

If the anaphylactic reaction occurs in the community, the woman should have basic life support and be transferred to a hospital setting as quickly as possible, unless a suitably trained healthcare professional is present with appropriate equipment and drugs in which case definitive resuscitation and treatment should be commenced.



The treatment for anaphylaxis is 1:1000 adrenaline 500 micrograms (0.5 ml) intramuscularly. This dose is for intramuscular use only.



What are the outcomes for mother and baby after maternal collapse?

Outcomes for mothers and babies depend on the cause of collapse, gestational age and access to emergency care, with survival rates being poorer if the collapse occurs out of hospital. In maternal cardiac arrest maternal survival rates of over 50% have been reported. [New 2019]



Who should be on the team?

In addition to the general arrest team, there should also be a senior midwife, an obstetrician and an obstetric anaesthetist included in the team in cases of maternal collapse.



The most senior obstetrician and senior anaesthetist should be called at the time of a cardiopulmonary arrest call.



The neonatal team should be called early if delivery is likely (antepartum collapse over 22⁺⁰ weeks of gestation).



Where the woman survives, a consultant intensivist should be involved as soon as possible.



Clinical governance

Documentation

Accurate documentation is essential in all cases of maternal collapse, whether or not resuscitation is successful.



Incident reporting

All cases of maternal collapse should generate a clinical incident form and the care should be reviewed through the clinical governance process.



All cases of maternal death should be reported to MBRRACE-UK. [New 2019]



Training

All generic life support training should consider the adaptation of CPR in pregnant women.



All maternity staff should have annual formal multidisciplinary training in generic life support and the management of maternal collapse.



Life support training improves resuscitation skills.



Small group multidisciplinary interactive practical training is recommended to improve the management of maternal collapse.



Debriefing

Debriefing is recommended for the woman, the family and the staff involved in the event.



1. Purpose and scope

Maternal collapse is a rare but life-threatening event, with a wide ranging aetiology. The outcome primarily for the mother, but also the fetus, depends on prompt and effective resuscitation. The purpose of this guideline is to discuss the identification of women at an increased risk of maternal collapse and the different causes of maternal collapse, to delineate the initial and ongoing management of maternal collapse, and review the maternal and neonatal outcomes. It covers both hospital and community settings, and includes all gestations and the postpartum period. The resuscitation team and equipment, and training requirements will also be covered.

2. Introduction and background epidemiology

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 cardiac arrest and death), at any stage in pregnancy and up to 6 weeks after birth. Importantly, if maternal collapse which is not as the result of cardiac arrest is not treated effectively, maternal cardiac arrest can then occur. There is a robust and effective system for maternal mortality audit in the UK in the form of the Confidential Enquiry into Maternal Death performed by MBRRACE-UK (Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK). However, the incidence of maternal collapse or severe maternal morbidity is unknown as morbidity data is not routinely collected. Even when it is, it is not collected in a standardised way to facilitate comparisons.¹ The incidence of cardiac arrest in pregnancy is much rarer than maternal collapse at around 1 in 36 000 maternities², with a case fatality rate of 42%. In a UK study, a total of 25% of cardiac arrests in pregnancy were secondary to anaesthesia and all were associated with a 100% survival rate.²

It is accepted that lessons can be learned from severe morbidity and near misses, and MBRRACE-UK now undertake targeted maternal morbidity confidential enquiries.³ The UK Obstetric Surveillance System (UKOSS), run by the National Perinatal Epidemiology Unit, has made a significant contribution towards the study of rare events and maternal morbidity.⁴ Severe maternal morbidity data were collected across Scotland for 10 years and published in 2014.⁵ A woman was defined as having had a severe maternal morbidity event if there was a risk of maternal death

without timely intervention. The data showed a severe maternal morbidity rate of 7.3 in 1000 (730 in 100 000) maternities in 2012, but not all cases of severe maternal morbidity involved maternal collapse (although all cases of collapse were included in the figures). A publication from Ireland showed a severe maternal morbidity rate of 6.35 in 1000 (635 in 100 000) births in 2015.⁶ These reports demonstrate that the rate of maternal morbidity has increased year on year. This is likely to reflect the changing demographics of women and better reporting, rather than a decline in care.⁷ Between 2012 and 2014, the maternal mortality rate was 8.5 in 100 000 in the UK.³ However, not all maternal collapse results in maternal death. Thus, the true rate of maternal collapse is unknown.

Whilst maternal collapse is such an uncommon event, the consequences are potentially devastating, therefore it is essential that the clinical team are skilled in initial effective resuscitation techniques, and are able to investigate and diagnose the cause of the collapse to allow appropriate, directed ongoing management. Unfortunately, in reports regarding morbidity^{5,6} and the MBRRACE-UK report 2016,³ areas of substandard care continue to be identified, including poor resuscitation skills. However, it should also be remembered that death and disability may result despite excellent care. It should be noted that vasovagal attacks and epileptic seizures⁸ are the most common causes of maternal collapse and are not covered by this guideline.

3. Identification and assessment of evidence

This guideline was developed in accordance with standard methodology for producing Royal College of Obstetricians and Gynaecologists (RCOG) Green-top Guidelines. The Cochrane Library (including the Cochrane Database of Systematic Reviews and the Database of Abstracts of Reviews of Effects [DARE]), EMBASE, Trip, MEDLINE and PubMed (electronic databases) were searched for relevant randomised controlled trials (RCT), systematic reviews and meta-analyses. The search was restricted to articles published up to June 2018. The databases were searched using the relevant Medical Subject Headings (MeSH) terms, including all subheadings, and this was combined with a keyword search. Search words included, '*labor complication', '*maternal morbidity', '*maternal mortality', '*pregnancy complication' and '*heart arrest'. The search was restricted to humans and the English language. The National Library for Health and the National Guideline Clearinghouse were also searched for relevant guidelines and reviews.

Where possible, recommendations are based on available evidence. In the absence of published evidence, these have been annotated as 'good practice points'. Further information about the assessment of evidence and the grading of recommendations may be found in Appendix I.

4. Clinical issues

4.1. *Can women at risk of impending collapse be identified early?*

An obstetric modified early warning score chart should be used for all women undergoing observation, to allow early recognition of the woman who is becoming critically ill.

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In some cases, maternal collapse occurs with no prior warning, although there may be existing risk factors which make this more likely. Antenatal care for women with significant medical conditions at risk of maternal collapse should include multidisciplinary team input with a pregnancy and birth management plan in place. Often there are clinical signs that precede collapse. In a previous report into maternal

Evidence level 4

deaths in the UK,⁹ substandard care was often identified where these signs and symptoms were not recognised and acted upon. The MBRRACE-UK report published in 2016 recommended a national obstetric early warning scoring system should be introduced and used for all obstetric women, including those being cared for outside the obstetric setting. It also recommended that clinical judgment must be incorporated in that if the woman looks or feels unwell, despite the score, her care should be escalated.³

The first Modified Early Warning Score (MEWS systems)¹⁰ 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.^{11–15} They are now extensively used in acute settings and critical care,^{16–18} although the optimal system has yet to be identified.¹⁹

Evidence
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Despite this, the MEWS systems have not been demonstrated to be highly effective, even when their use has triggered input from a specialised medical emergency team.²⁰ Although their use is recommended by the National Institute for Health and Care Excellence (NICE)²¹ and MBRRACE-UK³ this is based on informal consensus rather than evidence.

The physiological changes of pregnancy may render the existing MEWS systems inappropriate,²² and no validated system for use in pregnant women currently exists. Because of this, many maternity hospitals have developed their own modified MEWS system so local training is required, and there is ongoing work in the UK to try and develop a national obstetrics MEWS system. This, however, should be subjected to rigorous scrutiny to ensure that it is effective before it is universally implemented.

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The National Early Warning Score 2 (NEWS2)²³ is endorsed by NHS England and NHS Improvement but is not recommended for women who are more than 20 weeks pregnant because the physiological response to acute illness can be modified in pregnancy. With that in mind, it would seem reasonable to consider the use of NEWS2 in women who are less than 20 weeks pregnant. The timing of the use of NEWS2 postpartum is uncertain as the physiological changes of pregnancy are largely returned to pre-pregnancy levels by 48 hours although full return can take up to 6 weeks.

It is also important to consider the potential risks associated with the use of different scoring systems in the same organisation for the same patient depending on their stage of pregnancy.

A scoring system may still miss an unwell patient and a high level of clinical suspicion should be present if a patient looks unwell, even if her MEWS/Modified Early Obstetric Warning Score (MEOWS)/NEWS2 score is normal.

4.2. *What are the causes of maternal collapse?*

Maternal collapse can result from a number of causes. A systematic approach should be taken to identify the cause.

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Maternal collapse can result from many causes which may or may not be pregnancy related. A systematic approach to assessment facilitates identification of the cause of collapse. If the cause is reversible, the survival rates are greater²⁴ and those for which specific treatment exists must be rapidly considered. A systematic ABCDE approach should enable the clinical team to identify the most common causes of collapse. For ease of memory, these are divided by the Resuscitation Council (UK) into the '4 T's' and

Evidence
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'4 H's'.²⁴ In pregnant women, eclampsia and intracranial haemorrhage should be added. Other specific obstetric causes could also be present and should be considered systematically (please see Appendix 2). Due to the lack of robust morbidity data regarding collapse, maternal deaths are often used as a reference point. The common causes of maternal collapse are discussed below, but this is not an exhaustive list, as this is beyond the scope of this guideline.

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4.2.1. Haemorrhage

Major obstetric haemorrhage has an estimated incidence of 6 in 1000 maternities.⁵ This is among the most common causes of maternal collapse and was responsible for 13 maternal deaths between 2012 and 2014.³ 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 rupture²⁵ and hepatic rupture. Blood loss is often difficult to estimate,^{26,27} especially slow, steady bleeding, and fit, healthy women can tolerate significant loss prior to showing signs of decompensation.

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4.2.2. Thromboembolism

In the MBRRACE-UK report 2016,³ deaths were the result of thromboembolism, 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.^{3,28}

Evidence
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4.2.3. Amniotic fluid embolism (AFE)

UK data published in 2016 give an incidence of AFE of 1.7 per 100 000 maternities.²⁹ Survival rates seem to have improved significantly over time, from 14% in 1979,³⁰ to approximately 30% in 2005³¹ and 81% by 2014.²⁹ However, neurological morbidity in survivors is well recognised.²⁹ The perinatal mortality rate in cases of AFE is 67 per 1000 total births.²⁹ It presents as collapse during labour or birth, or within (usually) 30 minutes of birth, in the form of acute hypotension, respiratory distress and acute hypoxia.³⁰ Seizures and cardiac arrest may occur. There are different phases to the disease progression,^{32,33} which clearly depend on maternal survival. Initially, pulmonary hypertension may develop secondary to vascular occlusion either by debris or vasoconstriction. This often resolves and left ventricular dysfunction or failure develops. Coagulopathy often develops if the mother survives long enough, often giving rise to massive postpartum haemorrhage. If AFE occurs prior to birth, profound fetal distress develops acutely.³⁴ The underlying pathophysiological process has been compared to anaphylaxis or severe sepsis, and may be due to complement activation.^{35,36} Diagnosis in nonfatal cases is clinical, as there is no established accurate diagnostic test premortem, although research continues in the area.³⁷

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