough pain, and should not be withheld for fear of depressing the fetus.

- **Ketamine** - in 10 to 30 mg increments can be very useful in avoiding having to proceed to a GA and, if used in conjunction with alfentanil, seems to have a low incidence of unpleasant side effects.

- **Entonox** – a 50% oxygen:50% nitrous oxide mix administered by the anaesthetic breathing system is a useful approach. Do not add an anaesthetic vapour, as this risks loss of the airway reflexes.

- **General Anaesthetic** – unrelieved, persistent pain must be discussed with the patient and a GA offered, and this should be documented.

Combined Spinal-Epidural Anaesthesia

- **Why Use a CSE?**
  - **Reduced Intrathecal Dose** – the initial subarachnoid injection can be deliberately conservative (1.5mL local anaesthetic intrathecally, +/- 20mL 0.9% saline via the epidural to push the intrathecal block to T4), to minimise the risk of a dangerously high block (e.g. in the morbidly obese, or in a women with a difficult airway). In addition, the haemodynamic consequences of spinal anaesthesia will be minimised.

  - **Prolong the Block** – the subarachnoid block can be augmented by subsequent epidural top-ups (particularly useful if protracted surgery is anticipated). However, the initial spinal dose means that intrathecal catheter placement cannot have been excluded (i.e. the epidural catheter is untested).

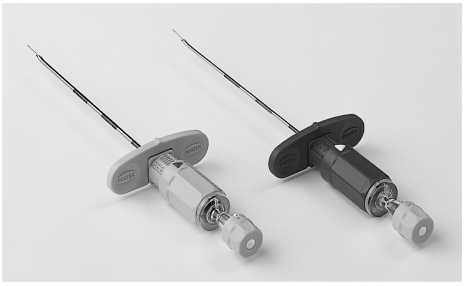
  - **Post-op Pain Relief** – the epidural catheter can be used to provide optimal analgesia (continuous epidural infusion) in the postoperative period (e.g. severe pre-eclampsia, cardiac disease).

- **Technique**

- **Double-Space Technique**

Insert epidural as normal at L2/3 and then site the spinal at a lower level. This technique requires two punctures, however minimises the time sitting after spinal sited because epidural catheter is already in situ.

- **Needle through Needle**



Portex CSEcure®
Combined spinal-epidural
system
with locking device,
available from Smiths Medical.

Only requires one puncture, may not always be possible to perform spinal, particularly if epidural slightly lateral. Difficulty in threading epidural catheter may result in difficulty extending spinal block.

Anaesthesia for Caesarean Section
General Anaesthesia

Pre-operative

- **Pre-operative Visit** – a normal anaesthetic history and examination should be performed, with particular attention paid to the airway (failed intubation 1:300 in an obstetric population versus 1:2000 in normal population). Rapid sequence induction should be explained. If you anticipate difficulty, summon help before starting. An awake fibre-optic intubation should be considered if airway difficulty is anticipated and sedation should not be omitted on the grounds of fear of fetal depression.

- **Equipment Check** – ensure that you are familiar with the available equipment for the management of the difficult airway. All available in difficult airway trolley NB Never reach for an unfamiliar device for the first time in a crisis!

- **Partners** – are not normally allowed in theatre when the mother is having a GA. However, provided there is a dedicated trained midwife, a partner may (once the maternal airway has been secured) be escorted in to witness the baby's birth.

Induction of General Anaesthesia for a Red LSCS Emergency

- Recent guidelines from Difficult Airway Society and Obstetric Anaesthetists Association include an algorithm for the conduct of safe obstetric general anaesthesia, see Appendix B (ref 23)

- **Patient Transfer** – women should be transferred in left lateral position (see intra-uterine fetal resuscitation, (**page 36**).

- **Skilled Assistance** – ensure that the Operating-Depatment Practitioner (ODP) has been contacted. Skilled assistance is essential and **no** anaesthetic should commence until assistance is available.

- **Sodium Citrate** – 30ml 0.3 Molar.

- **IV Access** – establish a freely running i.v.i. via a 16 or 14 gauge cannula.

- **Urinary Catheter** – inserted prior to induction of anaesthesia

- **Fetal Heart** – monitored until surgical preparation of abdomen.

- **Patient Position** – 15° left lateral tilt.

- **Head & Neck Position** – optimise head and neck position for intubation prior to induction (sniffing the morning air – neck flexed, head extended), consider using the ramped position in the morbidly obese the TROOP™ pillow is available in the back corridor.

- **Pre-induction** – start 100% O_2 via close-fitting facemask, at sufficient flow to prevent re-breathing. Ensure that the gas analyser is switched on and the sampling line is connected to the filter. Confirm the presence of a CO_2 trace. Pre-oxygenate for three minutes, or until the end-tidal oxygen concentration reaches 90%. The ODP should attach the ECG, NIBP and pulse oximeter probe during this period. Make sure the suction is working and close to hand. When the surgeon is ready, instruct the ODP to apply cricoid pressure (lightly). Ensure that pressure is being applied correctly and that the head and neck are optimally positioned for intubation. NB pre-oxygenation can be carried out whilst surgeons are scrubbing and prepping the patient to minimize delay in delivery.

- **Induction Drugs**

- Induction drugs are located in a “Headbox”in the drug fridge in the anaesthetic room. Spare “Headboxes in the fridge between the two theatres and in main theatre.

- **Thiopental** – 5 $mg.kg^{-1}$, **Propofol** 2-2.5 mg/kg, thiopental has been implicated in increased incidence of awareness with obstetric GA (ref 2)

- **Succinylcholine** – 1.5 $mg.kg^{-1}$, or **Rocuronium** -1mg/kg

- **Opioids** – for the mother with pre-eclampsia, cardiovascular or cerebrovascular disease, do not withhold an opioid at induction for fear of neonatal respiratory depression (easily antagonised by naloxone). See guideline for GA in pre-eclampsia **(page 86).**

- **Intubation** – when the jaw is fully relaxed, intubate and inflate the cuff. Attach the breathing system (still delivering 100% O_2), confirm tracheal intubation by auscultation and capnography. Check that there is no audible leak around the cuff before ordering the cricoid pressure to be removed.
    - Surgery may commence once the airway is secure.

Difficult Tracheal Intubation - hints

- **Smaller tracheal tube than usual** – especially if there is a history of upper respiratory tract infection or pre-eclampsia, both of which predispose to laryngeal oedema.

- **Pre-stiffened tracheal tube/ bougie** - an anterior larynx, just out of reach of the tube, can usually be cannulated with a well-lubricated gum-elastic bougie. When railroading the tracheal tube rotate it 90° anti-clockwise to help the tube bevel slip past the vocal cords. Alternatively a stylet can be used to alter the curve on an endotracheal tube.

- **Different laryngoscope** – a McCoy laryngoscope can convert a Grade 3 view into a Grade 2 view.

- **Head and Neck Position** – reassess. TROOP pillow is available in back corrridor

- **Re-direct cricoid pressure** – an unexpectedly poor laryngoscopy grade is often due to wrongly applied cricoid pressure, particularly if the ODP has not allowed for the fact that woman is tilted when calculating the direction of force. Careful re-adjustment can transform the view. Obstruction to insertion of the laryngoscope by the woman's breasts or the ODP's hand is usually resolved by adjustment of the position of the ODP's hand. Do not maintain cricoid pressure at the expense of oxygenation. Hypoxia is fatal, but aspiration is not inevitable and its occurrence will not necessarily lead to death.

- **Videolaryngoscope** – disposable McGrath is on top of difficult intubation trolley

Remember – women do not die from failure to intubate. They do die from prolonged attempts to intubate in the face of hypoxia, and from unrecognised oesophageal intubation.
If in doubt, take it out and ventilate with bag and mask.

Remember – if instituting the failed intubation drill, the consultant anaesthetist should be contacted by someone other than the ODP

Failed Intubation

OAA/DAS guidelines include algorithms for the management of failed intubation and "can't intubate/can't ventilate" scenarios as well as a table to provide guidance to aid the decision-making process as to whether to wake up or proceed with surgery – see Appendix B. [ref 23] Sugammadex is available in the anaesthetic room for the reversal of Rocuronium. DAS Algorithms – Appendix B

Maintenance and Reversal

- **$ETCO_2$** - keep the end tidal CO_2 ~ 4.0 kPa.
- **Anaesthetic Agents** –
    - **Oxygen** - use 33 - 50% O_2 in N_2O
    - **MAC** - add approximately 0.75 MAC [end-tidal] of volatile agent (Isoflurane or Sevoflurane) to the N_2O/O_2 mixture.[ref 24]
- **Volatile Issues**
    - **Over-pressure** – can be used initially e.g. 2-3% Isoflurane (inspired) for the first minute or two to ensure an end tidal concentration of at least 1.3% [ref 25, 26]. However, remember there is an increased risk of awareness that comes from the absence of opioid analgesia.
    - **"Light Anaesthesia"** – increase the volatile agent if needed, guided by measured end-tidal vapour and N_2O concentrations, pupil size, tachycardia, hypertension, sweating and lacrimation.
    - **Uterine Contractility** –The effect on uterine contractility of increased concentrations of volatile agent is rapidly reversible and the anaesthetic concentrations can be reduced to give a concentration of 1.0%, soon after the IV opioids are given, following umbilical cord clamping.
    - **Haemorrhage** – In the event of life-threatening haemorrhage, discontinuation of the volatile agent may be considered as a measure to improve uterine tone. In such a situation, ketamine ($1mg.kg^{-1}$) can be used to maintain anaesthesia (with sympathomimetic and strong analgesic effects).
- **Muscle Relaxants** – increments of a non-depolarising relaxant e.g. Atracurium or Rocuronium should be given, guided by the response to peripheral nerve

stimulation. Reversal of Suxamethonium is prolonged in pregnancy due to lowered levels of plasma cholinesterase. At the end of surgery, reverse neuromuscular block using a peripheral nerve stimulator to confirm full recovery. This is particularly important if Magnesium Sulphate has been given.

- **Analgesia** – after the umbilical cord has been clamped, give i.v. Morphine 10-20 mg. If there is an epidural is in situ, top up with 2.5 $mg.mL^{-1}$ levobupivacaine (assuming no major blood loss) and Diamorphine 3 mg / epidural Morphine 2 mg, otherwise set up a PCA – Smiths CADD Solis (grey front panel)
    - Consider transversus abdominis plane (TAP) blocks.

- **Blood Loss** – estimation of blood loss is difficult because of mixing with amniotic fluid, consider swab weighing if excessive bleeding, and checking Hb with Hemocue™.

- **Extubation** – extubation should occur when there is return of the airway reflexes and the patient recovered in the lateral, head down position until fully awake. Supplementary oxygen should be administered until SpO_2 is >95% breathing air. Pain should be treated with intravenous Morphine.

DRUGS FOR CAESAREAN SECTION

Peri-operative Drugs

- **Antibiotics – for prophylaxis**
  - See Caesarean Section guide-line on intranet
  - Administer iv antibiotics pre incision wherever possible[ref 27]
- **Oxytocics**

  - **Oxytocin Bolus** – **2-3 units** should be given by slow i.v. bolus at every CS as soon as the cord has been clamped (the last cord if multiple pregnancy). Oxytocin can cause transient, but severe vasodilatation, hypotension and tachycardia.**[ref 28].**

    - Precipitous drops in blood pressure can occur in the hypovolaemic or patients with fixed cardiac output. A further dose can be given if necessary.
    - Risk of myocardial ischaemia in susceptible patients
    - In severe cardiac disease consider using oxytocin by infusion only

  - **Oxytocin Infusion** – If requested by obstetrician, especially if increased risk uterine atony
    - Prolonged labour
    - Multiple pregnancy
    - Fetal macrosomia
    - Posterior placenta praevia

Regimen

40units Syntocinon in 50ml N Saline, 8 to 12.5 ml/hr by syringe pump

  - **Ergometrine** – If the uterus fails to contract adequately, ergometrine in 250 to 500 micrograms i.v. in increments is indicated, except in pre-

eclampsia (beware of its vasopressor effect). Expect nausea/vomiting in the awake woman.

- **Carboprost** – the third-line pharmacological approach is carboprost (prostaglandin F2α, Hemabate®) 250 micrograms by deep i.m. injection. Can be given intra-myometrially. Side effects include vasodilatation and bronchospasm. It should not be injected intravenously due to the risk of severe bronchospasm.

- **Misoprostol PR** – this is "off-licence", but is given as 800 micrograms (4 x 200 mcg) PR, once.

- **Vasopressors** – **see pages 40-41,44-46**
- **Uterine relaxation** – this may be requested to facilitate procedures such as delivery of a second twin. 50 micrograms increments of i.v. glyceryl trinitrate (GTN) are effective. Hypotension does not seem to occur in women already venodilated by a regional block. GTN can alternatively be given by metered dose (400 micrograms) sublingual spray.

Post-op Drugs – all cases (unless contra-indicated)

- **Analgesics**
  - **Diclofenac** –100 mg suppository should be administered at end of surgery. Prescribe 50 mg 8-hourly on the "regular" prescription area as PO/PR.

  - **Contraindications to Diclofenac**
    - **Hypovolaemia** - or continuing bleeding (risk of renal hypoperfusion).
    - **Renal impairment** - including poor urine output in pre-eclampsia).If diclofenac is withheld, review after 24 hours. If oliguria has resolved, then prescribe.
    - **Coagulopathy**

        - **Asthma with history of sensitivity to NSAIDs** – can be prescribed if the woman has previously taken other NSAIDs without adverse effects.
        - **Peptic ulceration** – if the history is for Helicobacter pylori, then NSAIDs can be prescribed.
        - **Hypersensitivity to NSAID**

    - **Paracetamol** -1 g intravenous can be administered at end of surgery. Prescribe 1g QDS. Rectal paracetamol – poor bioavailability and more expensive than iv. Remember to reduce dose in patients weighing < 50kg

    - **Oral Morphine Solution** – 0.3-0.6mg/kg (20-40mg) hourly on the PRN side of the prescription chart. The patient can receive this at anytime – unless opioid-free interval specified by anaesthetist.

    - **sc Morphine** – If preferred a subcutaneous morphine regime can be used instead of oral morphine**.**
      Typical regimen: Mild Pain 5mg. Moderate 10mg, Severe 15mg hourly

- **Anti-emetics**
    - **Cyclizine** - 50mg 8 hourly po/im/iv PRN
    - **Ondansetron** - 4mg 8 hourly po/iv/im PRN

- **Thromboprophylaxis**
    - **See pages 8-9**
- **Intravenous Fluids -** post-operative fluids should be prescribed to ensure that the IV access is maintained for at least 12-18 hours post-surgery in case post-partum haemorrhage occurs. This can be achieved by the slow infusion of 1-2 litres of crystalloid. With an uncomplicated CS under regional anaesthesia most women should be drinking within a short time. Be wary of fluid overload, particularly in pre-eclampsia

ANAESTHESIA FOR CAESAREAN SECTION
IMMEDIATE POST-OPERATIVE CARE

The midwife **must not** leave the woman unsupervised for the first 30 minutes post operatively.

Responsibilities of the Anaesthetist

- Following general anaesthesia the woman **must** be supervised by an anaesthetist until she is conscious and protecting her own airway.
- The anaesthetist should ensure that all woman are cardiovascularly stable before leaving
- Women should have received adequate analgesia and further analgesia prescribed.
- PCA / Spinal or epidural opioids – use Acute Pain Prescription chart
- IV fluids should be prescribed as necessary

Responsibilities of the Midwife

- **Monitoring**
  - Oxygen Saturations
  - Blood Pressure
  - Frequency
    - Every 15 minutes for first hour
    - Every 30 minutes for next two hours
    - 4 hourly thereafter
- **Analgesia**
  - All women should receive regular Paracetamol and Diclofenac (if not contra-indicated) and anti-emetics should be prescribed.
  - **Spinal / epidural opioids**
    - Use Acute Pain Prescription Chart
    - Monitor respiratory rate hourly
    - Give oxygen as prescribed
    - Observe opioid–free interval – if need for opioids in this period discuss with anaesthetist

- **Patient controlled iv analgesia (PCA)**
  - Useful if patient received GA especially if impaired coagulation
  - Post op emergency CS patient may require some education about using pump
  - Document basic obs, respiratory rate, basic PCA obs ie demands made / successful demands on Acute Pain Prescription Chart
  - All other pump problems will be resolved by anaesthetist

- **Subcutaneous morphine**
  - Indwelling sub-cut cannula should be clearly labeled
  - Assess pain scores hourly (see below) and administer prescribed dose for that level of pain
  - Monitor respiratory rate, pain score and sedation score
- **Epidural**
  - Epidural in situ post CS may be used to provide post-op. analgesia in ladies remaining on SBU eg severe PET.
  - Manage as epidural infusions for labour
  - Document on Acute Pain Prescription Form
  - Epidural should be prescribed on Acute Pain Prescription Form

Pain and Sedation Scores

Pain Score	Sedation Score
0 – no pain	0 - none
1 – mild pain	1 – mild – occasionally drowsy
2 – moderate pain	2 - moderate – frequently drowsy
3 – severe pain	3 – severe – difficult to rouse

- **Fluids and Oral Intake**
  - A functioning intravenous cannula must be left in-situ until 24 hours post-surgery and I.V. fluids given as prescribed
  - A drink of tea/coffee or squash may be offered to women who have undergone uncomplicated delivery under regional block, as long as the

uterus is well contracted and there is no evidence of significant post-partum bleeding.

- **Discharge from SBU**
  - Woman should be fully conscious and haemodynamically stable
  - Spinal or epidural blocks should be resolving, ie woman can move her legs freely
  - Woman should have adequate analgesia and nausea / vomiting should be controlled

- **Post-operative Problems** contact LW anaesthetist if woman complains of
  - **Awareness**
  - **Neurological deficit or severe backache**
  - **Severe postural headache**
  - **Pain during regional CS**
  - **Any other issues relating to anaesthesia**

ANAESTHESIA FOR CAESAREAN SECTION
RECOVERY – "ABC PROBLEMS"

Airway

- Airway problems are much more likely following general anaesthesia.
- **Causes:**
    - General anaesthetics and opioids are central nervous system depressants and will reduce the conscious level, this may result in airway obstruction from loss of pharyngeal tone, "swallowing the tongue" particularly when the patient is supine.
    - Presence of blood, secretions or vomit in the pharynx.
    - Post-extubation laryngospasm - Characterised by a crowing noise, all obstetric patients should be extubated awake to minimise this.
    - Airway problems in obstetric patients are exacerbated by the fact that all pregnant patients are at risk of aspiration of gastric contents.
- **Presentation:**
    - Look - Cyanosis, reduced oxygen saturations "see-saw" respiratory pattern, tracheal tug, use of accessory muscles.
    - Listen - Snoring, gurgling, crowing noises. Inspiratory noises as against expiratory noises.
    - Feel - May not be able to feel air moving
    - **NB complete airway obstruction may present with absolute silence!**
- **Management**
    - Call anaesthetist - Anaesthetist should not have left an unconscious patient unless totally unavoidable.
    - Oxygen
    - Turning patients into recovery position should sort out most problems associated with loss of pharyngeal tone – also reduces risk of aspiration if they vomit, therefore all patients should be nursed on their side until wide

awake.

- Simple airway manoeuvres – jaw thrust, chin lift
- Oro-pharyngeal airway
- Naso-pahryngeal airway
- Re-intubation

Breathing

Again commoner following general anaesthesia.

- **Central respiratory depression** due to opioids and anaesthetic drugs.
  - Will present with hypoxia and reduced oxygen saturations, slow respiratory rate. If on oxygen these changes may be late. Suspect if low respiratory rate especially if reduced conscious level.
  - Pregnant patients at greater risk because reduced oxygen reserves and also increased oxygen consumption.
  - Treatment: Oxygen
  - Severe opioid-induced respiratory depression may require Naloxone
- **Incomplete reversal of neuro-muscular blockade**
  - Patients are often agitated and display jerky or twitchy movements.
  - Administer oxygen and call anaesthetist
  - Will probably require further dose of reversal agent. Severe cases may need re-intubation.
- **High spinal / epidural block** leading to paralysis of muscles of respiration.
  - Patients may complain of difficulty breathing – as long as patient is still talking they are OK but inform anaesthetist.
  - If block high enough will present with complete apnoea.
  - Administer oxygen and call anaesthetist
  - If complete apnoea will need bag and mask ventilation, early intubation should be performed because of risk of aspiration
- **Bronchospasm**
  - Commoner in asthmatics
  - May result from aspiration of gastric contents or anaphylaxis
  - Presents with wheezing, if severe may desaturate.
  - Treat oxygen, bronchodilators

Circulation

Hypotension probably the commonest problem, hypertension and heart rate problems may also occur. Heart rate will be recorded by pulse oximeter. Trends are particularly important.

- Hypotension
    - Common following epidural or spinal
    - Consider PPH
    - May also occur as part of an anaphylactic reaction
    - Give oxygen
    - Increase fluids
    - Look for evidence of uterine atony or vaginal bleeding
    - If PPH, follow PPH guidelines
    - Otherwise anaesthetic review.
- Hypertension
    - Most likely cause following anaesthesia is pain, but in all obstetric patients consider PIH
- Bradycardia
    - May result from high spinal or epidural block
- Tachycardia
    - Commonest cause again is pain, but hypovolaemia and haemorrhage will present with tachycardia before hypotension.
    - Resting maternal heart rate is normally around 90.
    - Ask about pain and check for haemorrhage.

Disability

Reduced conscious level – drug-induced: opioids, general anaesthetics

Consider hypoglycaemia particularly in diabetics

ANAESTHESIA/ ANALGESIA FOR OTHER OPERATIVE PROCEDURES

Apart from Caesarean section, other common procedures are:

- **Insertion of cervical suture**
- **Trial of instrumental delivery**
- **Suturing of third degree tears**
- **Delivery of retained placenta**
- **Evacuation of retained products of conception**
- **Laparotomy**

General Principles

- **Reflux** - regard every woman from 20 weeks of pregnancy, until 2 days postpartum, or any woman with symptoms of gastro-oesophageal reflux as being at risk from reflux. All women should have H_2 antagonists (if time permits) and antacid premedication, and if a GA is chosen, induction by rapid sequence (with cricoid pressure).

- **Anaesthesia** - most women can routinely be offered spinal anaesthesia. The above procedures should be performed in the operating theatre rather than the delivery room. Beware of the forceps/vacuum delivery that can turn into a Category 1 emergency Caesarean section (the attempted instrumental delivery can exacerbate fetal compromise). Ensure there is an adequate block to T4 before the procedure starts. Apart from laparotomy and trial of instrumental delivery, all of the other procedures can be anaesthetised with 1.5 – 2.0 ml hyperbaric bupivacaine 0.5%, which should ensure cold sensation blockade to T10 or higher with minimal cardiovascular instability.[ref 28] Hyperbaric prilocaine 2% can be used for shorter procedures (use equivalent volume as bupivacaine) Note, hypotension in the course of regional anaesthesia for retained placenta can be related to the extent of maternal blood loss rather than block height.

- **Laparotomy** - pregnant women not uncommonly present with abdominal pain and require procedures such as appendicectomy or ovarian cystectomy. These are best performed under general anaesthesia. The risk of precipitating abortion/ premature labour is attributable to surgical activities rather than anaesthesia.
  Consider general anaesthesia for laparotomy for PPH in women with cardiovascular instability.

- **NSAIDs** - avoid if the fetus remains in-utero owing to possible detrimental effects on the child. Opioids and paracetamol are the mainstay of post-operative analgesia.

Late Termination of Pregnancy

This procedure is sometimes carried out on SBU, usually for severe fetal abnormality. These patients have labour induced and augmented and therefore often require epidural or PCA analgesia.

Some anaesthetists may wish to exercise their right, under the terms of the Abortion Act 1967 (section 4) and the Human Fertilisation Act 1900 (section 37) to not be involved with the provision of anaesthetic services for these patients, and this position must be respected and therefore the following guideline applies:

- **Trainees / SAS doctors –** any individual not wishing to become involved with these patients should notify the on-call consultant as soon as possible.

- **Emergency Care –** such as resuscitation, anaesthesia for bleeding etc, of patients having a late termination of pregnancy must not be compromised, no matter what the belief of the attending anaesthetist.

JEHOVAH WITNESS'S

See obstetric guideline. The principles of treating members of the Jehovah Witness group, and other patients refusing blood products are as follows:

- **Patient Autonomy**- any adult patients (18 years and over) who has the necessary mental capcity to understand any medical procedure or treatment have the right to refuse any treatment, even if this refusal would lead to their demise. You must follow their wishes and respect their decisions, even if you do not agree with them yourself. The decision to refuse blood / blood products has been upheld in court **(ref 30)**

    - **Patient Competency** - for the patient to be deemed competent they must be able to:
        - **Understand** – the information that you give them.
        - **Retain** - the Information that you give them.
        - **Weigh Up the Choices –** that are available to them.

    - **Under 18 Years** - in England, a patient under the age of 18 years, cannot refuse a treatment that is beneficial to them, nor can a parent, or guardian, consent for refusal of treatment on their behalf.
    - If the mother is too young to be mentally competent and the parents refuse to agree treatment that is, in the opinion of two Consultants, proper and necessary it may be necessary to involve Trust Solicitors and apply for a legal "Specific Issue Order". The High Court has emergency procedures to arrange for expedited considerations of such applications.
        - In an emergency, blood should be given
        - Full documentation of the decision by two consultants is essential and the Trust Solicitor and on call Manager must be informed.**(ref 31)**

- **Refusal of Treatment** – ascertain which products the patient refuses. Also, make sure that they understand that if they refuse blood, then it would be against

the law for anyone to give them blood, even if that meant that they would not survive.

- **They Usually Refuse**
  - **Blood** - be it homologous or pre-donation by themselves.
  - **Platelets**
  - **Clotting factors**
  - **Albumin**

- **Will Often Accept:**
  - **Cell salvage** – as long as they understand that the blood will remain in continuity with them.
  - **Activated factor VIIa** - produced from rabbit kidney cell lines.
  - **Blood patch**.
  - **Organ donation**
  - **Cardio-pulmonary bypass**

- **They Will Accept :**
  - **Crystalloids**
  - **Artificial colloids**

- **Antenatally** – check Hb regularly, start on Fe, B12 and Folic Acid. Refer to Anaesthetic Antenatal Clinic. If Hb <11, discuss with haematology re intravenous iron or erythropoietin.

- **Documentation** – document clearly the discussion that you have had with the patient, the products that they refuse and the treatments that they accept. Have this witnessed in writing. Take a copy of their “Advance Directive”, which you should have them sign and date for the day of your discussion and place this in the notes. Ask the patient to inform the staff that they are Jehovah Witness/ refuse blood products as soon as they arrive in hospital to have their baby.

- **Communicate with Staff** – in the acute situation inform the on-call anaesthetic consultant, the obstetric and midwifery team and arrange with theatres for them to identify a cell saver operator, which you may call upon.

- **Active Management of Labour** – check the patient's haemoglobin, ensure that 3rd stage oxytocics have been given, that any post-delivery suturing is done promptly after delivery and that all patients are started on a post-delivery infusion of oxytocin (10 iu/hr) for 4 hours.

- **Surgical Techniques** – great attention to haemostasis is required and techniques such as B Lynch suture/ arterial ligation/ hysterectomy may be necessary.

- **Severe Anaemia –** this may need to be treated by ventilation on 100% oxygen and possibly hyperbaric chamber therapy. They will require intravenous iron and erythropoietin therapy (haematology).

CELL SALVAGE (ref 32,33)

The use of cell salvage is a clinical decision and each case should be considered individually. In some situations the benefit to the patient may outweigh the risks of usual contra-indications, particularly in situations of life-threatening haemorrhage. The use of cell salvage in obstetrics is approved by NICE (ref 34)

Advantages

- **Reduced complications of Autologous Transfusion**
    - Infection – no viral / prion transmission
    - Coagulation – preservation of clotting products, although not platelets
    - Improved oxygen transport
    - Reduced risk of hypothermia
    - Reduced risk of transfusion reactions including TRALI (Transfusion Related Acute Lung Injury)
- **Financial**
- **Reduced availability of Autologous blood**
    - Decreasing donor pool

Indications in Obstetrics

- **Actual/ anticipated major haemorrhage** - during Caesarean section.
  e.g. placenta praevia , fibroid uterus
- **Jehovah Witness's** – and others who are undergoing a Caesarean section and refuses donor blood transfusion.
- **No Blood Available** – such as when there is difficulty in the provision of cross-matched blood e.g. rare blood type.

Contra-indications

- **Patient refusal**
- **Infection -** in the operative field.
- **Malignant tumours -** in the operative field
- **Sickle cell disease, trait and other red cell disorders** –may result in sickling

- **Blood from the vagina** - potential for bacterial contamination from normal resident bacteria.

Warnings

- Do **NOT** use if the surgical **field** contains:
    - Betadine / Chlorhexidine
    - Hydrogen peroxide
    - Alcohol
    - Distilled water
    - Antibiotics not for parenteral use
    - Fibrin adhesives
- **AVOID** aspirating into the collection set:
    - Topical clotting agents (collagen,thrombin)

GUIDELINES FOR USE:

- **Consent** - whenever possible the use of cell salvage should be discussed with the patient in advance and this discussion should be documented.

- **Training** - the responsible clinician must be familiar with the clinical aspects of cell salvage particularly in the obstetric situation. The cell salvage machine operator must have undergone training, be competent, and be named on a register of trained operators and understand cell salvage in the obstetric situation. Clinicians requesting cell salvage should also have undergone training.

- **Equipment** - use in accordance with the manufacturer's instructions. (**Caution:** ACD-A **MUST** be attached to the cell salvage machine immediately, and must not be left elsewhere in the theatre or anaesthetic room. This is to avoid the potential risk of administration to the patient).

    - Keep anticoagulant solutions apart from fluids for intravenous infusion.
    - Ensure wash solution is 0.9% isotonic saline only.

- **Surgical Technique**
  - Large-bore suction tip (minimum 4mm eg Yankauer)
  - Use as low as possible vacuum pressure to minimize haemolysis
  - Minimise surface skimming, allow blood to pool
  - Discontinue cell salvage if substances not licensed for iv usage are present in the surgical field
    - Use standard theatre suction
    - Irrigate thoroughly with saline before recommencing cell salvage

- **Anaesthetic Concern -** Beware dilutional coagulopathy and anaemia with large volume losses. If indicated, measure haematocrit / haemoglobin / coagulation profile during the procedure.

- **Amniotic Fluid/ Fetal Squames** – risk of amniotic fluid embolus during cell salvage is minimal (NICE [34]). Re-infused blood needs to be passed through a 40 micron PAL leucocyte depletion filter to minimise the risk of infusing fetal cell debris.

- **Swab washing** - surgical swabs following weighing within sterile area can be washed in anticoagulant and the resultant fluid collected and processed.

- **Bakri Balloon** – cell saver reservoir containing anticoagulant can be attached to the Bakri balloon in place of the collection system.

- **Re-Infusion –**
  - Salvaged blood packs must be clearly labelled with the patients name, hospital number, date of birth, date and time of collection, the signature of the person performing the procedure and the words ‘FOR AUTOLOGOUS USE ONLY’

- Prior to transfusing the blood back to the patient, the identity of the patient must be confirmed in accordance with Trust Guideline : ‘Blood and blood products administered by qualified nurses and healthcare professionals’.

- Strict aseptic technique must be maintained at all times.

- Salvaged cells should be re-infused within a maximum of six hours of the commencement of collection, in order to minimize the risk of infection. They must remain with the patient in theatre, at room temperature. The units must not be removed to a blood fridge under any circumstances, as this greatly increases the risk of the blood being given to the wrong patient.

    - Use of pressure bags is contra-indicated with salvaged blood as may damage red cells, and risk of air embolism.

- Salvaged blood presents the same health and safety hazards as bank blood, and thus universal infection control precautions must be maintained. Used blood packs from the cell salvage procedure must be disposed of as hazardous waste, in accordance with the control of infection procedures.

- A unit of salvaged blood must only be transferred to the ward setting if the transfusion has already been initiated in the operating theatre.

- Any adverse events involving the use of ICS must be notified to the Hospital Transfusion Team and an incident report raised. The Hospital TransfusionTeam will, if necessary, in turn report the adverse event to the Hospital Transfusion Committee and the National Haemovigilance bodies.

- **Audit** - Regular / continuous audit of cases should be undertaken, and each individual unit of salvaged blood must have an audit trail. To maintain these standards, all cell salvage procedures and volumes of blood re-infused must be

documented in the patient's records using the Intra-operative Cell Salvage Data Collection Form (one copy to patient's casenotes, one copy for retention in file.

- **Anti-D Prophylaxis** – will be required if cell salvage used on Rh –ve women, according to Rh –ve guideline.

- **Jehovah's Witness -** patients will usually require that the blood be circulated back to them with no break being made in the continuity of the collection and giving sets, so all blood must be given while in theatre and the lines connected to the cell salvage machine.

COLLAPSE IN THE PARTURIENT

Collapse, with or without seizure, may result from

- **Massive blood loss (page 78-82)**
- **Eclampsia**
- **Epilepsy**
- **Pulmonary thromboembolism**
- **Amniotic fluid embolism (page 77-78)**
- **Intracerebral pathology (e.g. aneurysm, AV Malformation)**
- **Myocardial infarction**
- **Local anaesthetic toxicity (page 22-24)**
- **Total spinal block (page 19-21)**
- **Sepsis**
- **Medical conditions**

- **Resuscitation equipment** - make sure you know where resuscitation equipment and drugs are kept on the delivery suite, and that you are familiar with the latest UK Resuscitation Council algorithms.

- **Oxygenate** - tracheal intubation should be instituted as early as feasible.

- **Displace the uterus** – manually, or rotate the woman by at least 15° (whole body or at the hips) and secure the position with a wedge or pillow.

- **Raise the legs.**

- **Cardiac arrest -** external cardiac massage will be ineffective unless steps are taken to minimise aorto-caval compression as above (without making chest compression impossible).

- **Caesarean section** - this is indicated if there is no response to advanced life support within 4 minutes.

Placental Abruption – see page 79.

Amniotic Fluid Embolism (anaphylactoid syndrome of pregnancy)

Thought to be an anaphylactoid reaction triggered by maternal exposure to foetal antigens from the amniotic fluid. The syndrome can occur at Caesarean section as well as in labour and during 2nd trimester terminations. Left ventricular dysfunction and pulmonary hypertension follow pulmonary vasoconstriction.

- **Signs**
  - **Hypoxia**
  - **Bronchospasm**
  - **Haemodynamic collapse**
  - **Coagulopathy**

- **Treatment**
  - **100% O_2,**
  - **Restoration of cardiac output**
  - **Correction of coagulopathy.**
  - **Critical Care**

Major Obstetric Haemorrhage

Obstetric haemorrhage can be primary or secondary (associated with coagulation failure). Placental abruption can fall into both categories (see below).

Primary	Secondary
Uterine atony	**Pre-eclampsia/HELLP**
Placental abruption	**Placental abruption**
Placenta praevia	**Intrauterine sepsis/septicaemia**
Retained placenta / products of conception	**Amniotic fluid embolism**
Genital tract trauma	**Pre-existing coagulopathy**
Uterine rupture	**Incompatible blood transfusion**
Uterine inversion	**Retained dead fetus**

Placental abruption - is the premature separation of a normally situated placenta. Intrauterine death implies that a large abruption has occurred; a sizeable covert haemorrhage can occur into the uterine myometrium. Coagulopathy can be expected in one to two thirds of women in whom intrauterine death has occurred, but is most unlikely if the fetus has been delivered alive. A significant abruption complicated by pre-eclampsia can lead to renal failure very quickly. If oliguria persists for > 4 hours, consider utilising a CVP line to allow controlled fluid replacement. A CVP of 1-2 is usually sufficient to ensure restoration of renal function.

Uterine inversion - is when the fundus of the uterus becomes displaced, usually in the 3rd stage of labour. It is classified as 'complete' if the fundus passes through the cervix. Haemorrhage can be severe, although the clinical signs of shock can be out of proportion to the blood loss. A reflex bradycardia can be mediated by the effect of traction on the ligaments supporting the uterus. Treatment involves restoring the uterus to its rightful position and the correction of any hypovolaemia.

Major Haemorrhage Resuscitation

For further info – see Major Haemorrhage Guideline on Intranet

- **Alert Appropriate Staff** – phone 2222 and declare Major Obstetric Haemorrhage and give location.
- **Use ABC Approach**

- **Oxygen** - a high concentration of oxygen should be given to the mother.

- **Two IV Lines** - at least two peripheral infusion lines will be necessary. The cannulae used should be 14 g (brown) or 16 g (grey).

- **Invasive Monitoring** – this will not be necessary at the outset and can divert attention from the resuscitation. When stable, consideration may be given to CVP monitoring. Unless the mother is septic or has a cardiac problem, the BP will respond to fluid/ blood therapy and an arterial line will usually not be required.

- **Blood Samples**
    - FBC, Coagulation, X-match, U+Es
    - ABG inc lactate

- **Volume Replacement** - initial volume replacement should be with 2 litres Plasmalyte (or N Saline, but beware of hyperchloraemic acidosis), until blood is available.
- **Cross Match/ Transfusion** –
    - **Blood** - a minimum of 6 units should be ordered. The woman's blood group and the presence of abnormal antibodies should have been ascertained during pregnancy and this information should be available in the casenotes.

    - **Group Specific** - group and Rhesus compatible blood should be requested and issued with minimal delay.

    - **Warming Device** - ideally, blood should be administered through a warming device with pressure bags, consider using Level 1 rapid infuser.

- **Clotting Factors & Platelets** – Although red cells are essential use of platelets and clotting factors should be withheld until major bleeding points have been controlled. Once surgical haemostasis has been more or less achieved, continued oozing may be due to blood factor deficiencies. Further blood samples (see above) should be sent, but this should not delay the giving of FFP or cryoprecipitate. (Liaise early with Consultant Haematologist) The sample sent to the lab will inform the haematology staff as to the likelihood of any additional requirements that you may have.

- Consider Tranexamic Acid

- **UN-CROSSMATCHED GROUP (O RhD-NEGATIVE) CAN BE LIFE-SAVING.** This is stored in the obstetric theatre fridge.

- **Cell Salvage** - this should be considered in cases of actual or anticipated major haemorrhage **(see page 72-76).**

- **Use of Factor VIIa** - can be lifesaving (and avert hysterectomy) [ref35] and is accepted by most Jehovah's Witnesses (from rabbit kidney cell lines).

    - **Indications** - when surgical opportunities for haemostasis have been exhausted and bleeding continues, recombinant factor VIIa (Eptacog alfa, NovoSeven®)
    - **Correct Hypothermia and Acidosis**
    - **Other Blood Products** - ensure that RBC's, FFP, cryoprecipitate, and platelets are given rapidly and aim to correct clotting wherever possible.
    - **Consultant Haematologist** – will need to authorize.

NovoSeven Dose

Weight	Dose
<55 Kg	4.8mg (1x4.8mg vial)
55-75kg	6mg (i.e. 1 x 4.8mg vial + 1 x 1.2mg vial)

>75kg	7.2mg (i.e. 1 x 4.8mg vial + 1 x 2.4mg vial)

NB: use booking weight as guide - this one-off dose is given as an IV bolus. It is unlikely that any further doses would be necessary; this should be discussed with the O/C haemostasis consultant.

High Dependency/ITU care – see pages 89-93, 94-96

ANAESTHETIC MANAGEMENT OF COMPLICATED PREGNANCY

Diabetes Mellitus

See Diabetes in Pregnancy Guideline on Intranet.

Aim to maintain blood glucose measurements between 4 and 8 mmol/l during labour/ C. section too reduce the risk of neonatal hypoglycaemia.

Placenta Praevia

Further info: Placenta Praevia Guideline

- **Pathology** - a placenta praevia is a placenta wholly or partially situated in the lower uterine segment. Grades I and II may allow vaginal delivery but grades III and IV necessitate Caesarean section. The risk of major peri-operative haemorrhage is significantly increased by previous Caesarean sections and age >35, which are risk factors for placenta accreta (placenta adherent to the myometrium).[ref 29]

Nos of Previous LSCS's	Incidence Praevia %	Incidence of Accreta %
0	0.26	5
1	0.65	24
2	1.8	47
3	3	40
4	10	67

- **Regional anaesthesia** - is not contra-indicated.[ref 30] There is a distinction between performing a regional block in a women who has bled and is dependent on sympathetic tone to maintain her BP, and a woman who is normovolaemic and bleeding is anticipated. The woman should be made aware that significant blood loss may ensue, and that being awake while large quantities of blood are

rapidly infused might not be a pleasant experience. In the event of serious difficulty securing haemostasis, general anaesthesia may have to be induced and the women should be informed of this risk.

- **Blood** - ensure that at least 4 units of red cells are available. These should be present in the theatre block prior to surgery commencing. Two i.v. lines (14 or 16 g cannulae) should be established with devices for rapid infusion available and fluid warmers should be set up from the outset. Cell salvage is indicated **(see page 74-78).** A senior anaesthetist and obstetrician should be present in theatre.

- **Post-partum haemorrhage** - placenta praevia is a risk factor.

Pre-Eclampsia

Further info: Pre-Eclampsia Guideline

- **Features of Severe Disease** - any one of the following elevates the diagnosis to 'severe'.
    - **Systolic ≥160**
    - **Diastolic ≥110 mmHg** – on 2 occasions, 6 hrs apart.
    - **Proteinuria ≥ 5 g/24 hrs**
    - **Oliguria ≤ 400 ml/24 hrs**
    - **Raised Creatinine** – in pregnancy this is > 80
    - **Pulmonary oedema**
    - **Cerebral or visual disturbances**
    - **Epigastric pain**
    - **Coagulopathy/ thrombocytopenia**
    - **'HELLP' -** haemolysis, elevated liver enzymes, low platelets
    - **Hepatic rupture**
    - **Intra Uterine Growth Retardation (IUGR) –** or oligohydramnios

- **Anaesthetic Management on delivery suite -** the anaesthetist may be involved with analgesia, blood pressure control, fluid therapy and monitoring. All severe

pre-eclamptics should have anaesthetic review twice daily and should be started on an Obstetric HDU Observation Chart.

- **Epidural analgesia** - is strongly indicated to provide optimal analgesia and thus prevent further rises in BP secondary to pain, but should not be regarded as a first-line treatment for hypertension. Platelets and coagulation should have been checked within the previous 2 hours in patients with severe pre-eclampsia, HELLP syndrome or Fatty Liver of Pregnancy.

- **Fluid management** - see obstetric guideline

- **Coagulopathy** – in severe pre-eclampsia, HELLP syndrome or Fatty Liver of Pregnancy, a full blood count should have been processed no more than 2 hours before a regional block is undertaken. If the platelet count is <100 000 mm^{-3}, or if the trend is steadily downwards, proceed to a coagulation screen (INR/APPT/TCT), which must be within normal limits for spinal/epidural block to be performed. If there are any petechiae, or the platelet count is <80 000 mm^{-3} (and coagulation screen normal), a platelet transfusion is indicated immediately prior to performing a regional block.

- **Anaesthesia for Caesarean Section**

    - **Control of hypertension** - it is essential, except in the most urgent of situations, that the BP is controlled prior to induction of anaesthesia. Aim for a BP of around 140/90.

- **Regional Anaesthesia for Caesarean Section**
    - **Hypotension** - excessive hypotension is not associated with spinal anaesthesia in pre-eclampsia, because the hypertension of pre-eclampsia is not mediated by the sympathetic nervous system **(Ref 31)**. It can be inferred that the pre-eclampsia is the more severe the less the hypotensive response to the spinal, because the humoral component of BP maintenance is the greater. Phenylephrine or ephedrine, given in

standard i.v. doses, does not cause an exaggerated hypertensive response. However, it is best to avoid prophylactic dosing

- **Epidural or CSE** – this type of anaesthesia has the advantage of facilitating post-operative analgesia by infusion of bupivacaine/fentanyl in a high dependency area.

- **General Anaesthesia**
  - **Indications** – as for GA in non-pre-eclamptics, but also when there is a coagulopathy or symptoms (especially piercing headache) or signs of impending eclampsia.

  - **Invasive monitoring** - have a low threshold for direct arterial pressure monitoring.
  - **Specific problems** - include laryngeal oedema (be prepared for difficult intubation) severe pressor response and potentiation of non-depolarising neuromuscular block by therapeutic serum concentrations of magnesium.

  - **Induction sequence** – this must attenuate the pressor response to intubation to protect the mother's cerebral circulation. Alfentanil 10-20 mcg kg^{-1} or remifentanil 2 mcg kg^{-1} should be given prior to rapid sequence induction. Inform the paediatrician that the mother will receive an opioid.
  - **Extubation** – prior to extubation, consider specific therapy (e.g. labetalol in 5-20 mg increments) to avert a dangerous pressor response. If a swollen larynx was evident at laryngoscopy, or if the intubation was traumatic, be extremely wary of post-extubation stridor. Consider a period of elective ventilation.

- **Post-partum** - the woman is still at risk of eclampsia and will require continued antihypertensive and anticonvulsant therapy, with careful fluid management and close monitoring of urine output in an HDU environment.

Eclampsia

Further info: see eclampsia guideline

- **General treatment**
  - **Summon skilled anaesthetic assistance**
  - **Maintain airway patency and give 100% oxygen** - if this is not possible using simple manoeuvres then intubate the trachea, preferably using thiopental or propofol and succinylcholine.
  - **Avoid aorto-caval compression**
  - **Prevent trauma** - to the mother and fetus.
  - **Post-seizure** - most initial seizures will be self-limiting. After the convulsion has terminated, examine the woman's respiratory system for signs of aspiration. The fetus may show signs of compromise secondary to maternal hypoxaemia or placental abruption.

a) Anaesthesia after eclampsia

- **Regional block** - may be appropriate after a single seizure provided: (ref 32)
  - **Fully conscious**
  - **Coagulation screen normal**
  - **Platelet count > 100 000 mm^{-3}** – or can be made so by a platelet transfusion
  - **Serum magnesium concentration** - is in therapeutic range

- **General anaesthesia**
  - **General principles** – as for pre-eclampsia **(see page 87-88).**
  - **Non-depolarising blocker doses** - must be reduced (but not succinylcholine) in the presence of therapeutic serum concentrations of magnesium.
    - **Peripheral nerve stimulator** - is mandatory
  - **Post-op ventilation** - consideration should be given to sedation and ventilation for any eclamptic woman who has had a Category 1 GA section. Consider CT brain to exclude intra-cerebral haemorrhage.
  - **Exclude laryngeal oedema** - prior to extubation.

OBSTETRIC HIGH DEPENDENCY CARE

Further info: Maternity Women Requiring High Dependency Care

SBU has two designated rooms (7 and 8) for the care of high dependency patients, rooms 4,6,9 and 11 can be converted if necessary.

- **Staff Responsibility** – Senior Obstetrician, Anaesthetist and Midwife, with support from Critical Care Outreach, if unavailable consider transfer to ICCU**.**

- **Communication** - between the above two doctor groups and with the midwifery staff is essential for the correct management of HDU type patients. Changes in management should be discussed with the responsible anaesthetist If uncertain seek Consultant advice.

- **Documentation** – the following is required:

    - **Admission Note** – describing the reason for HDU care, the initial findings on admission, management plan and time of future review.
    - **Serial Blood Results** – are to be recorded on a flow sheet to allow the identification of trends.
    - **HDU Observation Chart** – is to be started and the parameters, below, recorded at least hourly in the acute phase of the illness:
        - **Blood pressure**
        - **Heart rate**
        - **Respiratory rate**
        - **Peripheral oxygen saturation**
        - **Urine output**
        - **Accurate fluid balance**
        - **AVPU score**
    - **AVPU score –** this is an easy bedside assessment of conscious level. P and U indicate an obtunded conscious level that requires the patient to have their trachea intubated. This protects the upper airway from obstruction and the

lower airway from soiling. This level of diminished consciousness is a medical emergency.

A Alert

V Responds to voice

P Responds to pain only

U No response to stimuli

- **Patient Review** - depends upon the severity and stage of the patient's illness, but should be a minimum of twice a shift. These reviews and management plans should be documented in the notes by both anaesthetic and obstetric staff. All staff should write sequentially in the same record.

- **Patient Referral for HDU Care**
  - **MEOWS** - Permits early detection of deteriorating patient.
  - **Anaesthetic Referral** - obstetric or midwifery staff may refer to the anaesthetist any patient they are concerned about.
    - **Anaesthetic assessment** - the patient should be assessed by the anaesthetist at the first possible opportunity.

- **High Dependency Admission** - examples
  - Severe non-obstetric medical / surgical problems transfer to ICCU
  - **Major haemorrhage -** and/or the potential for continuing blood loss
  - **Severe pre-eclampsia, eclampsia, HELLP syndrome**
  - **Coagulopathy**
  - **Severe Sepsis**
  - **Multi-organ Dysfunction**
  - **Invasive Monitoring**

- **Postoperative care** – team decision by anaesthetist, obstetrician and midwife.
- **Pulmonary embolism.**
- **Pulmonary oedema**.
- **Medical conditions** – e.g. unstable diabetes mellitus, asthma.
- **Intensive Monitoring Required –** step down/ post-Critical Care.

- **Levels of Obstetric Care**
  - **Level 0 –** Normal midwifery / obstetric care
  - **Level 1 –** Risk of condition deteriorating, stepping down from higher levels of care, can be managed on SBU with input from midwifery, obstetric and anaesthetic teams.
  - **Level 2 –** More intensive monitoring, single organ support, step down from ICCU. Input as above with support from critical care outreach.
  - **Level 3 –** Multiple organ support required, isolated respiratory failure. Transfer to ICCU.

- **Outreach team** – referral for support should be instituted early in patients not responding to therapy or deteriorating, or if there are problems with invasive monitoring.

- **Central Venous Catheters & Central Venous Pressure Monitoring**
  - **Use** - if a patient would benefit from CVP monitoring/ access, then a discussion concerning this requirement should occur between the responsible anaesthetic and obstetric staff and central venous access instituted if required.
  - **CVC Lines** - an ante-cubital fossa “long line” is the safest option, however, should this fail or be deemed inappropriate an internal jugular line should be inserted, preferably utilizing ultrasound guidance.

- **Arterial lines** - should be used if the patient requires regular blood gases, or is already in situ from theatre. Patients requiring inotropic support should be transferred to ICCU. Consider in obese patients or severe pre-eclampsia.

- **Critical Care/ Intensive Care** – (see Obstetric Critical Care Transfer Guideline, below)

    - **Indications**
        - Need for CPAP or invasive ventilation
        - Need for inotropic / vasopressors for circulatory support
        - Airway protection: GCS≤ 8, AVPU – P or U
        - Renal Replacement Therapy: Rising creatinine (≥300), particularly when hyperkalaemia or acidosis develops.
        - Coagulopathy – unresponsive to blood products, surgical haemostasis should be assured.
        - Inadequate staffing to care for patient on SBU

- **Hand-over** - a comprehensive hand-over between anaesthetists, obstetricians and midwives should occur at each shift change until the patient no longer requires HDU support.

- **Discharge From HDU Care –** this must be a multidisciplinary decision and should involve the following:

    - **Consultant Obstetrician on call**
    - **Anaesthetist covering SBU**
    - **Labour Ward Co-ordinator**

- **Criteria For Discharge** – to be considered:

    - **Invasive lines removed**
    - **Haemorrhage/ Coagulopathy resolved**

- **No CNS depression/ irritation**
- **Not requiring:**
    - oxygen
    - hourly observations
    - ECG monitoring
    - intravenous anti-hypertensives

- **Discharge Documentation –** should include information concerning the patients condition and vital signs, the reason for discharge, the plan for further care and where the patient was discharged to. The name of the doctor authorising the discharge should be recorded.

CRITICAL CARE REFERRAL & TRANSFER

Further info: Maternity Women Requiring High Dependency Care Guideline

- **Indications**
  - Need for CPAP or invasive ventilation
  - Need for inotropic / vasopressors for circulatory support
  - Airway protection: GCS≤ 8, AVPU – P or U
  - Renal Replacement Therapy: Rising creatinine (≥300), particularly when hyperkalaemia or acidosis develops.
  - Coagulopathy – unresponsive to blood products, surgical haemostasis should be assured.
  - Inadequate staffing to care for patient on SBU

- **Decision to Transfer**
  - Input from Consultant Anaesthetist, Consultant Obstetrician, LW Co-ordinator
  - Discuss with Consultant Intensivist
  - Confirm bed with ICCU

- **Prior to Transfer**
  - Patient should be stabilized
    - Airway secured
    - Invasive monitoring
    - Inotropic support if necessary
    - Haemostasis
  - Decision to transfer, time, date and by whom should be documented in the notes.

- **Transfer**
  - Confirm ICCU bed ready

- Personnel: anaesthetist and obstetric ODP
    - Midwife to monitor FH if antenatal patient
    - Equipment and drugs for vaginal delivery should be taken to ICCU if antenatal patient.
- Treat as any intra-hospital transfer
    - Transfer trolley
    - Self-inflating bag and alternate oxygen supply for ventilated patients
    - Invasive monitoring, as indicated
- Take notes and charts with patient.
- Maternal Transfer to ITU Form (HDU guideline) should be completed.
- Plan for regular obstetric and midwifery review should be formulated and documented.

- **Shared Care**
    - **Medical responsibility** – there is shared care between the Critical Care team and the obstetric team responsible for the patient. However, ultimate responsibility for critical care matters lies with the Critical Care team headed by the Critical Care Consultant on-call.

    - **Review** - the referring obstetric team should review at the patient least daily.

    - **Contact numbers** - for midwifery & obstetric advice should be made available to the Critical Care team and a midwife should always be available to attend the women on the Critical Care Unit, if requested.

- **No ICU Bed**
    - Decision as to whether to transfer the woman to another hospital will be made by the Intensivist, having taken advice from the Obstetrician and Obstetric Anaesthetist.

- If need to transfer existing ICU patient to make space then decision whether to keep woman on SBU or to transfer her to main theatre recovery, until ICCU bed ready.
    - Decision: Obstetrician, Obstetric Anaesthetist, LW Co-Ordinator
    - Will be determined by whether woman can be safely managed on SBU without affecting her care or that of any other woman.
    - However multiple transfers of same patient should be avoided wherever possible.

ANTENATAL ANAESTHETIC MANAGEMENT OF HIGH RISK WOMEN

Anaesthetic Alerts

Women with the following conditions should be referred for Anaesthetic opinion using the Alert Form. **This list is <u>not exhaustive</u>**. If in doubt refer to Sherwood Birthing Unit
anaesthetist.

- **Cardiovascular**
    - Congenital Heart Disease – corrected or uncorrected
    - Valvular Heart Disease
    - Ischaemic Heart Disease
    - Cardiomyopathy including past history of peripartum cardiomyopathy.
    - Arrhythmia / pacemaker
    - Pulmonary hypertension

- **Respiratory**
    - Severe asthma
    - Cystic fibrosis
    - Bronchiectasis
    - Previous lung surgery.
    - Any restrictive lung disorders

- **Renal**
    - Chronic renal failure
    - Women on renal dialysis
    - Woman with renal transplant.

- **Musculoskeletal**
    - History of spinal injury / spinal surgery
    - Ankylosing spondylitis
    - Scoliosis / other anatomical spinal anomalies

- Rheumatoid, SLE and other multi-system disorders.

- **Neurological**
  - Brain tumour – operated or non-operated.
  - Sub-arachnoid haemorrhage
  - Multiple sclerosis
  - Paraplegia
  - Spina bifida, hydrocephalus, V-P shunt
  - Myasthenia gravis, myotonic dystrophy etc.

- **Endocrine**
  - Poorly controlled diabetes mellitus
  - Hyperthyroidism and poorly controlled Hypothyroidism
  - Addison's, Cushings, Conn's etc
  - Hypopituitarism
  - Phaeochromocytoma.

- **Haematology**
  - Thrombocytopenia
  - Anticoagulated woman
  - Haemoglobinopathies / thalassaemias etc.

- **Anaesthetic**
  - Difficult intubation
  - Previous major head, neck or airway surgery
  - Personal or family history of malignant hyperpyrexia or Scoline™ apnoea
  - Past history of major problems with general or regional anaesthesia
  - Allergy to anaesthetic agents, opioids, local anaesthetics or latex.

- **Obstetric**
  - Anticipated complex Caesarean Section e.g. anterior praevia with previous scar, fibroid uterus

- Women who decline blood and blood products especially if operative delivery planned.

- **Others**
  - Obesity: BMI > 40, or booking weight > 130kg
  - Any unusual syndrome (will allow us to exclude potential anaesthetic hazards early)
  - IV drug abusers
  - Severe needle phobia.

Mechanism of Referral

- Identify on alerts section of electronic pathway that a referral has been made.
- Complete alerts form (Appendix C)
- Leave notes and attached alert form in tray in obstetric medical records
- Completed form should be filed in the notes, with a photocopy placed in the "alerts file" in the anaesthetic office on labour ward

Communication

- When patients with an anaesthetic alert are booked for induction / Caesarean section it is the responsibility of the obstetrician to ensure this is documented in the labour ward diary.
- Labour Ward Co-ordinator to inform duty anaesthetist when a woman with an anaesthetic alert is admitted.

2) Antenatal Anaesthetic Clinic

- Takes place fortnightly on alternate Wednesday afternoons in antenatal clinic
- Lead anaesthetist for this clinic is Dr A Kathirgamanathan.
- **Referral Process**
  - Appointments will be given based on the urgency of the clinical situation and the availability of clinic space.
  - Women are usually selected from those on whom anaesthetic alert forms have been submitted
  - Women may be referred directly for clinic review by letter from an obstetrician

- Please inform the woman she may be asked to attend the anaesthetic antenatal clinic, or asked to see the anaesthetist covering SBU (in this situation please inform her that she may have to wait if the anaesthetist is busy.)
- If a community midwife wishes to refer a patient without obstetric input they should discuss the case directly with Dr Kathirgamanathan.
- Women with otherwise normal pregnancy who wish to discuss choices for labour analgesia or anaesthesia for Caesarean section may also be referred.

- **Communication**
  - Patients seen in the clinic with a completed anaesthetic plan will have that documented in the notes using the standard anaesthetic alert form, with a copy in the anaesthetic office
  - Letters to the relevant obstetrician / midwife will be written giving updates on those ladies requiring further investigations etc.

3)High Risk Women Booked for Caesarean Section

- When a high risk woman is booked for elective Caesarean section, the referring obstetrician is to inform Dr Kathirgamanathan of the date of the planned procedure so that he can liaise with the relevant anaesthetist.
- If a high risk women is booked for a “green” section the following day it is the responsibility of the referring obstetrician to contact the anaesthetist who will be covering the labour ward the next day.

Appendix A – PDPH Letter

Patient Name:

DOB:

Address:

NHS Number:

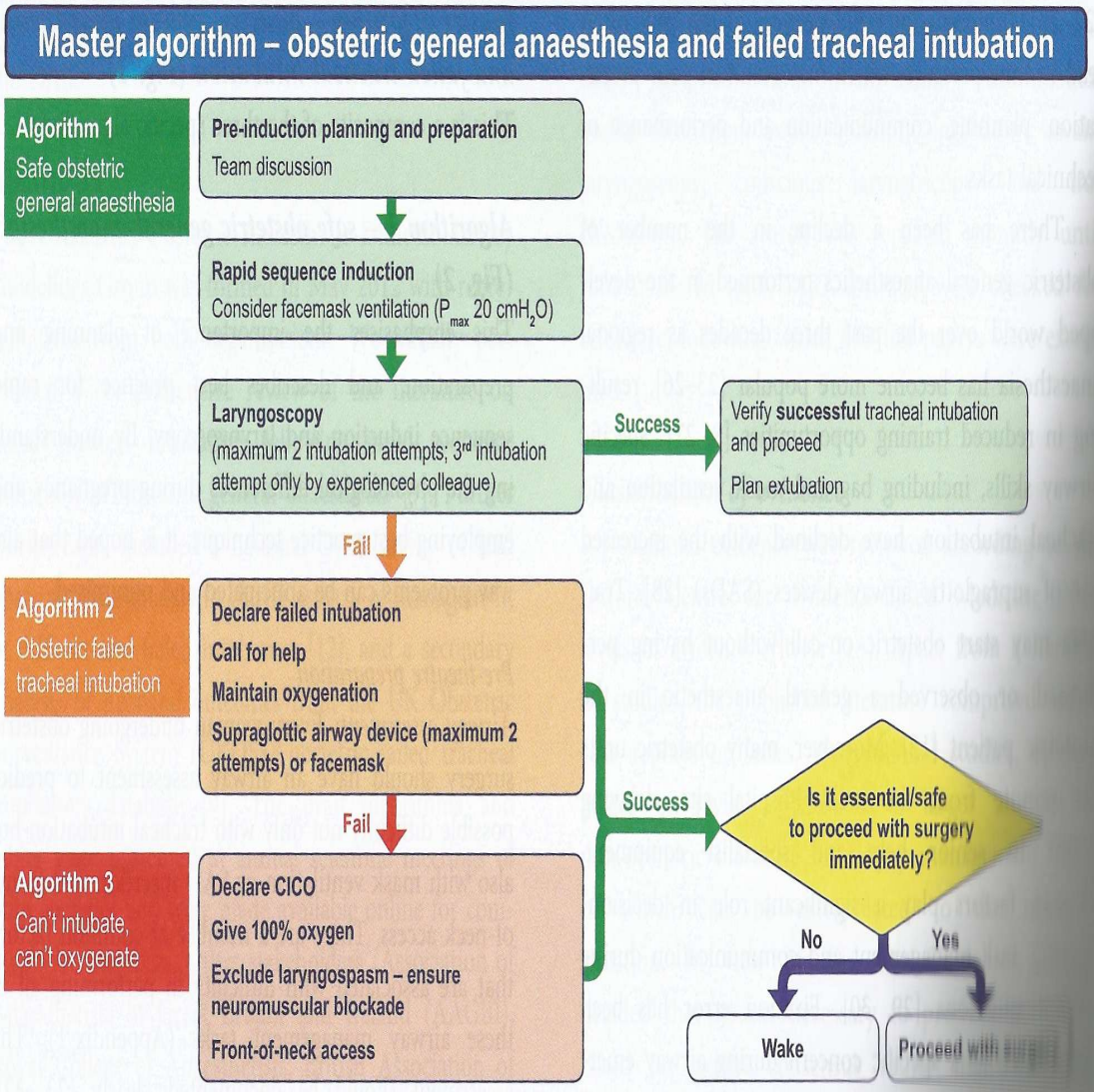
Date:

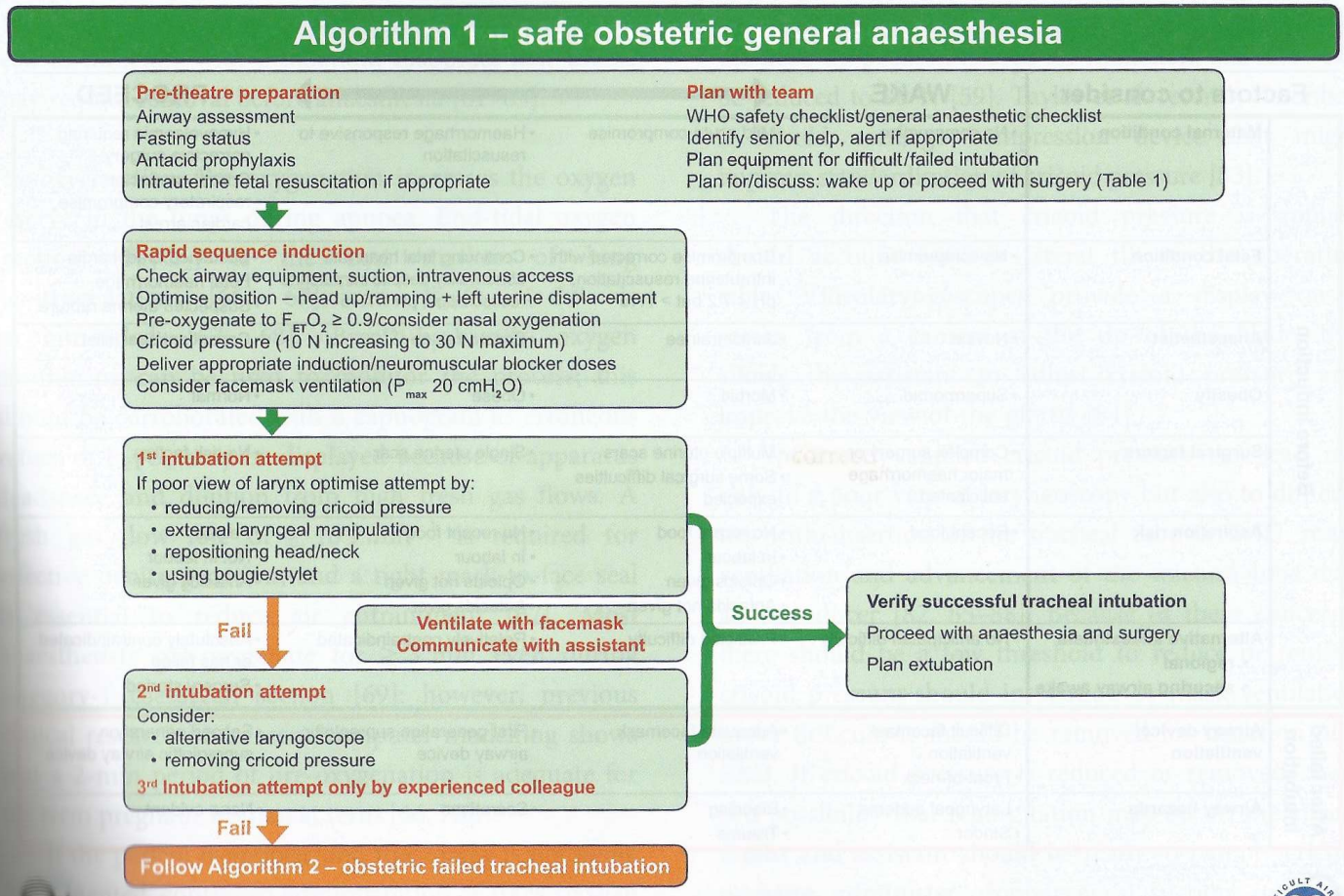
Dear Dr

During a recent obstetric admission the above lady had an epidural / spinal (delete as appropriate). She developed a post-dural puncture headache which did / did not (delete as appropriate) require blood patching. She has been reviewed and was discharged with simple analgesics. Follow up has been arranged in the obstetric anaesthetic clinic. She has been advised to contact the anaesthetist on Sherwood Birthing Unit should the headache deteriorate or recur or should she develop any neurological symptom such as altered motor, bladder or bowel function. Urgent radiological imaging and neurological review may be required.
Please be aware that persistent post-dural puncture headache has rarely been implicated in the development of subdural haematoma, cranial nerve palsies and seizures. Rare complications of epidural blood patch include meningitis, epidural abscess and neurological deficits.
For any further advice please contact the obstetric anaesthetist on Sherwood Birthing Unit.

Yours Sincerely

Appendix B- Difficult Airway Algorithms




Algorithm 1 – safe obstetric general anaesthesia
Pre-theatre preparation
Airway assessment
Fasting status
Antacid prophylaxis
Intrauterine fetal resuscitation if appropriate
Plan with team
WHO safety checklist/general anaesthetic checklist
Identify senior help, alert if appropriate
Plan equipment for difficult/failed intubation
Plan for/discuss: wake up or proceed with surgery (Table 1)
Rapid sequence induction
Check airway equipment, suction, intravenous access
Optimise position – head up/ramping + left uterine displacement
Pre-oxygenate to $F_{ET}O_2 \geq 0.9$/consider nasal oxygenation
Cricoid pressure (10 N increasing to 30 N maximum)
Deliver appropriate induction/neuromuscular blocker doses
Consider facemask ventilation (P_{max} 20 cmH_2O)
1st intubation attempt
If poor view of larynx optimise attempt by:
• reducing/removing cricoid pressure
• external laryngeal manipulation
• repositioning head/neck
• using bougie/stylet
Fail
Ventilate with facemask
Communicate with assistant
Success
Verify successful tracheal intubation
Proceed with anaesthesia and surgery
Plan extubation
2nd intubation attempt
Consider:
• alternative laryngoscope
• removing cricoid pressure
3rd intubation attempt only by experienced colleague
Fail
Follow Algorithm 2 – obstetric failed tracheal intubation
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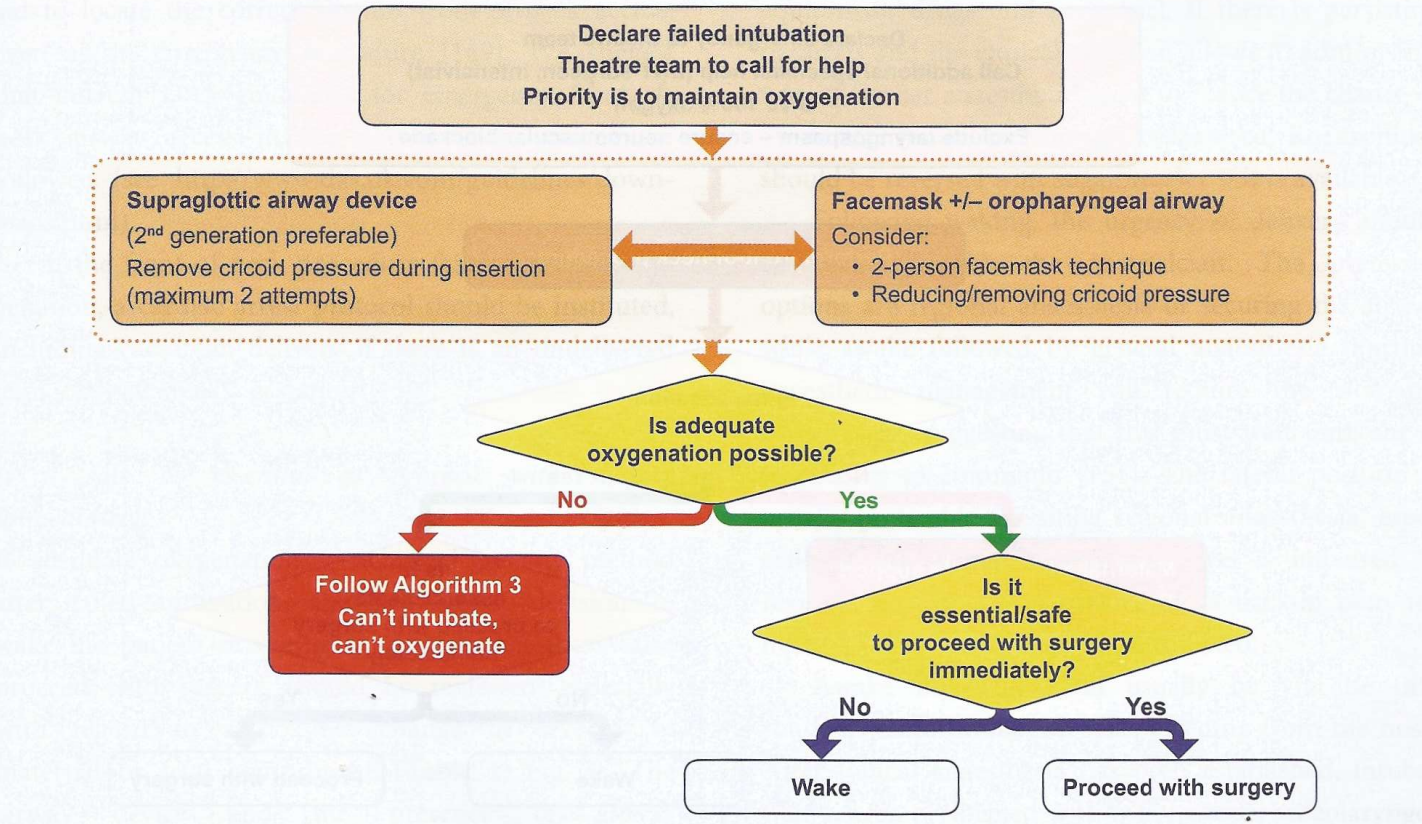
Algorithm 2 – obstetric failed tracheal intubation



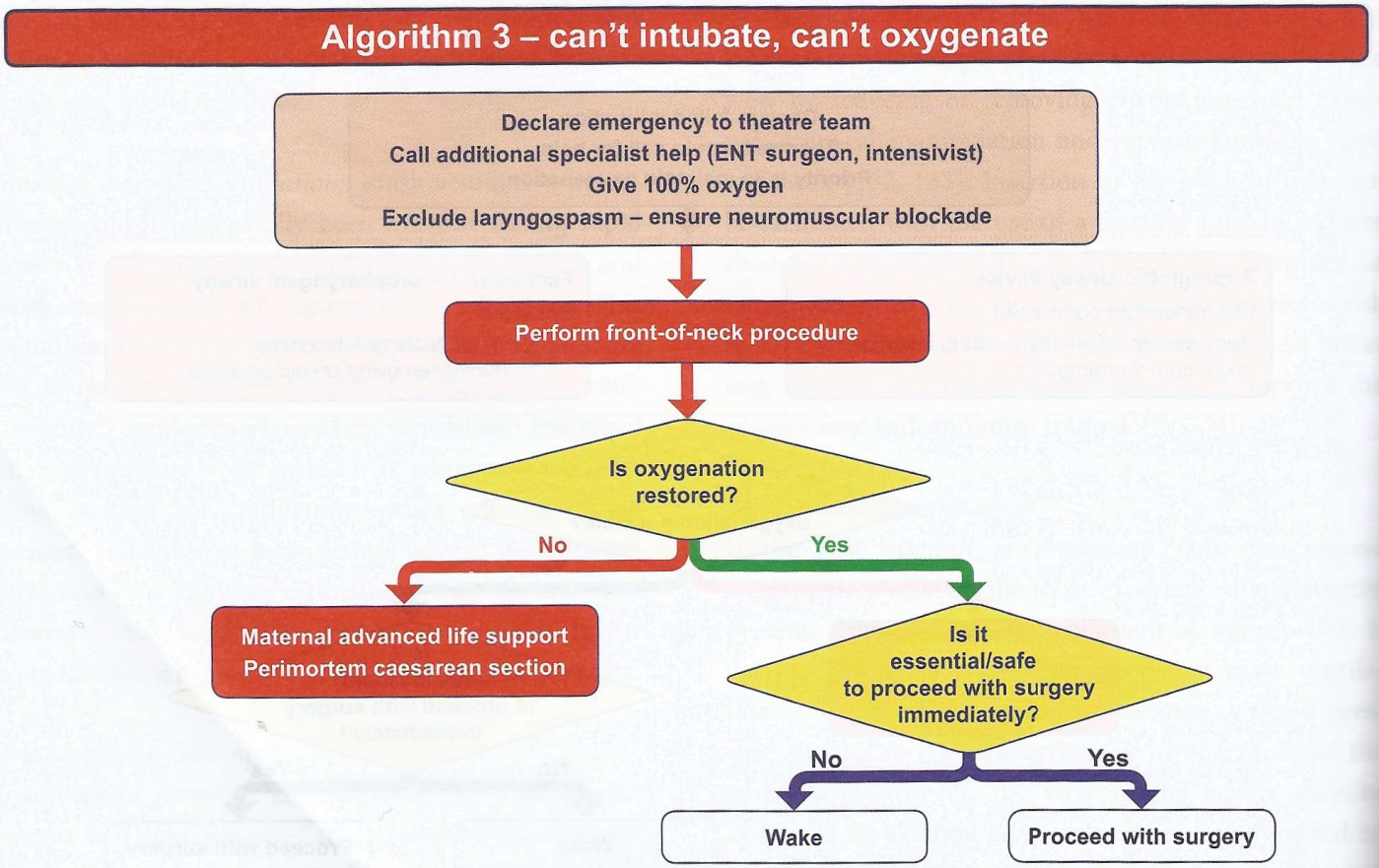

Algorithm 3 – can't intubate, can't oxygenate
Declare emergency to theatre team
Call additional specialist help (ENT surgeon, intensivist)
Give 100% oxygen
Exclude laryngospasm – ensure neuromuscular blockade
Perform front-of-neck procedure
Is oxygenation restored?
No
Yes
Maternal advanced life support
Perimortem caesarean section
Is it essential/safe to proceed with surgery immediately?
No
Yes
Wake
Proceed with surgery
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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

APPENDIX C - ANAESTHETIC OBSTETRIC ALERT

Patient Sticker or Name DOB NHS Number	Obs Cons ……. Referring Doctor…….. EDD…….. Date of Referral

Clinical Details

Parity…….

Reason for referral: ……

……

……

Obstetric Plan: ……

Anaesthetic Assesment / Management Plan

……

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Investigations Required/ Physician Referral: ……

……

Consultant Anaesthetist …….

Delivery Details

……

Please photocopy and file original in woman's notes, leave copy in Anaesthetic Office on SBU.

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