

MATERNAL COLLAPSE AND PERIMORTEM CAESAREAN SECTION

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Introduction

Maternal collapse is a non-specific description that can be applied to a variety of medical conditions, ranging from a simple faint through to cardiac arrest. The clinical outcome is largely determined by the promptness of management of the collapse. The fetal outcome is directly related to the wellbeing of the mother.

Maternal collapse can occur from direct obstetric complications, indirectly from pre-existing medical conditions exaggerated by the pregnancy, or from conditions unrelated to the pregnancy.

Maternal mortality

The most recent estimate of the overall world maternal mortality ratio (MMR) is 400 per 100,000 live births.¹ This figure is an estimate since accurate data is reliant on reporting of all maternal deaths; this tends to be more accurate in developed than developing countries. The MMR is calculated as the number of direct and indirect maternal deaths per 100,000 live births.

Direct deaths are defined as deaths resulting from obstetric complications of the pregnant state, from interventions, omissions, incorrect treatment or from a chain of events resulting from the above.¹

Indirect deaths are defined as 'deaths resulting from previously existing disease, or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was exaggerated by the physiological effects of pregnancy.'¹

The risk and causes of death occurring during pregnancy, childbirth or unsafe abortion is determined geographically. The average MMR in developing countries is 1 in 65, compared to 1 in 9,000 in the United Kingdom. More than 99% of all maternal deaths occur in developing countries.

Causes of maternal mortality

Beyond the numbers, published by the World Health Organisation in 2004, looked not only at the number of maternal deaths, but at the principle causes.³ The key message was that preventing many maternal deaths is possible, even where resources are scarce, as long as appropriate programmes are in place. More than 80% of deaths are estimated to be avoidable through affordable and effective actions, possible in even the poorest countries. The WHO is working towards the United Nations Millennium Development Goal to reduce maternal deaths by 75% by 2015.

Globally, 80% of maternal deaths are due to direct obstetric causes and 20% due to indirect causes. The five leading direct causes account for 80% of the direct deaths and are shown in table 2.

Indirect deaths account for 20% of worldwide maternal deaths. In developing countries infections are the commonest cause of indirect deaths with HIV/AIDS the leading cause in most African countries. In areas with endemic malaria, women are at risk from malaria itself and also from malaria related anaemia which contributes to death from haemorrhage.

In contrast, in the UK, the latest Confidential Enquiry into Child and Maternal Health (CEMACH) showed that there are more indirect deaths (55%) than direct deaths (44%) and that the commonest cause of death overall was due to psychiatric disease.⁴ The commonest cause of direct death in the UK is thromboembolic disease.

Management of maternal collapse

The UK Resuscitation Council published guidelines for the management of maternal cardiac arrest in 'Standards for Clinical Practice' in 2004.⁵

Specific management of a collapsed pregnant woman is dependant on the number of weeks of gestation.

Table 1: Maternal mortality estimates by the World Health Organisation and United Nations, 2000.²

Region	Number of maternal deaths	Maternal mortality ratio
World total	529,000	400
Developed regions	2,500	20
Developing regions	527,000	440
Africa	251,000	830
Asia	253,000	330
Latin America/Caribbean	22,000	190
Oceania	530	240

Table 2: Estimated incidence of major global causes of direct maternal deaths 2000.²

Cause	Number of maternal deaths	% of all direct deaths
Haemorrhage	132,000	28
Sepsis	79,000	16
Preeclampsia/eclampsia	63,000	13
Obstructed labour	42,000	9
Abortion	69,000	15

After 22-24 weeks the physiological and anatomical changes seen in pregnancy become significant and may hinder effective resuscitation.

The most significant effect is aortocaval compression in the supine position, which can reduce maternal cardiac output by up to 25%. For this reason any woman of more than 22 weeks gestation should be managed with a lateral tilt or with a wedge. Even if there is no sign of hypotension in the supine position there may still be some compromise of venous return and cardiac output.

As with any acute medical condition requiring resuscitation, the initial management is that described by the European Resuscitation Council (see *Update 22, 2007*): assess and manage the airway (and apply lateral tilt), breathing, circulation whilst treating the underlying cause. As well as calling for the resuscitation team, the delivery suite must also be informed so that obstetricians and paediatricians can become involved.

Factors affecting resuscitation

A – Airway

- Increased incidence of difficult intubation, with a failed intubation rate of about 1 in 250.^{6,7} Can't intubate, can't ventilate occurs in about 1 in 500.
- Anatomically made difficult by oedema or obesity of the neck, large breasts and/or supraglottic oedema.
- Difficult airway equipment should be available.
- Increased risk of aspiration.
 - Increased intragastric pressure from 8 to 16cmH₂O.
 - Reduced oesophageal tone.

B – Breathing

- Less effective pre-oxygenation:
 - 20-30% increased oxygen requirements.
 - 10-15% decreased functional reserve capacity (raised diaphragm).
- Reduced thoracic compliance.

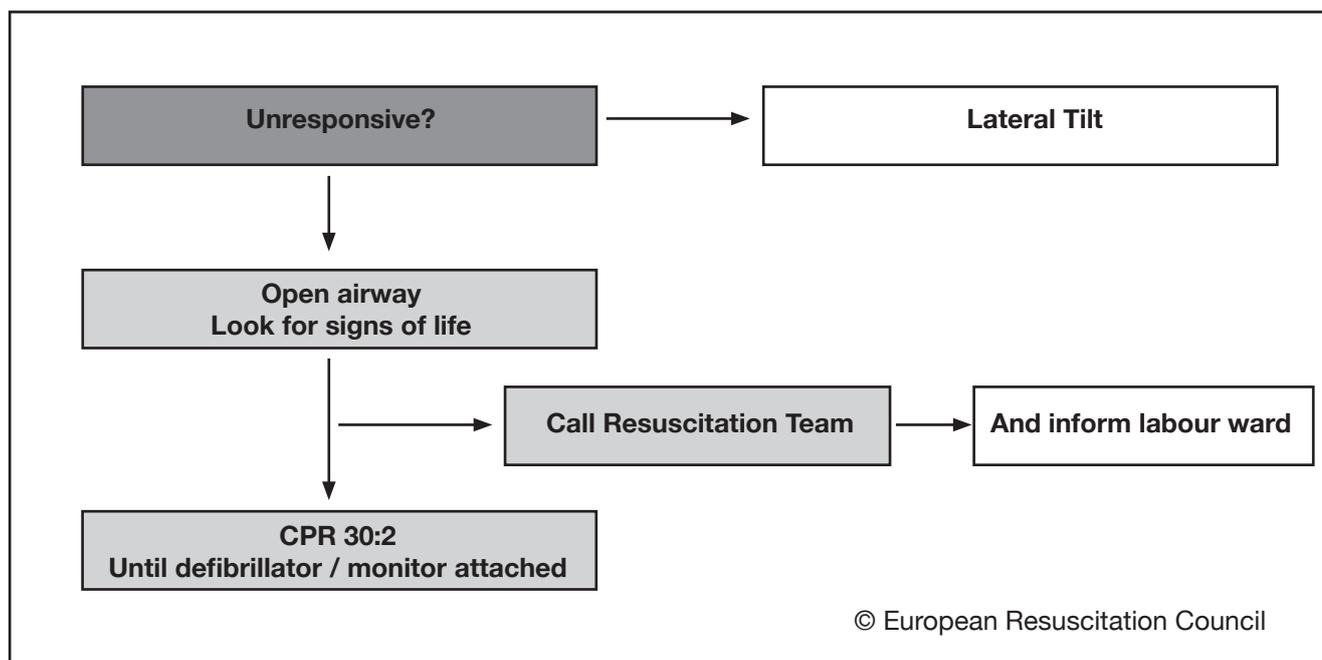


Figure 1: Adult basic life support 2005 with additional considerations (white boxes) for pregnant patients.

C – Circulation

- Lateral tilt to minimise aortocaval compression.
- Chest compression is physically more difficult in the lateral tilt position.
- 2 large bore cannulae.
- Epinephrine should be used despite its effect on fetal circulation.
- Consider **perimortem caesarean section**.

Perimortem caesarian section

The concept was first introduced in 1986 and adopted by the American Heart Association.⁸ The recommendation is to perform a caesarean section within four minutes of maternal arrest, when cardiopulmonary resuscitation (CPR) has been unsuccessful. The rationale is that delivery of the fetus makes CPR more effective, aortocaval compression ceases to be a factor and cardiac output increases by as much as 20%. The patient can then be managed in a supine position making resuscitation easier.

Indications for perimortem caesarean section

- Pregnancy more than 22 weeks gestation.
- Personnel with appropriate skills available.
- The mother fails to respond to CPR with return of spontaneous circulation after 4 minutes.
- Appropriate facilities to care for the mother and (ideally) the baby afterwards.

A perimortem caesarean section is potentially a life-saving procedure for both mother and baby, and should be performed even if there is no fetal heart beat and no time should be wasted in assessing the fetus before undertaking the procedure.

The best survival rates are reported when the caesarian section is performed in under 5 minutes, although there are reports of infants surviving after up to 20 minutes of cardiac arrest time. It is clear that the caesarian section greatly improves the chances of survival for the mother.

The practice of perimortem caesarean section was reviewed in 2006, covering the period from 1985 to 2004.⁹ This showed that of 38 perimortem caesarian sections, 34 infants survived and 4 survived initially but died several days later. Of the 20 caesarian sections performed on women with potentially reversible causes of cardiac arrest, 13 were discharged from hospital in good condition. In 12 of 18 cases that documented haemodynamic status, delivery brought a return of maternal pulse, and it was also noted that in the other cases the caesarian section did not cause deterioration in maternal condition.

For those women who survive appropriate post-operative care is essential. The long-held belief that pregnant women can endure great haemodynamic fluctuations without longstanding morbidity because of their young age has recently been challenged. New evidence is emerging that a proportion of pregnant patients, suffering collapses and significant haemorrhages, do suffer myocardial damage and, where facilities exist, monitoring of myocardial damage with troponin levels is performed.¹⁰

Conclusion

Some 80% of all maternal collapses are from a potentially treatable cause. For the outcome to be favourable regular updates and training in resuscitation must be provided for all staff on delivery units. There must be clear protocols for the management of all obstetric emergencies in an effort to prevent collapse, but, in the event of maternal cardiac arrest, perimortem caesarean section must be considered at an early stage.

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