

Maternal collapse during pregnancy and puerperium

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Purpose

- The purpose of this guideline is,
- To discuss the identification of women at increased risk of maternal collapse
- To identify different causes of maternal collapse.
- To delineate the initial and continuing management of maternal collapse.
- To review maternal and fetal outcomes.

Maternal collapse

- Maternal collapse is defined as an acute event involving the cardiorespiratory systems and/or brain, resulting in a reduced or absent conscious level (and potentially death), at any stage in pregnancy and up to six weeks after delivery.

- *Can women at risk of impending collapse be identified early?*
- **An obstetric early warning score chart should be used routinely for all women, to allow early recognition of the woman who is becoming critically ill.**
- It depends on previous risk factors during pregnancy.
- The first early warning scoring (EWS) systems were introduced on the basis that a deterioration in simple physiological vital signs will precede significant clinical deterioration, and that early intervention will reduce morbidity.

Causes of maternal collapse

- Reversible causes;

- 4H's

- Hypovolemia

- Hypoxia

- Hypokalemia/Hyperkalemia

- Hypothermia

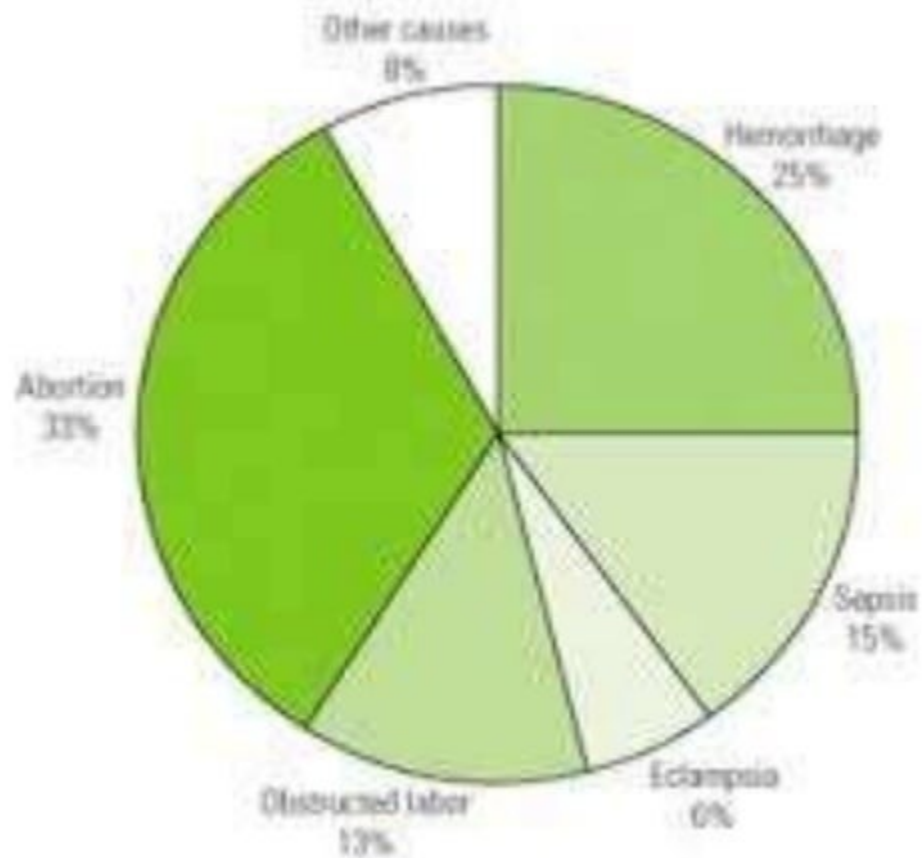
- 4T's

- Thromboembolism

- Toxicity

- Tension pneumothorax

- Temponade (cardiac)



Haemorrhage

- This is the most common cause of maternal collapse, and was responsible for 1.7 maternal deaths in the last triennium.

Types of haemorrhage

Revealed haemorrhage

Concealed haemorrhage

causes of revealed haemorrhage

Postpartum haemorrhage

Major antepartum haemorrhage from placenta praevia accreta, placental abruption

Uterine rupture and

Ectopic pregnancy.

Causes of concealed haemorrhage

Placental abruption

Splenic artery rupture,

Hepatic rupture



Thromboembolism

In the last CEMACH report¹ there were 41 deaths due to thromboembolism (33 pulmonary embolism and eight cerebral vein thrombosis), making it the most common cause of direct maternal death.

Appropriate use of thromboprophylaxis has improved maternal morbidity and mortality, but improvements in clinical risk assessment and prophylaxis are still required.

Amniotic fluid embolism

The estimated frequency of amniotic fluid embolism (AFE) lies somewhere between 1.25/100 000 and 12.5/100 000 maternities, with the most recent UK data giving an incidence of 2/100 000 maternities.

Survival rates seem to have improved significantly over time, from 14% in 1979 30% in 2005 and 80% in 2010

BIPHASIC RESPONSE

FIRST PHASE[30 MIN]

PULMONARY
VASOSPASM

PULMONARY
HYPERTENSION

RIGHT HEART
DYSFUNCTION

SECOND PHASE

LVF,
PULMONARY
EDEMA

ARDS

DIC

Cardiac disease

- Cardiac disease was the most common overall cause of maternal death in the CEMACH report, 1 being responsible for 48 maternal deaths.

Maternal collapse due to cardiac causes include

myocardial infarction

aortic dissection

cardiomyopathy

dissection of coronary artery

acute left ventricular failure

infective endocarditis

Sepsis

- 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 obstetrics are the streptococcal groups A, B and D, pneumococcus and *Escherichia coli*.

Drug Toxicity

- Magnesium sulfate causes renal impairment.
- Anaesthesia drugs cause feeling of inebriation and lightheadedness followed by sedation, circumoral paraesthesia and twitching; convulsions can occur in severe toxicity.

On intravenous injection, convulsions and cardiovascular collapse may occur very rapidly

seizures

- Eclampsia
- Epilepsy

Intracranial haemorrhage

- Intracranial haemorrhage is a significant complication of uncontrolled, particularly systolic hypertension, but can also result from ruptured aneurysms and arteriovenous malformations.
- The initial presentation may be maternal collapse, but often severe headache precedes this.

Anaphylaxis

- Anaphylaxis is likely when all of the following three criteria are met:
 - sudden onset and rapid progression of symptoms
 - life-threatening airway and/or breathing and/or circulation problems
 - skin and/or mucosal changes (flushing, urticaria, angioedema).

Exposure to a known allergen for the woman supports the diagnosis, but many cases occur with no previous history. Mast cell tryptase levels can be useful

Other causes

- Hypoglycaemia and
- Other metabolic/electrolyte disturbances
- Other causes of hypoxia such as airway obstruction secondary to aspiration/foreign body,
- Air embolism
- Tension pneumothorax,
- Cardiac tamponade secondary to trauma and hypothermia.

Physiological and anatomical changes during pregnancy

Parameter	Percentage of change	
Cardiac output	40–50%	Increase
Stroke volume	30%	Increase
Heart rate	15–25%	Increase
Intravascular volume	45%	Increase
Systemic vascular resistance	20%	Decrease
Systolic BP		Minimal
Diastolic BP	20%	Decrease at mid-pregnancy Pre-pregnant values at term
CVP		Unchanged
O ₂ consumption	30–40%	Increase

Variable	Change in pregnancy
Kidney size	The kidney length increases by 1 cm to 1.5 cm, and kidney volume increases by up to 30%
Hydronephrosis	Physiological dilation of the urinary collecting system with hydronephrosis in up to 80% of women (Rt > Lt)
Renal blood flow	Increased by 80% above baseline
GFR	150–200 mL/min (rises 40–50% above baseline)
S. creatinine	Falls to 0.4 to 0.5 mg/dL ($n = 0.8$)*
Uric acid	Falls to 2.0 to 3.0 mg/dL ($n = 4-5$)
BUN	Falls to 8 to 10 mg/dL ($n = 13$)*
Sodium	Mild hyponatremia (Fall of 4–5 mol/L)
Osmolality	Falls to a new osmotic set point of about 270 mosm/kg

*Considered normal in a non-pregnant individual, reflects renal impairment in a pregnant woman.

Aortocaval compression

- **Aortocaval compression significantly reduces the efficacy of chest compressions during resuscitation.**
- When cardiopulmonary arrest occurs, chest compressions are needed to produce a cardiac output.
- In nonpregnant women, chest compressions achieve around 30% of the normal cardiac output.
- Aortocaval compression further reduces cardiac output to around 10% that achieved in nonpregnant women. Cardiopulmonary resuscitation (CPR) is less likely to be effective in a woman who is 20 weeks pregnant or more



- **Respiratory changes**

- Changes in lung function, diaphragmatic splinting and increased oxygen consumption make the pregnant woman become hypoxic more readily and make ventilation more difficult.
- The increased progesterone level in pregnancy increases the respiratory drive leading to an increase in tidal volume and minute ventilation. Splinting of the diaphragm by the enlarged uterus reduces the functional residual capacity and also makes ventilation more difficult.
- These factors along with the markedly increased oxygen consumption of the fetoplacental unit, mean that the pregnant woman becomes hypoxic much more rapidly during periods of hypoventilation

- **Intubation**

Difficult intubation is more likely in pregnancy

- **Aspiration**

Pregnant women are at an increased risk of aspiration including

Aspiration pneumonitis

Mendelson syndrome

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 is advised

circulation

Healthy women tolerate blood loss remarkably well, and can lose up to 35% of their circulation before becoming symptomatic.

Blood loss is tolerated less well if there is a pre-existing maternal anaemia, and clotting is less efficient if there is a significant anaemia.

- *What is the optimal initial management of maternal collapse?*
- **Maternal resuscitation should follow the Resuscitation Council (UK) guidelines using the standard A, B,C approach, with some modification.**

Resuscitation is conducted by

- Basic life support (BLS),
- adult advanced life support (ALS) and
- automated external defibrillation (AED)

- **Tilt**

From 20 weeks of gestation onwards, the pressure of the gravid uterus must be relieved from the inferior vena cava and aorta

- **A left lateral tilt of 15 DEGREE on a firm surface will relieve aortocaval compression in the majority of pregnant women and still allow effective chest compressions to be performed**



- **Airway**

- **The airway should be protected as soon as possible by intubation with a cuffed endotracheal tube.**
- Pregnant woman is more likely to regurgitate and aspirate in the absence of a secured airway (tracheal tube) than the nonpregnant patient, and that the early involvement of an appropriately skilled anaesthetist remains best practice.

- Recommended equipment for routine airway management:
 - Facemasks
 - Oropharyngeal airways: three sizes
 - Nasopharyngeal airways: three sizes
 - Laryngeal mask airways
 - Tracheal tubes in a range of sizes
 - Two working laryngoscope handles
 - Macintosh blades: sizes 3 and 4
 - Tracheal tube introducer ('gum-elastic' bougie)
 - Malleable stylet
 - Magill forceps

- **Breathing**

Supplemental oxygen (100%) should be administered as soon as possible

- **Bag and mask ventilation should be undertaken until intubation can be achieved.**

- **Circulation**

In the absence of breathing despite a clear airway, chest compressions should be commenced immediately.

Chest compressions should not be delayed by palpating for a pulse, but should be commenced immediately in the absence of breathing and continued until the rhythm can be checked and cardiac output is confirmed

Compressions should be performed at a ratio of 30:2 ventilations unless the woman is intubated.

compressions being performed at a rate of 100/minute and ventilations at a rate of 10/minute once women intubated.

Two wide-bore cannulae should be inserted as soon as possible.

There should be an aggressive approach to volume

Abdominal ultrasound by a skilled operator can assist in the diagnosis of concealed haemorrhage.

- The same defibrillation energy levels should be used as in the nonpregnant patient.**
- If defibrillation is required, the same settings should be used as in the nonpregnant patient as there is no change in thoracic impedance.**

- **Drugs**

There should normally be no alteration in algorithm drugs or doses

Postmortem caesarean section



- *When, where and how should perimortem caesarean section be performed?*

If there is no response to correctly performed CPR within 4 minutes of maternal collapse or if resuscitation is continued beyond this in women beyond 20 weeks of gestation, delivery should be undertaken to assist maternal resuscitation. This should be achieved within 5 minutes of the collapse

Perimortem caesarean section should not be delayed by moving the woman – it should be performed where resuscitation is taking place.

- **The operator should use the incision that will facilitate the most rapid access**
- **A perimortem caesarean section tray should be available on the resuscitation trolley in all areas where maternal collapse may occur, including the accident and emergency department.**

- *What does the continuing management consist of?*
- **Senior staff with appropriate experience should be involved at an early stage.**
- **Transfer should be supervised by an adequately skilled team with appropriate equipment.**

Haemorrhage

- In the case of maternal collapse secondary to antepartum haemorrhage, the fetus and placenta should be delivered promptly to allow control of the haemorrhage.
- In the case of massive placental abruption, caesarean section may occasionally be indicated even if the fetus is dead to allow rapid control of the haemorrhage.

Amniotic fluid embolism

The management of AFE is supportive rather than specific, as there is no proven effective therapy

Early involvement of senior experienced staff, including obstetrician, anaesthetist, haematologist and intensivist, is essential to optimise outcome.

Treatment includes

- inotropic support
- avoid fluid overload
- treatment of arrhythmias and pulmonary edema if develops

Coagulopathy needs early, aggressive treatment,
including aggressive use of fresh frozen plasma

- Various other therapies have been tried, including steroids, heparin, plasmapheresis and haemofiltration, usually in single cases.
- If undelivered, delivery of the fetus and placenta should be performed as soon as possible

- **Cardiac disease**
- **After successful resuscitation, cardiac cases should be managed by an expert cardiology team.**
- After initial resuscitation, the continuing 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.

sepsis

Septic shock should be managed in accordance with the Surviving Sepsis Campaign guidelines

- The following 'care bundle' should be applied immediately or within 6 hours, and has been shown to significantly improve survival rates:^{71–73}
 1. Measure serum lactate.
 2. Obtain blood cultures/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 >4 mmol/l:

a) deliver an initial minimum of 20 ml/kg of crystalloid/ colloid

b) once adequate volume replacement has been achieved, a vasopressor (norepinephrine,

epinephrine) and/or an inotrope (e.g. dobutamine) may be used to maintain mean arterial pressure over 65 mmHg.

Further management consists of:

5. In the event of hypotension despite fluid resuscitation (septic shock) and/or lactate over 4 mmol/l:
 - a) achieve a central venous pressure of at least 8 mmHg (or over 12 mmHg if the woman is mechanically ventilated) with aggressive fluid replacement
 - b) consider steroids.
6. Maintain oxygen saturation with facial oxygen.
Consider transfusion if haemoglobin is below 7g/dl
7. Continuing management involves continued supportive therapy, removing the septic focus, administration of blood products if required and thromboprophylaxis

Drug overdose and toxicity

Magnesium sulphate

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

Local anaesthetic agents

- **If local anaesthetic toxicity is suspected, stop injecting immediately.**
- **Lipid rescue should be used in cases of collapse secondary to local anaesthetic toxicity.**
- **Intralipid 20% should be available in all maternity units.**

Treatment of cardiac arrest

- Treatment of cardiac arrest with lipid emulsion, consists of an intravenous bolus injection of Intralipid 20% 1.5 ml.kg^{-1} over 1 minute (100 ml for a 70 kg woman) followed by an intravenous infusion of Intralipid 20% at $0.25 \text{ ml.kg}^{-1} \text{ min}^{-1}$ (400 ml over 20 minutes for a 70 kg woman).
- The bolus injection can be repeated twice at 5-minute intervals if an adequate circulation has not been restored (a further two boluses of 100 ml at 5-minute intervals for a 70 kg woman). After another 5 minutes, the infusion rate should be increased to $0.5 \text{ ml.kg}^{-1} \text{ min}^{-1}$ if adequate circulation has not been restored.
- CPR should be continued throughout this process until an adequate circulation has been restored, and this may take over an hour.

- Prolonged resuscitation may be necessary, and it may be appropriate to consider other options.
- The firstline treatment should be lipid emulsion, but if the facilities are available, some may consider the use of cardiopulmonary bypass

Anaphylaxis

- In cases of anaphylaxis, all potential causative agents should be removed, and the A, B, C, D, E approach followed.
- The definitive treatment for anaphylaxis is 500 micrograms (0.5 ml) of 1:1000 adrenaline intramuscularly.
- **PLEASE NOTE THIS DOSE IS FOR INTRAMUSCULAR USE ONLY.**
- Adrenaline treatment can be repeated after 5 minutes if there is no effect.
- In experienced hands it can be given intravenously as a 50 microgram bolus (0.5 ml of 1:10 000 solution).
- Adjuvant therapy consists of chlorpheniramine 10 mg and hydrocortisone 200 mg. Both are given intramuscularly or by slow intravenous injection

- *Who should be on the team?*
- **In addition to the general arrest team, there should be a senior midwife, an obstetrician and an obstetric anaesthetist included in the team in cases of maternal collapse.**
- If the maternity unit is an integral part of a general hospital, the maternal cardiopulmonary resuscitation team should be the hospital cardiopulmonary arrest team with the addition of:
 - a senior midwife
 - the most senior resident obstetrician – usually ST 3–7
 - a resident anaesthetist who has recognised skills in obstetric anaesthesia

- **The consultant obstetrician and consultant obstetric anaesthetist should be summoned at the time of the cardiopulmonary arrest call.**
- **The neonatal team should be called early if delivery is likely (antepartum collapse over 22 weeks of gestation).**
- **Where the woman survives, a consultant intensivist should be involved as soon as possible**

- *Documentation*
- **Accurate documentation in all cases of maternal collapse, whether or not resuscitation is successful, is essential.**
- Poor documentation remains a problem in all aspects of medicine, and can have potential medico-legal consequences.

- *Training*

All generic life support training should make mention of the adaptation of CPR in the pregnant woman

- **All maternity staff should have annual formal training in generic life support and the management of maternal collapse.**
- **Life support training reduces morbidity and mortality**

Attitude need to be changed.



Our AIM is to achive this.....





MDG 5 – Improve Maternal Health

“every mother’s life and health is precious”

thank you!

