Obstetric Anaesthesia Guidelines 7:

Obstetric Anaesthesia Emergencies
Including Maternal Collapse and Resuscitation

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V3 Updates Nov18 – Incorporates MBRRACE guidance / GAP analysis
Section 2.1- added advice on early cardiac compressions in sudden onset severe shock
section 2.4.2- advice on aortocaval compression
section 2.4.5 – Incorporates advice on sizes on ET Tubes on resus trollies/carts
V4 Updates Dec19- more comprehensive
Section 2 Management of total spinal
Section 3 LAST
Section 4 MH
Section 5.4.5Intubation section
Section 6 Maternal collapse
Section 8 Management of women with suspected neurological disorders
Section 9 Anaphylaxis
Section 10 Cardiac disease
Section 11 Drug overdoses
Obstetric anaesthetic emergencies

Failed intubation
Total Spinal
Local anaesthetic toxicity
Malignant hyperpyrexia

Causes of maternal collapse

Haemorrhage- APH, PPH
Sepsis
Amniotic fluid embolism
Seizures: eclampsia, intracranial catastrophe, hypoglycaemia
Anaphylaxis
Cardiac Disease- Peripartum cardiomyopathy/ aortic dissection
Drug Overdose- Magnesium toxicity, Local anaesthetic toxicity

Causes of maternal cardiac arrest

Hypoxia
Haemorrhage
Thromboembolic event: Pulmonary embolism, myocardial infarction, amniotic fluid embolism
Toxins
Hypo, hyperthermia
Hypo, hyperkalaemia
Tamponade
Tension pneumothorax
1. Management of Unexpected Difficult / Failed Intubation in Obstetrics

https://das.uk.com/guidelines/obstetric_airway_guidelines_2015
Algorithm 2 – obstetric failed tracheal intubation

Declare failed intubation
Theatre team to call for help
Priority is to maintain oxygenation

Supraglottic airway device
(2nd generation preferable)
Remove cricoid pressure during insertion (maximum 2 attempts)

Facemask +/- oropharyngeal airway
Consider:
• 2-person facemask technique
• Reducing/ removing cricoid pressure

Is adequate oxygenation possible?

No
Follow Algorithm 3
Can’t intubate, can’t oxygenate

Yes
Is it essential/safe to proceed with surgery immediately?

No
Wake

Yes
Proceed with surgery

*See Table 1, †See Table 2
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

Maternal advanced life support
Perimortem caesarean section

Yes

Is it essential / safe to proceed with surgery immediately?*

No

Wake§

Yes

Proceed with surgery§

*See Table 1, §See Table 2
### Table 1 – proceed with surgery?

<table>
<thead>
<tr>
<th>Factors to consider</th>
<th>WAKE</th>
<th>PROCEED</th>
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<tbody>
<tr>
<td><strong>Maternal condition</strong></td>
<td>• No compromise</td>
<td>• Mid acute compromise</td>
</tr>
<tr>
<td><strong>Fetal condition</strong></td>
<td>• No compromise</td>
<td>• Compromise corrected with intrauterine resuscitation, pH &lt; 7.2 but &gt; 7.15</td>
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<tr>
<td><strong>Anaesthetist</strong></td>
<td>• Novice</td>
<td>• Junior trainee</td>
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<tr>
<td><strong>Obesity</strong></td>
<td>• Supermorbid</td>
<td>• Morbid</td>
</tr>
<tr>
<td><strong>Surgical factors</strong></td>
<td>• Complex surgery or major haemorrhage anticipated</td>
<td>• Multiple uterine scars</td>
</tr>
<tr>
<td><strong>Aspiration risk</strong></td>
<td>• Recent food</td>
<td>• No recent food</td>
</tr>
<tr>
<td><strong>Alternative anaesthesia</strong></td>
<td>• No anticipated difficulty</td>
<td>• Predicted difficulty</td>
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<tr>
<td><strong>Airway device / ventilation</strong></td>
<td>• Difficult facemask ventilation</td>
<td>• Adequate facemask ventilation</td>
</tr>
<tr>
<td><strong>Airway hazards</strong></td>
<td>• Laryngeal oedema</td>
<td>• Bleeding</td>
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Criteria to be used in the decision to wake or proceed following failed tracheal intubation. In any individual patient, some factors may suggest waking and others proceeding. The final decision will depend on the anaesthetist’s clinical judgement.

2 Management of a “Total Spinal"

A “total spinal” block is extremely rare but can occur with frightening rapidity and result in death of the mother and unborn baby if not quickly recognised and treated. Usually it happens when topping up an epidural for surgical intervention with high doses of local anaesthetics, which are inadvertently injected intrathecally.

- **Call for help** straight away; you may need several pairs of hands.
- **Reassure** the mother and start ABC resuscitation: i.e. respiratory and cardiac support.
- **Give 100% oxygen** with bag and face mask and assist ventilation.
- Establish wide-bore intravenous access and infuse fluids rapidly.
- **Treat hypotension** with fluids, vasopressors, left lateral tilt and elevate legs.
- **Monitor blood pressure** and oxygen saturation and CTG continuously.
- You may need to intubate and ventilate (with small doses of midazolam/ induction agent) if breathing is difficult or the patient starts to lose consciousness.
- Watch for warning signs: hypotension, bradycardia, husky voice and weak hands. The combination of bradycardia, hypotension and hypoxia may lead to cardiac arrest. Hence **bradycardia** should be treated promptly with atropine.
- **Ventilation** needs to be continued until spinal block recedes and the patient is able to breath unaided.
- Consider urgent delivery of fetus if severe fetal bradycardia develops during resuscitation of mother.
- **Admit to high dependency or intensive care** unit post-operatively for close observation of vital functions and support if needed.
# Malignant Hyperthermia Crisis

**AAGBI Safety Guideline**

Successful management of malignant hyperthermia depends upon early diagnosis and treatment; onset can be within minutes of induction or may be insidious. The standard operating procedure below is intended to ease the burden of managing this rare but life-threatening emergency.

## 1 Recognition

- Unexplained increase in ETCO₂ AND
- Unexplained tachycardia **AND**
- Unexplained increase in oxygen requirement
  
  (Previous uneventful anaesthesia does not rule out MH)

## 2 Immediate management

- **STOP** all trigger agents (anaesthetic vapours, etc.)
- **CALL FOR HELP**. Allocate specific tasks (action plan in MH kit)
- Install clean breathing system and **HYPERVENTILATE with 100% O₂ high flow**
- Maintain anaesthesia with intravenous agent
- **ABANDON/FINISH** surgery as soon as possible

## 3 Monitoring & treatment

- Give **dantrolene**
- Initiate active **cooling** avoiding vasoconstriction

**TREAT:**

- **Hyperkalaemia**: Calcium chloride, NaHCO₃, glucose/insulin
- **Arrhythmias**: magnesium/amiodarone/metoprolol
  
  **AVOID** calcium channel blockers - interaction with dantrolene
- **Metabolic acidosis**: hyperventilate, NaHCO₃
- **Myoglobinuria**: forced alkaline diuresis (mannitol/frusemide + NaHCO₃) may require RRT later
- **DIC**: FFP, cryoprecipitate, platelets
- Check plasma CK as soon as able

**DANTROLENE**

2.5mg/kg immediate iv bolus. Repeat 1mg/kg boluses as required to max 10mg/kg

**For a 70kg adult**

- **Initial bolus**: 9 vials dantrolene 20mg (each vial mixed with 60ml sterile water)
- Further boluses of 4 vials dantrolene 20mg repeated up to 7 times.

**Continuous monitoring**

Core & peripheral temperature
- ETCO₂
- **SPO₂**
- ECG
- **Invasive blood pressure**
- CVP

**Repeated bloods**

- ABG
- U&Es (potassium)
- FBC (haematocrit/platelets)
- Coagulation

## 4 Follow-up

- Continue monitoring on ICU, repeat dantrolene as necessary
- Monitor for renal failure and compartment syndrome
- Repeat **CK**
- Consider alternative diagnoses (sepsis, phaeochromocytoma, thyroid storm, myopathy)
- Counsel patient & family members
- Refer to MH unit (see contact details below)

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The UK MH Investigation Unit, Academic Unit of Anaesthesia, Clinical Sciences Building, St James’s University Hospital Trust, Leeds LS9 7TF. Direct line: 0113 206 5370. Fax: 0113 206 4140. Emergency Hotline: 07827 609603 (usually available outside office hours). Alternatively, contact Prof Hopkins or Dr Halsall through hospital switchboard: 0113 248 3144.

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Your nearest MH kit is stored...
5 Cardiopulmonary Resuscitation in Pregnancy

5.1 Best Practice Points
• All staff involved in intrapartum care should be familiar with basic life support guidelines for the pregnant patient and should follow them during resuscitation attempts.
• 30 degree left lateral tilt should be used to minimise aortocaval compression and maximise cardiac output.
• In sudden onset severe maternal shock e.g. anaphylaxis, the presence of a pulse may be an unreliable indicator of adequate cardiac output. In the absence of a recordable blood pressure or other indicator of cardiac output, the early initiation of external cardiac compressions may be life-saving.
• Caesarean section should be performed after 4 minutes of unsuccessful resuscitation.
• Senior obstetric, anaesthetic and neonatal staff should be involved as early as possible.
• Record keeping should be meticulous ensuring that treatment given and timings are clearly identified.

5.2 Background
Cardiac arrest in pregnancy is thought to occur in approximately 1:30,000 maternities\(^1\). Maternal and fetal survival rates are low following cardiac arrest.\(^2\) (Exact figures are not known but it has been suggested that maternal survival is approximately 40\%\(^3\)). This is partly due to the generally catastrophic events leading to cardiac arrest, but also the physiological changes of pregnancy can hamper resuscitative efforts.

5.3 Possible causes of cardiac arrest at term

Obstetric Causes
• Massive Haemorrhage
• Amniotic Fluid Embolism
• Eclampsia/HELLP syndrome
• Magnesium Sulphate Toxicity

Non - Obstetric Causes
• Pulmonary embolism
• Septic shock
• Cardiovascular disease
• Myocardial infarction
• Peripartum cardiomyopathy
• Trauma
• Anaesthetic complications

5.4 Resuscitation in Pregnancy
In the event of maternal cardiorespiratory arrest, resuscitation should begin immediately and should follow current basic and advanced life support guidelines (see below). Physiological changes of pregnancy and the presence of the fetus demand some additions to the normal algorithms:
• 30\(^0\) left lateral tilt of the mother
• Early tracheal intubation
• Perimortem Caesarean section

These are explained below:
5.4.1 **Physiological changes of pregnancy**
The following is a list of the major physiological and anatomical changes that make resuscitation in pregnancy difficult and the steps that can be taken to minimise their effects.

5.4.2 **Veno-caval Occlusion**
Aortocaval compression significantly reduces cardiac output from 20 weeks of gestation onwards and the efficacy of chest compressions during resuscitation. [C]

From around 20 weeks of gestation onwards the gravid uterus reduces venous return in the supine position. At term, the vena cava is completely occluded in 90% of supine pregnant women. Compression of the aorta and inferior vena cava in the supine position by the uterus decreases cardiac output to 25-30%.

Aortocaval compression should be suspected in any supine pregnant woman who develops severe hypotension after induction of anaesthesia, even if some lateral tilt has been applied. If there is a delay in delivery, putting the woman into the left lateral position may be the only option if other manoeuvres fail or if the woman has refractory severe hypotension.

During resuscitation, tilt the mother approximately 15-30° to the left in order to reduce aortocaval compression. This can be achieved by using a rescuer's knees as a ‘human wedge’, pillows or a purpose made wedge under the patient's right side, and by then moving the uterus to the left by manual displacement.

5.4.3 **Cardiac Output**
Maternal cardiac output increases by 40-50% in late pregnancy to satisfy a 20% increase in resting oxygen demands of the fetoplacental unit. In late pregnancy the uterus receives approximately one tenth (some reports suggest 30%) of the cardiac output.

When cardiopulmonary arrest occurs, chest compressions are needed to produce a cardiac output. In the nonpregnant situation, they achieve around 30% of the normal cardiac output. Aortocaval compression further reduces cardiac output to approximately 10% of the nonpregnant cardiac output. When a pregnant patient is tilted the efficiency of compressions is reduced further but the detrimental effect of aortocaval compression is greater than that of left tilt.
BLS

Unresponsive and not breathing normally

- Call 999 and ask for an ambulance

- 30 Chest compressions

- 2 Rescue breaths

- Continue CPR 30:2

- As soon as AED arrives switch it on and follow instructions
5.4.4 Oxygen Consumption and FRC

Changes in lung function, diaphragmatic splinting and increased oxygen consumption make pregnant women become hypoxic more readily and make ventilation more difficult. [C]

Oxygen storage is reduced due to a 20% decrease in functional residual capacity of the lungs. Maternal cardiac output increases by 40-50% in late pregnancy to satisfy a 20% increase in resting oxygen demands of the fetoplacental unit. These changes make it difficult to provide enough oxygen delivery using CPR to resuscitate a near term pregnant mother.

Hypoxia occurs very rapidly. For this reason, early tracheal intubation is ideal although attempts at intubation should not override oxygen delivery. Irreversible brain damage will occur 4-6 minutes following cerebral hypoxia.

5.4.5 Intubation

Supplemental high flow oxygen should be administered as soon as possible to counteract rapid deoxygenation. [GPP]

Bag and mask ventilation should be undertaken until intubation can be achieved. [GPP]

Difficult intubation is more likely in pregnancy. [C]

Weight gain in pregnancy, large breasts inhibiting the working space and laryngeal oedema can all contribute to making intubation more difficult.6-7

5.4.6 Gastric Contents

Pregnant women are at an increased risk of aspiration. [C]

Pregnant women are at a significantly higher risk of regurgitation and aspiration, secondary to the progesterone effect relaxing the lower oesophageal sphincter and delayed gastric emptying, along with the raised intra-abdominal pressure secondary to the gravid uterus. Aspiration pneumonitis in pregnant women, known as Mendelson’s syndrome,8 can be severe, particularly as the gastric pH is lower than in the nonpregnant population. The risks can be minimised by early intubation with effective cricoid pressure, and the use of H2 antagonists and antacids prophylactically in all women considered to be at high risk of obstetric intervention during labour. [Evidence Level 2+]

Early intubation will protect the airway from aspiration of gastric contents but see caveat above. It is recommended that all resuscitation carts used in maternity units should include endotracheal tubes no larger than 7.0mm and include smaller sizes such as 6.0mm and 5.0mm.
5.5 Perimortem Caesarean Section

The concept of perimortem Caesarean section was introduced in 1986. The theory is that resuscitation is likely to be ineffective in the third trimester because of aortocaval compression and that timely delivery will optimize outcome for mother and baby. As CPR produces (at maximum) 30% of normal cardiac output and the uterus takes 30% of cardiac output at term, CPR is unlikely to sustain maternal and foetal life. A recent review has supported this hypothesis. Perimortem Caesarean section should be initiated within 4 minutes of cardiac arrest if resuscitation is unsuccessful, in order that cardiac output may be re-established within 5 minutes. This will minimise the danger of hypoxic neurological damage to the mother. This means that decision for perimortem section should be made at 2-3 minutes, if no return of spontaneous circulation has been achieved within this time from initiating CPR. A pair of gloves, scalpel and some swabs will suffice initially and transfer to theatre is not necessary until after the baby is delivered. The neonatal resuscitation team should be present at delivery. It is prudent to trigger the massive haemorrhage protocol in an undelivered woman at the time the decision to proceed to peri-mortem caesarean section is made, and within the same time frame for a delivered woman in whom there is also no return of spontaneous circulation at four minutes after advanced life support commences.

Further Care The neonatal team will take charge of the baby. The mother should be transferred to ITU/HDU. Early involvement of ITU specialists is essential. Relatives should be kept fully informed of events by senior staff. Records should be reviewed to make sure they are complete and any further retrospective information should be added once the patient is stable.

Unsuccessful Resuscitation In the event of unsuccessful resuscitation the bereavement team should also be involved. The head of midwifery and the clinical director should be informed. Refer to “maternal death” guidelines for further information.

Staff Debrief All staff involved in a maternal cardiac arrest should be involved in a formal debrief. This should be organised by senior midwifery and medical staff.
6 Maternal Collapse

Maternal collapse is defined as an acute event involving the cardiorespiratory systems and/or central nervous systems, resulting in a reduced or absent conscious level (and potentially death), at any stage in pregnancy and up to 6 weeks after delivery. Maternal collapse can result from a number of causes. A systematic approach should be taken to identify the cause. [B]

This section aims to cover situations which may be classed as an emergency that may involve anaesthetic input, as the condition may lead to the patient becoming critically ill or suffering a cardiac arrest.

Causes of maternal collapse
Common causes of maternal collapse

- Haemorrhage
- Sepsis
- Amniotic fluid embolism
- Seizures: eclampsia, intracranial catastrophe, hypoglycaemia
- Anaphylaxis
- Cardiac Disease – Ischemic heart disease, arrhythmia’s, peripartum cardiomyopathy/ aortic dissection
- Drug overdose and toxicity - Magnesium sulphate and local anaesthetics

1. Haemorrhage

This is among the most common causes of maternal collapse and was responsible for 13 maternal deaths between 2012 and 2014. Major obstetric haemorrhage has an estimated incidence of 6 in 1000 maternities. Causes of major obstetric haemorrhage include postpartum haemorrhage, major antepartum haemorrhage from placenta praevia, placental abruption, uterine rupture and ectopic pregnancy. In most cases of massive haemorrhage leading to collapse, the cause is obvious, but concealed haemorrhage should not be forgotten, including following caesarean section and ruptured ectopic pregnancy. Other rarer causes of concealed haemorrhage include splenic artery rupture and hepatic rupture. Blood loss is often underestimated, especially slow, steady bleeding, and fit, healthy women can tolerate significant loss prior to showing signs of decompensation.

Management refer to obstetric haemorrhage including placenta praevia/ Accreta guideline MYH-GUIDE-36

2. Sepsis

Sepsis has been recognised for centuries as a significant cause of maternal morbidity and mortality, and substandard care continues to feature in the cases that result in death. Bacteraemia, which can be present in the absence of pyrexia or a raised white cell count, can progress rapidly to severe sepsis and septic shock leading to collapse. The most common organisms implicated in obstetric sepsis are the streptococcal groups A, B and D, pneumococcus and Escherichia coli. [Evidence level 2–]

Septic shock should be managed in accordance with the MYH-GUIDE-48 and Surviving Sepsis Campaign guidelines.

The Surviving Sepsis Campaign has updated the management of sepsis and septic shock. The speed and appropriateness of therapy administered in the initial hours after severe sepsis develops are likely to influence outcome with early resuscitation improving survival rates. A multidisciplinary team approach is required, including midwives, consultant obstetricians, anaesthetists, haematologists, intensivists and microbiologists. The following ‘Care Bundle’ should be applied immediately or within 6 hours, and has been shown to significantly improve survival rates:

1. Measure serum lactate.
2. Obtain blood cultures and culture swabs prior to antibiotic administration.
3. Administer broad spectrum antibiotic(s) within the first hour of recognition of severe sepsis and septic shock according to local protocol.

4. In the event of hypotension and/or lactate more than 4 mmol/l:
   a) Give an initial minimum of 30 ml/kg of crystalloid
   b) Once adequate volume replacement has been achieved, a vasopressor (norepinephrine, with vasopressin or epinephrine in addition, if required) and/or an inotrope (for example, dobutamine) may be used to maintain mean arterial pressure more than 65 mmHg.

Further management consists of:

5. In the event of hypotension despite fluid resuscitation (septic shock) and/or lactate more than 4 mmol/l:
   a) dynamic variables of fluid status are preferred to static variables and the use of central venous pressure alone to guide fluid resuscitation can no longer be justified
   b) consider steroids if unresponsive to adequate fluid resuscitation and vasopressor therapy.

6. Maintain oxygen saturation at more than 94% (88%–92% in women at risk of hypercapnic respiratory failure) with facial oxygen. Consider transfusion if haemoglobin less than 70 g/l.

Ongoing management involves continued supportive therapy, removing the septic focus, administration of blood products if required, and thromboprophylaxis. [Evidence Level 1+]

### 7 Amniotic Fluid Embolism (AFE)

#### 7.1 Introduction
AFE is one of the leading causes of maternal mortality according to the recently released UKOSS (UK Obstetric Surveillance System) seventh annual report 2013.

#### 7.2 Definition
Amniotic Fluid Embolism is the entry of amniotic fluid into the maternal circulation. AFE is defined clinically according to the criteria below:

**In the absence of any other clear cause, acute maternal collapse with one or more of the following features:**

**Either**
- Cardiac arrhythmias or arrest
- Coagulopathy
- Convulsion
- Hypotension
- Maternal haemorrhage
- Acute fetal compromise
- Shortness of breath
- Premonitory symptoms, e.g. restlessness, numbness, agitation, tingling

**Or**

Women in whom the diagnosis was made at post-mortem examination by finding fetal squamous cells or hair in the lungs
7.3 Objectives
This guideline aims to:
• Ensure clear, evidence-based and referenced guidance is in place to inform the clinical practice of all members of the multidisciplinary obstetric team in relation to the risks and management of amniotic fluid embolism.
• To ensure safe and consistent care is provided at the MYHT.
• To promote effective and seamless teamwork in an emergency situation.
This guideline should be used in conjunction with Obstetric Haemorrhage and obstetric collapse guidelines.

7.4 Practice recommendations
Although, the incidence of AFE quoted is 2/100,000 pregnancies \(^{19}\) estimates of incidence vary considerably (1.3-12.5 / 100,000 pregnancies) \(^{19}\). Maternal mortality attributed to AFE varies from 16-86%. UKOSS has data on 119 confirmed cases of AFE from 2005 till 2013. In the recent MMBRACE report\(^{20}\) there were 8 confirmed cases of maternal mortality attributed to AFE.

7.5 Risk factors
• Induction of labour
• Caesarean section
• Multiple pregnancy
• Older ethnic minority women

7.6 Presentation
AFE presents at or before delivery in 53% of cases, the remainder occurring within six hours of delivery, usually in the first 30 minutes. The most common features at first presentation are\(^{21}\)
• Premonitory symptoms (62%)
• Acute fetal compromise (46%)
• Seizures (38%)
• Shortness of breath (33%)
• Hypotension (28%)
• Cardiac arrest (20%)

7.7 Management
The treatment of AFE is supportive\(^{22}\)
Remember ABC
• Adequate oxygenation and ventilation
• Maintenance of cardiac output
• Aggressive correction of coagulopathy.

The incidence of uterine atony is increased in AFE and may contribute to a postpartum haemorrhage. The Major Obstetric Haemorrhage protocol (MOH) should be instituted at time of decision for perimortem Caesarean section, and within same time frame for delivered woman with no response to CPR at 4 minutes. Transfusion should be with red cells as soon as possible to avoid haemodilution, and in a ratio of 1:1:1 red cells:FFP:platelets in the first instance. Keep checking fibrinogen and platelet levels and arterial blood gases.
and lactate at frequent intervals. See Obstetric Haemorrhage and obstetric collapse guidelines for more details.

7.8 Key messages
Induction of labour is a high risk factor for AFE.
Remember Airway, Breathing, Circulation.
Perimortem caesarean section should be carried out within five minutes or as soon as possible after cardiac arrest and is carried out for the benefit of the woman; there is no need to confirm fetal viability.
Massive obstetric haemorrhage protocol should be initiated in an undelivered woman at the time the decision to proceed to peri-mortem caesarean section. Hysterectomy should not be delayed in case of intractable bleeding from atonic uterus. It is important to replace major blood loss with red cells, plasma and platelets as soon as possible.

8 Management of women with suspected Neurological disorders - Seizures
Neurological disorders were the 5th leading cause of maternal death and the 3rd leading cause of direct maternal death in the 2013-15 MBRRACE-UK report, published in 2017. Stroke accounted for 12 deaths between 2013-15, with 7 from subarachnoid haemorrhage and 5 from intracranial haemorrhage. A further 16 women died from stroke between 6 weeks and 1 year post-natal.

These numbers do not include intracranial haemorrhage from pre-eclampsia. There were no deaths reported from thrombotic stroke.

8.1.1 Definition
Neurological disorders can encompass a whole range of conditions from severe epilepsy to stroke. We are concerned with those causing maternal collapse, which is mainly haemorrhage, neurological infection (meningitis) and other causes of acute raised intracranial pressure. For the purposes of this document we will be focussing on stroke secondary to haemorrhage.

Pregnancy should not alter the investigation and treatment of a woman presenting with a stroke (MBRRACE 2017)

8.1.2 Objectives
This guideline aims to:

1. Ensure clear, evidenced-based guidance is in place to inform the clinical practice to all members of the MDT in relation to the risks and management of neurological causes of maternal collapse.
2. To ensure safe and consistent care is provided.
3. To highlight a high index of suspicion in patients presenting with atypical headache.
4. To promote effective and seamless teamwork in an emergency situation.

Although the incidence of maternal death due to stroke is rare, 0.48 per 100000 maternities, its management and prognosis is reliant on early recognition, CT scan and referral/transfer to a neurosurgical centre.

8.1.3 Risk factors/Red flag signs
Headache in pregnancy is common. Patients presenting with new onset headache or headache with atypical features need a full neurological examination, including fundoscopy to establish a concern and exclude intracranial pathology (MBRRACE 2017).

Atypical features:

1. Vomiting
2. Neck stiffness
3. Visual disturbance
4. Focal neurology

8.1.4 **Differential diagnosis**

1. Simple/tension headache
2. Migraine – can get focal neurology. May be past medical history
3. PDPH
4. Pre-eclampsia/eclampsia
5. Subarachnoid/intracranial haemorrhage
6. Infection
7. Cortical vein thrombosis
8. Space-occupying lesion

8.1.5 **Management**

This relies on an index of suspicion, full history and examination, including fundoscopy, and CT scan or referral to neurologist/medics. In the case of maternal collapse-

1. ABC
2. Early anaesthetic/critical care involvement
3. Adequate oxygenation and ventilation (keep \( \text{pO}_2 \) 10-15kPa and \( \text{pCO}_2 \) 3.5-4.5), may need to be intubated to maintain normal ventilation variables.
4. Maintain good cardiac output.
5. Appropriately sedated (to reduce CMR)

8.1.6 **Learning points**

1. High index of suspicion with full neurological management, including fundoscopy is needed for prompt diagnosis.
2. Diagnosis needs early CT scan.
3. In maternal collapse follow ABC.

9 **Anaphylaxis**

Anaphylaxis is a severe, life-threatening generalised or systemic hypersensitivity reaction,\(^{23}\) resulting in respiratory, cutaneous and circulatory changes, and possibly gastrointestinal disturbance and collapse.
Anaesthesia, Surgery, and Life-Threatening Allergic Reactions

Anaphylaxis is the operating theatre is a life-threatening drug reaction that happens suddenly, without warning and can affect anyone. Low blood pressure, impaired circulation and lack of oxygen in the lungs combine to starve the tissues of oxygen, leading to shock which in extreme cases rapidly progresses to cardiac arrest or even death. The 6th National Audit Project of the Royal College of Anaesthetists (NAP6): Perioperative Anaphylaxis is the largest ever prospective study of anaphylaxis related to anaesthesia and surgery.

1. 100% of NHS hospitals took part in NAP6, which studied every case of life-threatening anaphylaxis during 3 million anaesthetics given in the UK over a year long reporting period.

2. The incidence of perioperative anaphylaxis was 1 in 10,000 anaesthetics.

3. Antibiotics were the most common trigger for anaphylaxis.
   - The commonest triggers were:
     - Antibiotics (47%)
     - Muscle relaxants (33%)
     - Chlorhexidine (9%)
     - Patent Blue dye (5%) used in some breast surgery

4. Actions by anaesthetists were prompt and >96% of patients with life-threatening anaphylaxis survived the event.

5. Low blood pressure was the commonest presenting feature in NAP6 and occurred in all cases during the event.

6. 15% of patients had a cardiac arrest and treatment was prompt, but when blood pressure was very low CPR was often delayed.

7. Elderly patients with cardiac disease and the obese were most at risk of cardiac arrest and death.

8. Teicoplanin is 17-fold more likely to cause anaphylaxis than alternatives.
   - It is regularly used for patients who are believed to be allergic to penicillin – though we know that more than 90% of these patients are not truly penicillin-allergic.
   - Better identification of these patients will improve safety.

9. Three quarters of patients required admission to ICU, but most recovered quickly.

10. >100 days was the average time taken for investigation to take place in an allergy clinic – more specialist services are required.

11. Investigation was frequently imperfect and communication to patients by anaesthetists and allergy doctors needs improvement.

12. One third of patients experienced harm
   - In some form: Anxiety about future anaesthetics was the commonest reported consequence.

RCOA
Royal College of Anaesthetists

NAA
National Audit of Anaesthesia

HSRC
Health Services Research Centre

www.nationalauditprojects.org.uk/NAP6Home  @HSRCNews
**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, drowsy/coma

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: 500 micrograms IM (0.5 mL)
  - Child 6 - 12 years: 300 micrograms IM (0.3 mL)
  - Child less than 6 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 colloid if this might be the cause of anaphylaxis

4 Chlorphenamine (IM or slow IV)
- Adult or child more than 12 years: 10 mg
- Child 6 - 12 years: 5 mg
- Child 6 months to 6 years: 2.5 mg
- Child less than 6 months: 250 micrograms/kg

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

Cardiac disease was the most common overall cause of indirect maternal death in the latest MBRRACE report, being responsible for 51 maternal deaths between 2012 and 2014. The majority of deaths secondary to cardiac causes occur in women with no previous history, and almost one in five deaths occurred in an ambulance or accident and emergency department. The main cardiac causes of maternal death are ischaemia and sudden arrhythmic cardiac death with a structurally normal heart.

Most cardiac events have preceding signs and symptoms. Aortic root dissection can present in otherwise healthy women, and signs and symptoms, such as central chest or interscapular pain, a wide pulse pressure (mainly secondary to systolic hypertension) and a new cardiac murmur, must prompt appropriate imaging and, if required, referral to a cardiologist. The incidence of congenital and rheumatic heart disease in pregnancy are increasing, secondary to increased survival rates with improved management of congenital heart disease and increased immigration. In addition, women with mechanical prosthetic heart valves are at particularly increased risk of complications in pregnancy. These cases should be managed by an appropriately skilled and experienced multidisciplinary team, usually in regional centres. Other cardiac causes include: cardiomyopathy; dissection of the coronary artery; acute left ventricular failure; infective endocarditis; and pulmonary oedema.

After successful resuscitation, cardiac cases should be managed by an expert cardiology team. After initial resuscitation, the ongoing management of cardiac disease is similar to that in the nonpregnant state, although in many cases, delivery will be necessary to facilitate this. Although thrombolysis can be associated with significant bleeding from the placental site, it should be given to women with acute coronary insufficiency, although caution should be exercised in the perioperative period. If available, percutaneous angioplasty allows accurate diagnosis and definitive therapy.

11 Drug overdose and toxicity

Many drug overdoses have specific therapy which is dependent on the drug in question and appropriate help should be sought in the management of such cases. In obstetric practice, the two main drugs that can give rise to overdose or toxic problems are magnesium sulphate and local anaesthetic agents.

Magnesium sulphate

The antidote to magnesium toxicity is 10 ml 10% calcium gluconate given by slow intravenous injection.

Local anaesthetic agents- See section 3

References


### Classification of evidence levels

<table>
<thead>
<tr>
<th>Evidence Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1++</td>
<td>High-quality meta-analyses, systematic reviews of randomised controlled trials with a low risk of bias</td>
</tr>
<tr>
<td>1+</td>
<td>Well-conducted meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a high risk of bias</td>
</tr>
<tr>
<td>1–</td>
<td>Meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias</td>
</tr>
<tr>
<td>2++</td>
<td>High-quality systematic reviews of case–control or cohort studies or high-quality case–control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal</td>
</tr>
<tr>
<td>2+</td>
<td>Well-conducted case–control or cohort studies with a low risk of confounding, bias or chance</td>
</tr>
<tr>
<td>2–</td>
<td>Case–control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal</td>
</tr>
<tr>
<td>3</td>
<td>Non-analytical studies, e.g. case reports, case series</td>
</tr>
<tr>
<td>4</td>
<td>Expert opinion</td>
</tr>
</tbody>
</table>

### Grades of Recommendation

**A**  
At least one meta-analysis, systematic reviews or RCT rated as 1++, and directly applicable to the target population; or a systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results

**B**  
A body of evidence including studies rated as 2++ directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+

**C**  
A body of evidence including studies rated as 2+ directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++

**D**  
Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+