Introduction to Obstetric Anaesthesia: Evidence based Guidelines for those completing Initial Assessment of Obstetric Competence

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Anatomy and Considerations in the Pregnant Patient

Although not specific to the completion of the IAOC, a good understanding of the relevant anatomy and physiology is considered essential and is included in the curriculum for basic anaesthetic practice.

Labour and Delivery

There were 697,852 live births in England and Wales in 2015 (office for national stats). NICE considers that birth is not a medical event but a normal process and where possible should proceed without medical intervention. For the anaesthetist, involvement in a normal labour should therefore be minimal aside from the provision of regional anaesthesia for pain relief but it is useful to have a working knowledge.

First stage
The duration of this stage is highly variable, usually for primigravida lasts an average of 8 hours and for a multiparous woman an average of 5 hours. Viewed as two phases:

Latent: Regular contractions <10 minutes apart but minimally painful. Membranes may remain intact initially but should break (or be broken) in the active phase. Cervix dilates to 3-4cm.
Active: Ongoing dilation of the cervix by 0.5-1cm/hr associated with increasingly painful contractions. Foetal head descends into the pelvis and the neck flexes.

Second Stage
From fully dilated to birth. This should last no more than 2 hours in a nulliparous woman and 1 hour in a multiparous woman otherwise instrumental delivery should be considered. Contractions are strong, sustained and occur at less than 5 minute intervals. Associated with the need to push. The second stage is active when baby’s head is visible. Oxytocin is usually given as soon as baby is born.

Third Stage
Delivery of the placenta and membranes. Usually less than 5 minutes. The midwife will continue controlled cord traction and suprapubic compression during this time to help with expulsive contractions.

Augmentation
Failure to progress is considered to occur in the first stage when the active phase has continued for 4 hours. The patient should be reviewed by an appropriately trained clinician prior to intervention. Intervention usually takes the form of an infusion of syntocinon infusion. Epidural may be requested at this point.

Epidural and Spinal spaces
Vertebrae and Spinal Nerves
The vertebral column is formed of 24 vertebrae, 7 cervical, 12 thoracic and 5 lumbar which vary in size and shape depending on their location. There are also between 3 and 5 fused vertebrae which form the sacrum and coccyx. In obstetrics, epidurals are most often sited between L1 and L5 spaces, the widest and sometimes easiest being the L4-5 space. Remember that the spinal cord finishes at L1-2 and the dural sac which finishes at approximately S2, continues as the filium terminale. Spinal nerves exit below their associated vertebral body (so L4 nerve root leaves inferiorly to L4 vertebral body). The exception to this is the cervical region where there are 8 nerves and only 7 vertebral bodies hence the nerves are numbered according to the vertebra below except for C8 which exits between C7 and T1 (CCEAP).

Ligaments
Anterior spinal ligament: Runs from occiput cranially to sacrum caudally attached to the intervertebral discs at each level.

Posterior spinal ligament: Runs cranially to caudally fas before, attaching to each vertebrae and disc.

Ligamentum Flavum: Connects the laminae of the vertebral discs from C2 to S1. Thick and strong, responsible for maintaining stability of the spinal column.

These have no sensory innervation and should cause no pain when pierced during a procedure (FRCA). It is worth remembering that spinal ligaments, like all others in the body are affected by pregnancy and become softer and less distinguishable.

Boundaries of the epidural space
- Anteriorly- Posterior longitudinal ligament and vertebral bodies
- Posteriorly- Ligamentum Flavum
- Superiorly- Fusion of spinal and periosteal dural layers at foramen magnum
- Inferiorly- Sacrococcygeal membrane
- Laterally- Pedicles and intervertebral foramina

Physiological Changes in Pregnancy

CCEAP

For ease of discussion, this will be broken down into systems.
Central and peripheral nervous system

MAC is reduced by 30% for inhalational agents. Onset and depth of anaesthesia are also increased due to changes in the respiratory system.

The combined effects of hormones and increased venous pressure secondary to compression by the gravid uterus causes engorgement of the epidural vessels. This in turn reduces the volume of the epidural space and leads to a compensatory reduction in CSF production. Hence a relative dose reduction may be required in obstetric patients for regional anaesthesia.

Cardiovascular system

Blood pressure and cardiac output
Mean Arterial Pressure (MAP) falls in the first trimester due to the effects of progesterone on vascular smooth muscle causing peripheral vasodilation and reduced systemic vascular resistance (SVR). These changes are seen from 5 to 8 weeks of gestation.

To ensure adequate uteroplacental perfusion in the face of reduced blood pressure, cardiac output must increase. This is achieved through a number of mechanisms, first the reduced MAP stimulates the Renin Angiotensin Aldosterone System causing salt and water retention and an increase in plasma volume. Secondly blood volume increases throughout pregnancy until 34 weeks resulting in an overall increase of 40-50%. These changes increase preload (quantifiable as end diastolic volume EDV) and contribute to a markedly raised stroke volume (SV) which maintains cardiac output.

MAP increases gradually from 24 weeks and regains pre-pregnancy levels once more around term. The increase in SV is maintained however towards the end of pregnancy due to the effects of aortocaval compression, an increase in heart rate is also needed.

Central venous pressure and pulmonary capillary wedge pressure are unchanged.

Heart and Blood vessels
There is an increase in ventricular wall mass with corresponding left axis deviation of up to 20°. The heart dilates and flow murmurs are common.

- Aorto-caval compression (BJA 2012)

From approximately 20 weeks gestation, the gravid uterus begins to compress the abdominal viscera and vessels. As term approaches this effect becomes gradually more pronounced until compression of both the IVC and abdominal aorta occurs and CO may reduce by as much as 30% when supine. In severe cases this can compromise utero-placental blood flow to the extent that the foetus may become acidic. Fortunately this is a rarity with only 8% of patients developing hypotension when lying supine. This is because the majority of the patients are able to compensate by increasing cardiac output and systemic vascular resistance (SVR) through an increase in sympathetic tone. During regional anaesthesia, this ability to compensate is removed and can result in significant hypotension. It is recommended that the patient is placed in left lateral tilt of at least 15 degrees if a supine position is required.

Haematological system
Coagulation
Pregnancy is a prothrombotic state due to the increased production of clotting factors and reduced fibrinolysis and antithrombotic components such as protein C and S. For this reason, prophylaxis with low molecular weight heparins is usually recommended for any pregnant women admitted to hospital.

Platelets
Overall count normally remains relatively unaltered however it is important to remember that the relative amounts of platelets may be less due to haemodilutional effects. It is advisable to check levels before performing regional techniques. Patients with pre-eclampsia should have a platelet count performed to check for the presence of HELLP syndrome.

Leucocytes
Level of leucocytes demonstrate a slight increase compared with non pregnant patients.

Respiratory system
Progesterone alters the response to carbon dioxide and there is increased CO2 production due to enhanced metabolism and combined output from the mother and foetus. Oxygen demand is similarly increased.

To match these increased demands for supply of O2 and removal of CO2, minute ventilation increases through an increase in tidal volume. Through this mechanism PaCO2 is reduced to 4kPa at term (CCEAP) despite respiratory rate remaining relatively unaltered. Blood pH remains within normal limits due to enhanced renal secretion of bicarbonate. Aggressive hyperventilation will negate this effect and result in respiratory alkalosis which will impair maternal-foetal oxygen exchange.

From 20 weeks onwards, the expanding uterus compresses the abdominal viscera and vessels, pushing the diaphragm upwards. Functional residual capacity is thereby reduced by up to 30% when supine. Conversely alveolar dead space is reduced as increased CO improves perfusion of lung units.

Tissue oedema and swelling affecting the larynx and arytenoids is seen towards term and may be enhanced with labour and bearing down. This combined with fat and breast tissue makes the obstetric airway additionally challenging to intubate. Unsurprisingly therefore this patient group has a higher incidence of failed intubation and difficult ventilation. Laryngoscopes with McCoy or Polio blades can be useful adjuncts.

Hepatic
Liver function tests are usually slightly lower than pre-pregnancy levels. ALP (alkaline phosphatase) may be slightly higher due to production of ALP by the placenta. Levels should be monitored in patients at high risk for HELLP syndrome.

Sensitivity to Suxamethonium may be increased in pregnancy due to the reduction in plasma cholinesterases, particularly in the presence of co-morbidities such as pre-eclampsia or liver disease.

Gastrointestinal
The majority of pregnant patients suffer from gastro-oesophageal reflux from 20 weeks. This occurs as a result of compression of the stomach and bowel by the uterus combined with the relaxation of the lower oesophageal sphincter. During labour gastric emptying is also delayed, an effect further enhanced by opioids regardless of their route of administration. After 12 weeks, all pregnant women should be considered to have a full stomach regardless of fasting state.

Renal

Actions of aldosterone and pregnancy hormones act to retain salt and water from filtered fluid, causing volume expansion. This increases the volume of distribution.

Renal blood flow increases by as much as 50% at term thus filtration rate also increases to approximately 150ml per minute. The increased levels of filtrate exceed the ability of the renal tubules to reabsorb all solutes hence glycosuria and proteinuria become more likely.

Endocrine

Human Chorionic Gonadotrophin (HCG) shows cross reactivity with thyroid stimulating hormone receptors in the anterior pituitary due to a common subunit between the two hormones. This causes gland hyperplasia resulting in transient hyperthyroidism.

During pregnancy there is reduced peripheral sensitivity to insulin causing enhanced production from beta islets which enlarge as a result through pregnancy.

Hypertension and Management in the Obstetric Patient

CG107

Hypertensive disorders during pregnancy are associated with significant morbidity and mortality (NICE). For the mother, the implications of significant hypertension during gestation are far reaching and associated with an enhanced lifetime risk of cardiovascular and cerebrovascular disease. Foetal wellbeing is also at risk, with incidence of pre-term delivery, still birth and intra-uterine growth restriction (IUGR) all substantially higher in affected pregnancies. Offspring of affected pregnancies also have a higher incidence of haemorrhagic or thrombotic stroke. Such strong evidence has lead to development of a national screening programme to facilitate the early diagnosis and management of hypertensive disorders. The severity of hypertension can be divided into:

- **Mild**: systolic blood pressure 140–149 mmHg and/or diastolic blood pressure 90–99 mmHg
- **Moderate**: systolic blood pressure 150–159 mmHg and/or diastolic blood pressure 100–109 mmHg
- **Severe**: systolic blood pressure 160 mmHg or greater and/or diastolic blood pressure 110 mmHg or greater

1. **Primary hypertension**

Hypertension which existed prior to pregnancy or which becomes evident before 20 weeks of gestation is considered primary hypertension. It is usually due to essential hypertension but may be secondary to underlying disease.
2. **Pregnancy-induced (gestational) hypertension**

This condition is seen in approximately 10% of pregnancies and is a risk factor for the development of pre-eclampsia. It is defined as a rise in blood pressure during the second half of pregnancy, without proteinuria.

3. **Pre-eclampsia**

Pre-eclampsia is defined as hypertension (usually severe) occurring after 20 weeks of pregnancy with proteinuria >3g in 24 hours (BJA 2003). It is a multi-system disorder most often seen in primigravida or the first pregnancy with a particular partner. The exact aetiology of the condition remains unknown but is believed to be associated with abnormal placentation and immunological response. Other criteria which may be considered when making a diagnosis of pre-eclampsia include:

- oliguria < 400 ml per 24 h
- cerebral irritability
- epigastric or right upper quadrant pain (liver capsule distension)
- pulmonary oedema

Associated risk factors for the development of pre-eclampsia are maternal hypertension or diabetes, obesity, multiple, IVF or molar pregnancy and advancing maternal age.

**Investigations (AAGBI/OAA)**

Blood tests (pregnancy specific ranges):
- Full blood count - with special emphasis on platelet count.
- Urea & electrolytes - serum creatinine, serum urate.
- Liver function test - serum transaminases (AST or ALT). Check glucose if ALT >150

Urine tests:
- Urine dipstick and sample for culture and sensitivity.
- Urinary protein creatinine ratio (PCR) from a random sample if >30mg/mmol continue to 24 hour collection. Diagnosis of proteinuria is confirmed if >300mg/mmol protein is produced in 24 hours.

**Treatment**

Green Top Guidelines recommend the following:

**Uncomplicated hypertensive disease**

Aim to keep blood pressure lower than 150/100 mmHg. Diastolic blood pressure should not be lowered below 80mmHg. Delivery should be at term where possible. Women with pressures of >160/>110 should be admitted regardless of gestation.

**Pre-Eclampsia**

If moderate or severe hypertension with other evidence of organ dysfunction the patient should be admitted to hospital until blood pressure is below 140/80mmHg. During admission
blood pressure should be monitored a minimum of four times daily and the patient should be asked about symptoms of pending eclampsia. Serum urea and electrolytes, liver function and full blood count should be monitored at least bi-weekly. Delivery should be scheduled for 34-36 weeks gestation maternal and foetal health permitting. If refractory to treatment or evidence of maternal or foetal compromise, delivery may be sooner than this and decided by the consultant obstetrician.

**Pharmacological Options for the Treatment of Hypertension and Pre-eclampsia**

(AAGBI/BJA)

1. **Labetalol**

   This is usually the first line treatment in non asthmatic patients
   - PO 200-1600 mg in divided doses
   - IV - 50mg bolus and in increments every 20 minutes. Followed by infusion commenced at 20mg/hour which can be doubled at 30 minute intervals if no effect observed.

2. **Methyldopa**: PO 250mg-3g in 24 hours as 3-4 divided doses

3. **Nifedipine**: PO 20-90 mg od (Avoid sublingual route)

4. **Hydralazine**: IV only 5 mg slow bolus followed by infusion of 5 mg/hr

Other drugs which may be considered are alpha-blockers, diuretics and furosemide.

**Complications of Hypertension**

**Eclampsia**

Eclampsia is the occurrence of generalised seizure activity in a woman with pre-eclampsia and may occur at any point up to 48 hours post delivery. It has a proposed incidence of approximately 1 in 2000 women with severe pre-eclampsia although there is no clear correlation between severity of hypertension and development of symptoms. Prodromal symptoms include:

- headache
- visual disturbance
- hyper-reflexia
- right upper quadrant pain

(it is worth noting the overlap here between the symptoms of pre-eclampsia and eclampsia)

**Treatment**

Magnesium sulphate: 4g IV over 5–10 min followed by an infusion of 1 g per hour for 24 hours or 0.5g/hour if oliguric.

Further bolus of 2g over 10minutes may be repeated if seizures recur

Works by antagonism of NMDA receptors and at calcium channels reducing vasospasm and stabilising excitable membranes. At high doses (>5mmol/L) will cause hyporeflexia and
blurred vision followed subsequently by respiratory depression and cardiac arrest (>10mmol/L). Therefore patients receiving high dose infusions should have

- Monitoring of reflexes and physiological parameters particularly oxygen saturations
- Consider intubation and ventilation
- Call paediatric team as high levels of magnesium will produce respiratory depression and hypotonia in the neonate

Current evidence does not support the use of benzodiazepines or phenytoin for treatment of seizures in such patients but it may be considered in refractory cases.

**HELLP Syndrome**

Clinical or biochemical evidence of microangiopathic haemolysis, hepatic dysfunction and thrombocytopenia. This complication is seen in up to 50% of cases with severe pre-eclampsia. Management is generally supportive with enhanced monitoring of physiological parameters and biochemical testing for signs of compromise. In the event of haematological disease, aggressive management with blood products may be required and should be discussed with the consultant haematologist on call.

The Yorkshire Association of Obstetric Anaesthetists has produced an excellent guideline for the management of pre-eclampsia, from which some of the information contained above is taken. For your reference please follow the link below:

http://www.oaa-anaes.ac.uk/assets/_managed/editor/File/Guidelines/Pre-eclampsia/Pre-eclampsia_guidelines_Regional_Yorkshire_Vipond.pdf

**Foetal and Neonatal wellbeing**

Foetal (AAGBI)

Two main methods of assessing foetal wellbeing are common to daily practice.

1. **Cardiotocography (CTG)**
   Two external transducers are placed over the gravid uterus and continuously record foetal heart rate and regularity and strength of uterine contractions. This may be enhanced by replacing one of the transducers with an electrode on the foetal scalp. Indications for continuous CTG monitoring are various but include meconium stained liquor, maternal request and fresh bleeding during labour. All patients who have augmentation of labour or who have regional anaesthesia should have continuous CTG monitoring.

   Interpretation of a CTG is a skill which can take years to master with frequent exposure. However in essence:

   **Baseline rate**: Of the foetal heart rate (FHR). Should be between 110-160beats per minute (bpm).

   **Variability**: Of beat-to-beat foetal heart rate. Generally this should be 5-15bpm. There are many causes including foetal sleep, reduced or absent variability in conjunction with other abnormal signs is considered worrying.
**Accelerations**:Transient increases in FHR usually >15bpm sustained for at least 15 seconds and usually associated with foetal movement. This is a reassuring sign.

**Decelerations**: In FHR usually coinciding with uterine contraction. Although these may be a normal physiological response to labour, if late or variable ie occurring after the peak of uterine contraction they are a worrying sign and can reflect foetal hypoxia. Prolonged decelerations are defined as a FHR of <30bpm for 2 minutes and represent foetal distress. Urgent delivery is recommended in this instance.

2. **Foetal Blood Sampling**
This is undertaken in the presence of a pathological CTG trace (without evidence of foetal compromise). A small sample of blood is obtained from the presenting part of the foetus. If pH is greater than 7.25 repeat in 1 hour. If pH is 7.24-7.21 repeat in 30 minutes, if pH is <7.21 urgent delivery is indicated.

**Neonatal Wellbeing**
This is usually assessed by the midwife following delivery. It is a scoring system designed to assess the wellbeing of the infant taken at 1 and 5 minutes of life and at 5 minute intervals or until total score exceeds 6 (max 10)

- **Appearance**: Blue 0
  - Acrocyanotic (blue extremities) 1
  - Pink 2

- **Pulse**: Absent 0
  - <100bpm 1
  - >100bpm 2

- **Grimace**: No response 0
  - Grimace 1
  - Cough, Sneeze or Cry 2

- **Activity/Tone**: Limp 0
  - Some flexion 1
  - Active motion 2

- **Respiratory Effort**: Absent 0
  - Slow or irregular breaths: 1
  - Good respiratory rate and cry: 2

**Caesarean Section**

Source Good Practice Guideline No 11. 2010 RCOG
NICE Guideline Aug 2012, CG132

The decision for Lower Segment Caesarean Section (LSCS) may be made for a multitude of reasons and is part of strategy to manage a spectrum of risk applicable to both mother and foetus. Although formal classifications are now well established (see below), ultimately the level of risk involved in each case must be considered on its own merit.
Use of standardised system has many merits, not least enabling clear communication between health professionals but also helping to guide decision-to-delivery intervals (DDI). Each grade is discussed below in more detail.

- **Category 1** - immediate threat to life of woman and or foetus

Ideally the procedure is carried out with as little delay as possible. Performance standards aim for a DDI of 30 minutes for this Category. Where appropriate, regional anaesthesia should be provided as this is associated with reduced maternal and neonatal morbidity.

- **Category 2** - maternal or foetal compromise but no immediate threat to life

Aim to conduct the procedure with a 75 minute DDI. As a performance indicator, 30 minute marker is also used.

- **Category 3** - Requires early delivery

- **Category 4** – Scheduled at a time to suit woman or maternity services

As with any procedure of moderate risk, decision to deliver by C-section must be carefully considered. The following are indications for elective LSCS:

- Breech presentation or abnormal lie, usually after a failed attempt of external cephalic version (ECV) where appropriate
- Multiple pregnancy- if twin one is cephalic in presentation, individuals may be considered on case by case basis about whether to proceed with NVD. There is some evidence to support slight elevation to morbidity and mortality of twin two in such cases. For non-cephalic presentation, LSCS is usually offered.
- Placenta Previa- even minor occlusion of the internal OS warrants delivery by LSCS
- Morbidly adherent placenta- confirmed on MRI. In addition such cases should be delivered around 34 weeks gestation and have a fully consultant delivered service including paediatrics and haematology. Blood products and provision of a critical care bed should also be available prior to commencing the procedure.
- Maternal infection- HIV with no anti-retroviral therapy, women taking anti-retroviral agents but with a high viral count or those with co-infection of hepatitis C should be offered LSCS to reduce the risk of vertical transmission. Maternal occurrence of Herpes Simplex Virus (HSV) in the third trimester should also be considered.
- Maternal request- it is important that all aspects of this request are explored prior to granting this request.

**Timing of delivery**

LSCS before the onset of labour is associated with an increased risk of respiratory dysfunction in the neonate. This risk decreases 1.5 times with each week of gestation and is markedly reduced after 39 weeks thus most cases are not booked before this without good reason (Cohen 1985).

**Additional considerations**
Blood loss during delivery is expected and is relatively reduced with LSCS with only 2-4% experiencing >1L. All expectant mothers should be screened for anaemia and where necessary a group and save should be obtained to allow additional resources to be secured if needed.

All should be offered ephedrine or phenylephrine intra-operatively with volume loading to manage the risk and extent of hypotension associated with regional blockade.

Aspiration risk should also be considered. Mendelsons syndrome (pneumonitis secondary to inhalation of gastric acid). Current guidelines recommend the use of H2-receptor antagonists (Ranitidine), Metoclopramide and Citrate (maximum of 30 mins pre-procedure) to reduce gastric acid and neutralise pH prior to procedure.

**Post Partum Haemorrhage**

Post partum haemorrhage based on greentop guideline no 52 (May 2009)

Obstetric Haemorrhage, antepartum (APH) and post partum (PPH) is a significant cause of maternal morbidity and mortality. In cases where haemorrhage resulted in maternal death, the UK Confidential Enquiry into Maternal Deaths considered that substandard care was a prominent feature in the majority. Prompt recognition and management including timely escalation to consultant level is crucial to providing optimal care.

Primary PPH is loss of blood from the genital tract within 24 hours of delivery. Secondary PPH is loss of blood from the genital tract from 24 hours until 12 weeks post partum

**Minor**
- 500-1000ml
- without signs of shock (tachycardia, oliguria, hypotension, tachypnoea, delayed cap refill)

**Major**
- Moderate 1000-2000ml
- Severe >2000ml
- or less with clinical features of shock

Allowing for the physiological increase in pregnancy, total blood volume at term is approximately 100 ml/kg. Most mothers will therefore cope with a loss below 500mls. In estimating percentage of blood loss, consideration should be given to body weight and the original haemoglobin. Visual estimation of blood loss is frequently inadequate, the risk of concealed bleeding is high and amniotic fluid may contribute significantly to loss.

**Risk Factors**

**Tone** (most common)
- Age >40yrs
- BMI >35
- Previous PPH
- Foetus >4kg
- Prolonged labour >12 hours
- Multiple pregnancy
- Placental abnormalities eg praevia

**Trauma**
- Delivery by C-Section- emergency or elective
- Operative vaginal delivery
- Episiotomy
- Big baby >4kg

**Tissue**
- Retained placenta

**Thrombin**
- Placental abruption
- Maternal pyrexia
- Pre-eclampsia/ maternal hypertension

**Management**

**Prophylaxis and Prevention**
Risk factors may be reduced by (AAGBI TOTW):
- Avoidance of prolonged labour
- Minimal trauma during assisted vaginal delivery
- Detection and treatment of anaemia
- Identification of placental abnormality prior to delivery
- Active Management of the third stage of labour including use of oxytocics and controlled cord traction in placental delivery

Oxytocics are routinely given in the third stage of labour. Evidence suggests active management of the third stage in this way may reduce the risk of PPH by up to 60% (green top). For vaginal delivery 10 units IM or 5 IV. During C section 5 units IV is given.

**Minor PPH**
Minor PPH is likely to be managed by the midwife and obstetric team and will rarely require involvement of an anaesthetist. It remains worthwhile looking up local departmental policies on how this is managed to appreciate what measures may have been implemented.

Clear concise communication is vital in these situations, not least with the patient and birth partner who are likely to be very frightened.

**Major PPH**
Call for experienced and senior help early

An experienced midwife and the midwife in charge should already be in attendance. Ensure that an appropriate grade of Obstetric specialist has been informed and is en route. Inform the consultant anaesthetist on call.

Alert the blood transfusion laboratory to allow mobilisation of blood products and dedicate a porter for the provision of these. All obstetric units will have a protocol agreed with the
laboratory for major obstetric haemorrhage. In the first instance 4 units of crossmatched blood should be requested.

Dedicate a member of staff to scribe and keep track of patient observations, blood loss/products and treatments given.

**Airway and Breathing**
Provide 15L 100% oxygen via a non rebreathe system. Support the airway as required and simultaneously assess the airway.

Ensure you have the necessary drugs, equipment and staff ready if intubation or theatre is required. Rapid sequence intubation is recommended if there is ongoing haemodynamic instability. Aim to give a cardiostable anaesthetic with emergency vasopressors and atropine immediately available. Ventilate with 100% oxygen until the bleeding is controlled. Remember the use of volatile anaesthetic agents will reduce uterine tone.

**Circulation**
Establish two 14-gauge (orange) intravenous lines. Take samples for basic investigations and blood transfusion whilst doing so.

Commence infusion of crystalloid or colloid, under pressure whilst waiting for blood. Up to 3L crystalloid or 2L colloid may be given. Aim to give warmed fluids as this will avoid cooling the patient. As soon as possible begin blood transfusion. Consider the use of cell salvage and rapid infusers if available.

If haemodynamically unstable, consider carefully the application of regional anaesthesia as this may worsen hypotension due to sympathetic blockade. The presence of coagulopathy should also be evaluated in such patients. Epidural anaesthesia is recommended as it is generally more cardiostable than spinal.

**Disability**
Continuous monitoring of blood pressure, heart rate and oxygen saturations should be commenced if not already ongoing. Be aware that induction agents and volatiles may contribute to uterine atony and hypotension, be judicious in their use.

**Monitoring**
Placement of an arterial line and urinary catheter should be considered once definitive management is underway. A central venous catheter may also be useful but is not essential. Do not delay treatment to allow their placement.

Maintain normothermia, particularly in the face of massive transfusion as hypothermia will contribute to coagulopathy.

**Blood and Blood Products**
Ensure that all blood and products are checked fully before administration.
An appropriate sample of blood for transfusion should have already been taken and 4 units of blood requested, rectify this immediately if not.

In the absence of type specific blood administer O- Rh D Negative blood until crossmatched blood is available.
• FFP- Give 4 units for every 6 units of red cells or prothrombin time/activated partial thromboplastin time > 1.5 x normal (12–15 ml/kg or total 1 litres)
• Platelets if <50 x 10^9
• Fibrinogen if <1g/L

If blood loss reaches 4.5L, complications of massive transfusion become an important consideration. Empirical transfusion of cryoprecipitate and up to 1L of FFP may be given whilst the results of other investigations are awaited.

Pharmacological Interventions

1. “Rub up” the uterus
2. Syntocinon 5 units IV. This can repeated once as needed and is then followed by 30 units/500mls (0.9% normal saline) infusion at 125ml/h.
3. Ergometrine: 0.5mg IM or IV. Be aware side effects include hypertension, flushing and vomiting. Concurrent provision of antiemetics is advised.
4. Carboprost (Hemabate or prostaglandin F_2alpha) 250mcg IM (not iv). May cause bronchospasm, flushing and hypertension.
5. Misoprostal 100mcg PR
6. Consider systemic haemostatic agents such as Aprotinin (Trasylol®), Vitamin K, Tranexamic acid and Recombinant Factor VIIa (NovoSeven®)

Surgical and Radiological Intervention
Please refer to individual texts for further explanation of individual techniques

• Delivery for placental and uterine pathology
  B-Lynch suture (brace suture)
• Uterine tamponade e.g. Rusch urological balloon or Sengstaken-Blakemore tube
• Uterine replacement if uterine inversion
• Surgical ligation of uterine and internal iliac arteries
• Hysterectomy
• Compression/clamping aorta to buy time
• Radiological arterial embolisation or balloon occlusion

Post Procedure
• Transfer the patient to a place of safety with enhanced monitoring, most likely ICU.
• Ensure all documentation is completed
• Debrief with colleagues and provide support to patient, partner and family

Pain Relief in Pregnancy, Labour and the Post-partum period

Non-Pharmacological methods
There is little evidence to support these techniques and their availability varies between units. For reference these include:

- Relaxation/breathing techniques
- Temperature modulation: hot or cold packs, water immersion
- Hypnosis
- Massage
- Acupuncture
- Aromatherapy

**Transcutaneous electrical nerve stimulation (TENS)**

Multiple electrodes are placed over the skin at 2cm intervals over T10-L1 dermatomes (first stage) or S2-S4 dermatomes (second stage). A current is passed through the electrodes and stimulates the underlying dermatome. Patient controls the level of current delivered.

There are two prominent theories on how this may provide analgesia. The first works on gate theory of pain control using stimulation of Alpha fibres to overcome more significant pain stimulus. Local release of ß-endorphins is another proposed theory. Although there is no clear evidence that TENS provides better analgesia than placebo.

**Pharmacological Agents**

**Nitrous oxide and Entonox**

Long history of use and good safety profile. Provides rapid analgesia within 1 minute of administration. An added advantage is that it can be self delivered by the patient. Some patients find it difficult to tolerate due to nausea and vomiting or drowsiness. It may be insufficient for severe labour pain.

**Opioid Analgesia**

All opioid analgesics will cross the placenta and have a dose dependent effect on the foetus. This may restrict their ability to breast feed in the early post natal period (FRCA). In addition, it will delay gastric emptying and volume in the mother.

**Pethidine (Meperidine)**

- Synthetic phenylpiperidine
- Dose 1mg/kg IM(can be given by midwife without prescription)
- Provides analgesia with peak concentrations seen in the foetus at 2 hours. Half life 4 hours
- Variable evidence for efficacy of analgesia, use may be limited by nausea, sedation and confusion.
- Metabolised to Norpethedine (active) which has proconvulsant activity and is not recommended in the pre-eclamptic patient (CCEAP).

**Morphine**
• Opiate
  • Dose 2-5mg IV or 5-10mg IM
  • Peak concentration at 1 hour
  • Rapid maternal elimination reduces foetal transfer although dose dependent effects still seen.
• Active metabolites
• Small amount of evidence to suggest sedation is more frequent than effective analgesia (CCEAP)

Fentanyl

• Synthetic phenylpiperadine.
• Dose 1-2 micrograms/kg
• Rapid onset of action due to high lipid solubility
• Metabolised to inactive compounds

Patient-controlled analgesia (PCA)

PCA may be useful in patients who are contraindicated for regional techniques and have the added advantage of giving control to the patient, provided they understand how to use it correctly. Practical application has been documented in two small randomised control trials which found equivalent patient satisfaction between the regional and PCA groups (CCEAP). The following summary is suggested for Fentanyl PCA (CCEAP):
• It is not as effective as, but a useful substitute for, regional analgesia.
• The ideal loading dose, bolus dose, lockout time and maximum hourly dose are still unknown.
• Both the parturient and neonate require careful monitoring during and after delivery.
• Absence of active metabolites is an advantage

Remifentanil has also been considered for use in such situations particularly given the rapid hydrolysis of this drug reducing transfer to the infant. Experimental evidence suggests a bolus only regime should be used due to respiratory depression and desaturation when a background infusion is used. Effects on the foetus are unclear but one study did report transient foetal heart rate abnormalities (CCEAP).

Regional Anaesthesia

Regional anaesthesia is a well-established mode of providing analgesia to women in labour and during operative delivery or management of complications of delivery. An awareness of how procedures must be adapted for this specific patient group is pivotal in ensuring the safety of both mother and foetus.

Monitoring

The following are the recommended standards from the AAGBI:

1. Sufficient IV access must be secured prior to commencing any regional procedure. Some obstetric units will only accept 16G cannulas for this purpose.
2. During establishment of regional analgesia or after top-up (10 ml or more of low-dose solutions), measure blood pressure every 5 minutes for 15 minutes. As well as blood pressure, pulse, respiratory rate, level of sedation and temperature should be recorded.

3. If the woman is not pain-free 30 minutes after each administration of local anaesthetic/opioid solution, recall the anaesthetist.

4. Assess the level of the sensory +/- sensory block hourly using the Bromage Scale (see Appendix). Regular pain scoring should also be completed.

5. Continuous CTG monitoring is also considered appropriate

**Epidural Anaesthesia**

There are many different practices surrounding the use of epidural anaesthesia in obstetrics. Below is a broad outline based on standards of best practice as recommended by NICE.

**Timing and Indication**

There is no definite ideal time to insert an epidural and is often guided by maternal request or requirement for augmentation. Be aware that epidurals can take up to 30 minutes to exert their effect. Imminent delivery would not always allow time for the benefit of the procedure to balance the risk of having undertaken it. Provision of epidural anaesthesia is indicated for (OAA, Southampton):

- Patient request
- Maternal cardiac, cerebrovascular or respiratory disease Pre-eclampsia
- Trial of labour after previous LSCS or uterine surgery Fetus “at risk” e.g. PET
- Breech delivery or multiple pregnancy
- Obese patient or other risk factors for GA.
- Intra-uterine death or known congenital anomaly of fetus

The only absolute contra-indication is maternal refusal. Relative contraindications include coagulopathy or haemorrhage, anticoagulant therapy, spinal abnormality or sepsis.

**Pre-procedure**

Ensure full informed consent. The patient should receive written material to support the verbal consent process by the clinician. The RCoA have an excellent online resource which supports this and in a number of different languages. In particular the following should be discussed:

- It provides more effective pain relief than opioids.
- It is not associated with long-term backache.
- There is no association with longer first stage of labour however there is an increased risk of prolonged second stage and subsequent instrumental delivery.
- Patient mobility will be restricted secondary to enhanced monitoring and IV cannulation.
All women should have appropriate IV access prior to siting the epidural and have fluids running.

**Catheter insertion**

There are many differing techniques and approaches to epidural insertion. Median approach is the most common. Patient positioning is vital to the success of the procedure, usually this is sitting with the neck fully flexed and shoulders relaxed. In brief, procedure is as follows:

1. Ensure the skin is cleaned with an appropriate solution to create a sterile site
2. Prepare equipment (this will allow the Chlorhexidine time to dry), flush and prime the catheter and filter.
3. Drape and palpate for site of intended insertion
4. Apply local anaesthetic to skin
5. Insert the Touhy needle into the ligamentum flavum
6. Remove the introducer and attach the loss of resistance syringe filled with saline
7. Slowly advance the syringe until there is a loss of resistance. Note the depth of the needle on its surface markings.
8. Insert the catheter to 15-20cm (depending on the depth of the space). Remove the needle keeping the catheter secure
9. Withdraw the catheter until an appropriate amount remains within the epidural space. A general rule of thumb is to add 5cm to the depth of the needle when loss of resistance was achieved
10. Check the position of the catheter by applying gentle negative pressure, check for a falling meniscus
11. Give top up dose via filter and secure the catheter with adhesive dressings.

In addition specific consideration should be given to the following aspects:

- **Aseptic procedure**
  This should include hand washing, sterile gloves, sterile gown, hat, mask, appropriate skin preparation and sterile drapes around the injection site. Note the use of Chlorhexidine 2% is not recommended due to increased incidence of arachnoiditis and burns in the event of pooling of the solution.

- **Catheter position**
  The tip of the epidural catheter should be positioned at an appropriate spinal level. A catheter placed in a low position may be associated with poor analgesia and need for large volumes of infusion.

- **Clear marking of lines and filters**
  The AAGBI recommend that an epidural catheter is never used without a bacterial filter. The infusion system should be a closed one and clearly marked for epidural use only.

- **Test Doses and Top-Ups**
  Most obstetric units have local guidance on the solution used to provide initial and top up analgesia via epidural. Test doses are recommended to confirm the position of the catheter and ensure the catheter is not intrathecal (or you will give a spinal). Ideally the minimal amount of local anaesthetic is administered to achieve sensory block without motor involvement. Choice of recipe for top ups is often down to personal experience and
preference using various combinations of local anaesthetic and opioid. A suggested example from the AAGBI of top up dose is 20mls of 0.1% Bupivicaine with 2micrograms per ml of Fentanyl. It is recommended that the anaesthetist remains close by for the first 20 minutes following placement of an epidural in the event of any complications or inadequate block height (should be bilateral to T10). Level of block is assessed with the Bromage Scoring system:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Criteria</th>
<th>Degree of Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Free movement</td>
<td>0%</td>
</tr>
<tr>
<td>2</td>
<td>able to flex knees with effort, feet moving normally</td>
<td>33%</td>
</tr>
<tr>
<td>3</td>
<td>unable to flex knees</td>
<td>66%</td>
</tr>
<tr>
<td>4</td>
<td>unable to move</td>
<td>100%</td>
</tr>
</tbody>
</table>

Management of patients with epidurals in situ

- Women should be encouraged to move around as normal.
- Once fully dilated and in the absence of an urge to push or visible presenting foetal part, delay pushing for at least one hour. After this time, pushing should be actively encouraged with each contraction. Delivery should be achieved within 4 hours of this point.
- The use of oxytocin in the second stage is not recommended
- Regional analgesia should be continued until all procedures are complete including any necessary perineal repair.
- Perform continuous cardiotocography for at least 30 minutes during epidural siting and after administration of each further bolus of 10 ml or more.

Troubleshooting
For advice on trouble shooting problems with epidurals, follow the link below:
http://www.oaa-anaes.ac.uk/assets/_managed/editor/File/Guidelines/epidural%20for%20labour/Painrelief_for_labour_Swales_Southampton.pdf

Complications
There has been much interest in the association between epidural anaesthesia and the risk of prolonged second stage. In the event of motor block this will undoubtedly impair the mothers ability to push hence the use of weaker 0.1% solutions of Bupivicaine. There is split opinions about whether epidural does increase the risk of instrumental or operative delivery.

Additional Complications of epidural anaesthesia include:
- Post dural puncture headache
- Nerve damage
- Infection
- Epidural haematoma
- High Block

Further details can be found here: http://www.frca.co.uk/article.aspx?articleid=100589

**Spinal Anaesthesia**

This is performed to achieve rapid anaesthesia under 3 minutes. As before, patient should be appropriately consented for the procedure where possible. Spinal anaesthesia remains the safest option for the provision of analgesia even in the emergency obstetric situation provided there is enough time and should be considered where possible.

Patient is positioned, prepped and draped as for epidural above. Palpate for Tuffiers line (line adjoining ileac crests corresponding to L3/4), the L4/5 space or the L5/S1 space is usually preferred. Skin is numbed and then the chosen space is pierced with a pencil point needle (eg 24G Sprott) to separate the dural periosteum. Position is confirmed by the presence of CSF from the hub of the needle and then the space is infiltrated with local anaesthetic.

Both motor and sensory block will occur, ideally to the level of T3-4 as this will include innervation of the peritoneum (be aware of increased spread in the pregnant patient due to reduced density of CSF). Block height should be confirmed by gentle pin prick testing (FRCA).

Sympathetic block of fibres to the lower limbs will also occur. This is of particular importance in the pregnant patient since cardiac output is maintained by enhanced sympathetic tone. Application of regional anaesthesia will therefore result in profound hypotension and should be managed accordingly with continuous infusion of ionotropic agents. Each obstetric unit will have guidelines for the provision of this.

Other complications which may occur as a result of spinal anaesthesia are
- Bradycardia even progressing to asystole
- Post dural puncture headache affecting approximately 1/200 cases
- Nausea and vomiting (usually associated with hypotension)
- Itching
- Shivering
- High Block

Further details may be found here http://www.frca.co.uk/article.aspx?articleid=100589

**Combined Spinal and Epidural Anaesthesia**

A combination of the two procedures above may be employed to give both short and long duration of analgesia at a reduced dose allowing greater preservation of motor function.
Thromboprophylaxis

The Royal College of Obstetricians and Gynaecologists (RCOG) suggests that all women should undergo a risk assessment for venous thromboembolism, repeated at appropriate intervals. If admitted to hospital for any reason, all women should be offered prophylaxis with Low Molecular Weight Heparin (LMWH). For women with specific comorbidities please refer directly to the RCOG guidelines which can be accessed here https://www.rcog.org.uk/globalassets/documents/guidelines/gtg-37a.pdf

Regional techniques
Women booked for elective section should receive thromboprophylaxis 6 hours following the regional technique or catheter removal at a time to be specified by the anaesthetist. Regional anaesthesia is not recommended within 12 hours of a prophylactic dose and 24 hours of a treatment dose.

Fasting guidelines

Any woman who is undergoing a planned procedure should be fasted for 6 hours (OAA, FRCA). Women who are high risk or who are having augmentation of labour are allowed to consume clear fluids but should not consume food (OAA). If low risk, a light diet is permitted.

Recognising the Deteriorating and Critically Unwell Obstetric Patient

Do not forget that an experienced midwife may be the best judge of her patient and baby in this environment. If they are concerned, it is worth taking this seriously as they may intuitively be more aware than clinicians.

There are a number of scoring systems existing within hospitals to identify the critically ill and deteriorating patient and obstetrics is no exception. As discussed the labouring patient should have basic monitoring, one to one care and the addition of CTG monitoring to make you aware of any deterioration. However, there are a few situations which are considered obstetric or anaesthetic emergencies and which sometimes may occur without warning. They are:
- PPH- discussed above
- Eclampsia- discussed above
- Cant intubate, cant ventilate- algorithm shown in Appendix A
- High/Total Spinal- See Appendix B
- Anaphylaxis- please see Appendix C
- Local Anaesthetic Toxicity- Please see Appendix D
- Air or Amniotic Fluid Embolism

Amniotic Fluid Embolism

This is a very rare situation occurring intra-partum or up to 48 hours post partum and is seen in approximately 1 in 53,800 cases. It is thought to occur secondary to maternal immune response to exposure to amniotic fluid containing vernix although the exact aetiology remains
unclear. Evidence suggests that maternal mortality associated with the condition is around 20% and neonatal outcomes are poor (CCEAP).

Risk Factors:
1. Maternal age > 35 years
2. Placental abnormalities
3. Caesarean or Instrumental delivery
4. Eclampsia
5. Fetal distress
6. Induction/augmentation of labour

Clinical features are variable and often the first presenting time is sudden cardiovascular collapse. Confidential Enquiry into Maternal and Child Health found that this was often preceded by premonitory symptoms including breathlessness, panic, nausea and lightheadedness. Tan et al suggest the following as diagnostic criteria in the intrapartum period and up to 30 minutes post partum:
1. Hypoxia
2. Hypotension or cardiac arrest
3. Evidence of coagulopathy
Seizures are also seen in approximately 50% of patients.

Management
Early recognition and treatment are vital to improving outcome in the event of AFE. Although a diagnosis of exclusion, clinical should be high when the risk factors above are present in the context of maternal collapse.

1. Follow ALS algorithm in the event of collapse
2. Ensure appropriate IV access and monitoring
3. Ensure adequate oxygenation, by intubation if necessary
4. Correct coagulopathy
5. Arrange for urgent delivery of the foetus if appropriate

Advanced Life Support

In the rare event that this should be necessary, the anaesthetist will be expected to play an active role in management. In this instance reversible causes should be considered more likely than a primary cardiac event.

Maternal

Adult Life Support Algorithm is shown in Appendix F. Resuscitation in the pregnant woman has several important adaptations. Firstly the increased oxygen demand of the mother will cause rapid desaturation and profound hypoxia in the event of collapse. Evidence advocates rapid intubation and provision of maximal oxygen therapy. Secondly the uterus should be displaced laterally to improve venous return and cardiac output. Finally do not forget that delivery of the foetus will dramatically improve cardiovascular status and quality of chest compressions. If >20 weeks gestation, perimortem section should be undertaken after 4 minutes of unsuccessful CPR. The foetus should be delivered in under 5 minutes.
Do not forget that drugs such as magnesium and opioids will cross the placenta and can have a profound effect on the foetus. Where there is cause of concern the paediatric team should always been involved early. Neonatal Life Support is shown in Appendix E.
Appendix A: CICV Algorithm

Algorithm for the Management of a High Regional Block in Obstetrics

RECOGNITION
- Tingling of Arms
- Shoulder Weakness
- Difficulty in Breathing
- Slurred Speech
- Sedation
- Demonstrable High Block

CALL FOR HELP
- Anaesthetist
- Obstetrician
- Resuscitation Equipment

IMMEDIATE MANAGEMENT
- 100% oxygen via mask
- Stop epidural infusion if present
- Consider placing the woman in head up position (reverse Trendelenberg)
- Briefly explain situation to relative and ask a member of staff (not your anaesthesia assistant!) to escort relatives from room

ASSESS PATIENT
- Airway
- Breathing
- Circulation
- Disability

Consider alternative diagnoses e.g. subarachnoid haemorrhage, eclampsia, cerebral malaria

Airway + breathing compromised? or Patient unconscious NO

Intubate and ventilate
- RSI with cricoid pressure
- Ensure anaesthesia is provided as patient may be aware even if she appears unconscious
- Maintain sedation
- Ventilate until block worn off

Failed Intubation
- Failed intubation drill
- Remember, spontaneous ventilation will not return

Is baby compromised?

Emergency LSCS

Circulation compromised?

YES

Close observation

Bradycardia
- Treat with atropine 500mcg bolus x 2 if necessary

Hypotension
- Rapid IV fluid infusion
- Vasopressors - titrate to effect
  - Ephedrine 6mg bolus
  - Phenylephrine 100mcg bolus
  - Metaraminol 500mcg bolus
- If severe hypotension/unresponsive/requiring high doses of vasopressors use epinephrine (adrenaline) 50 - 100mcg bolus

NO

Discuss with senior obstetrician

Adapted from Southampton University Hospital's High Spinal Drill

Figure 1. Available for download at: www.update.anesthesiologists.org
Appendix B: Management of High or Total Spinal Block

Resuscitation Council (UK)

Anaphylaxis algorithm

Anaphylactic reaction?

Airway, Breathing, Circulation, Disability, Exposure

Diagnosis - look for:
- Acute onset of illness
- Life-threatening Airway and/or Breathing
  and/or Circulation problems
- And usually skin changes

- Call for help
- Lie patient flat
- Raise patient’s legs

Adrenaline

When skills and equipment available:
- Establish airway
- High flow oxygen
- IV fluid challenge
- Chlorphenamine
- Hydrocortisone
- Monitor:
  - Pulse oximetry
  - ECG
  - Blood pressure

1 Life-threatening problems:
- Airway: swelling, hoarseness, stridor
- Breathing: rapid breathing, wheeze, fatigue, cyanosis, SpO₂ < 92%, confusion
- Circulation: pale, clammy, low blood pressure, faintness, drowsiness

2 Adrenaline (give IM unless experienced with IV adrenaline)
  IM doses of 1-1000 adrenaline (repeat after 5 min if no better)
  - Adult: 500 micrograms IM (0.5 mL)
  - Child more than 12 years: 300 micrograms IM (0.3 mL)
  - Child 2-12 years: 300 micrograms IM (0.3 mL)
  - Child less than 5 years: 150 micrograms IM (0.15 mL)

Adrenaline IV to be given only by experienced specialists
  Titrated: Adults 50 micrograms; Children 1 microgram/kg

3 IV fluid challenge:
  - Adult: 500 - 1000 mL
  - Child: crystalloid 20 mL/kg

  Stop IV colloids
  If this might be the cause of anaphylaxis

4 Chlorphenamine
  (IM or slow IV)
  - Adult or child more than 12 years: 10 mg
  - Child 2-12 years: 5 mg
  - Child 6 months to 2 years: 2.5 mg
  - Child less than 6 months: 25 micrograms/kg

5 Hydrocortisone
  (IM or slow IV)
  - 200 mg
  - 100 mg
  - 50 mg
  - 25 mg

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Telephone (020) 7388-6678  •  Fax (020) 7383-0773  •  Email enquiries@resus.org.uk
www.resus.org.uk  •  Registered Charity No. 265990
**Appendix C: Management of Anaphylaxis**

**Appendix D: Management of Local Anaesthetic Toxicity**

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### AAGBI Safety Guideline

#### Management of Severe Local Anaesthetic Toxicity

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

**1 Recognition**

- Stop injecting the LA
- Call for help
- Maintain the airway and, if necessary, secure it with a tracheal tube
- Give 100% oxygen and ensure adequate lung ventilation (hyperventilation may help by increasing plasma pH in the presence of metabolic acidosis)
- Confirm or establish intravenous access
- Control seizures: give a benzodiazepine, thiopental or propofol in small incremental doses
- Assess cardiovascular status throughout
- Consider drawing blood for analysis, but do not delay definitive treatment to do this

**2 Immediate management**

**IN CIRCULATORY ARREST**
- Start cardiopulmonary resuscitation (CPR) using standard protocols
- Manage arrhythmias using the same protocols, recognising that arrhythmias may be very refractory to treatment
- Consider the use of cardiopulmonary bypass if available
- **GIVE INTRAVENOUS LIPID EMULSION** (following the regimen overleaf)
  - Continue CPR throughout treatment with lipid emulsion
  - Recovery from LA-induced cardiac arrest may take >1 h
  - Propofol is not a suitable substitute for lipid emulsion
  - Lidocaine should not be used as an anti-arrhythmic therapy
- **CONSIDER INTRAVENOUS LIPID EMULSION** (following the regimen overleaf)
  - Propofol is not a suitable substitute for lipid emulsion
  - Lidocaine should not be used as an anti-arrhythmic therapy

**WITHOUT CIRCULATORY ARREST**
- Use conventional therapies to treat:
  - Hypotension,
  - Bradycardia,
  - Tachyarrhythmia

**3 Treatment**

- **Arrange safe transfer to a clinical area with appropriate equipment and suitable staff until sustained recovery is achieved**
- Exclude pancreatitis by regular clinical review, including daily amylase or lipase assays for two days
- Report cases as follows:
  - In the United Kingdom to the National Patient Safety Agency (via [www.npsa.nhs.uk](http://www.npsa.nhs.uk))
  - In the Republic of Ireland to the Irish Medicines Board (via [www.imb.ie](http://www.imb.ie))

If lipid has been given, please also report its use to the international registry at [www.lipidregistry.org](http://www.lipidregistry.org). Details may also be posted at [www.lipidrescue.org](http://www.lipidrescue.org)

**4 Follow-up**
Annex E: European Resuscitation Council Guidelines

Newborn Life Support

- **Birth**
  - Dry the baby
    - Remove any wet towels and cover
    - Start the clock or note the time

- **Assess (tone), breathing and heart rate**

- **If gasping or not breathing**
  - Open the airway
  - Give 5 inflation breaths
  - Consider SpO2 monitoring
  - Re-assess
    - If no increase in heart rate
    - Look for chest movement

- **If chest not moving**
  - Recheck head position
  - Consider two-person airway control or other airway manoeuvres
  - Repeat inflation breaths
  - Consider SpO2 monitoring
  - Look for a response

- **If no increase in heart rate**
  - Look for chest movement

- **When the chest is moving**
  - If the heart rate is not detectable or slow (< 60)
  - Start chest compressions
    - 3 compressions to each breath

- **Reassess heart rate**
  - every 30 seconds

*www.pediatrics.org/cgi/doi/10.1542/peds.2009-1510*
Appendix F: UK Resuscitation Council Adult Advanced Life Support