

Cardiopulmonary resuscitation in pregnancy

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Dr Fiona Donald	Version 1 Written 2006		Ratified by Intra partum Clinical Team, NBT
Dr Fiona Donald / Dr Christina Laxton	Version 2 Written June 2011		Ratified by IPCT 27 th June 2011
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Dr S Moxham, Post CCT fellow Anaesthesia Dr N Weale, Consultant Anaesthetist	Version 4 Oct 2019	Updated guideline	19/011/19 for review November 2022

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Best Practice Points

1. **All** clinical staff involved in intrapartum care should be familiar with basic life support guidelines for the pregnant patient and should follow them during resuscitation attempts¹.
2. Basic Life Support Training should be multi-professional and refreshed annually¹.
3. High quality chest compressions should be performed immediately once 'Maternal Cardiac Arrest' is identified and ongoing until return of spontaneous circulation or the resuscitation attempt is abandoned. Interruptions should be kept to a minimum.
4. Left lateral uterine displacement should be used to minimise aortocaval compression and maximise cardiac output after 20 weeks gestation.
5. **Prepare** for Perimortem Caesarean Section (or Operative Vaginal Delivery, if second stage) as soon as "Maternal Cardiac Arrest" is declared. **Perform** Perimortem Caesarean Section (or Operative Vaginal Delivery) within 4 minutes of cardiac arrest. Do not move patient to perform.
6. Record keeping should be meticulous ensuring that team member arrival, treatment given and timings are clearly identified.
7. When calling "2222" ensure that "**Maternal** Cardiac Arrest Team" is requested and location of incident identified. Ensure access to Maternity Services Buildings for the arrest team, especially out of hours.
8. Senior obstetric, anaesthetic and neonatal staff should be involved as early as possible

Background

Cardiac arrest in pregnancy is thought to occur in approximately 1:36 000 maternities². Maternal survival is around 60%; arrest as an inpatient has better survival data than those occurring in the

outpatient setting². Maternal mortality is associated with cardiac arrest occurring at home, being moved prior to perimortem section, and a longer time between collapse and delivery². 71% of infants delivered perimortem survive² but it is performed to restore circulation to mother and improve her outcome rather than the fetus³.

Possible Causes of Cardiac Arrest

All causes of cardiac arrest that occur in the non-obstetric population may also occur in the pregnant woman. However, there are a few additional causes and some different physiological requirements in pregnancy that need consideration during the resuscitation attempt. Cardiac pathology remains the most common cause of maternal death⁴. However, 25% of cardiac arrests in the pregnant woman occur secondary to anaesthesia².

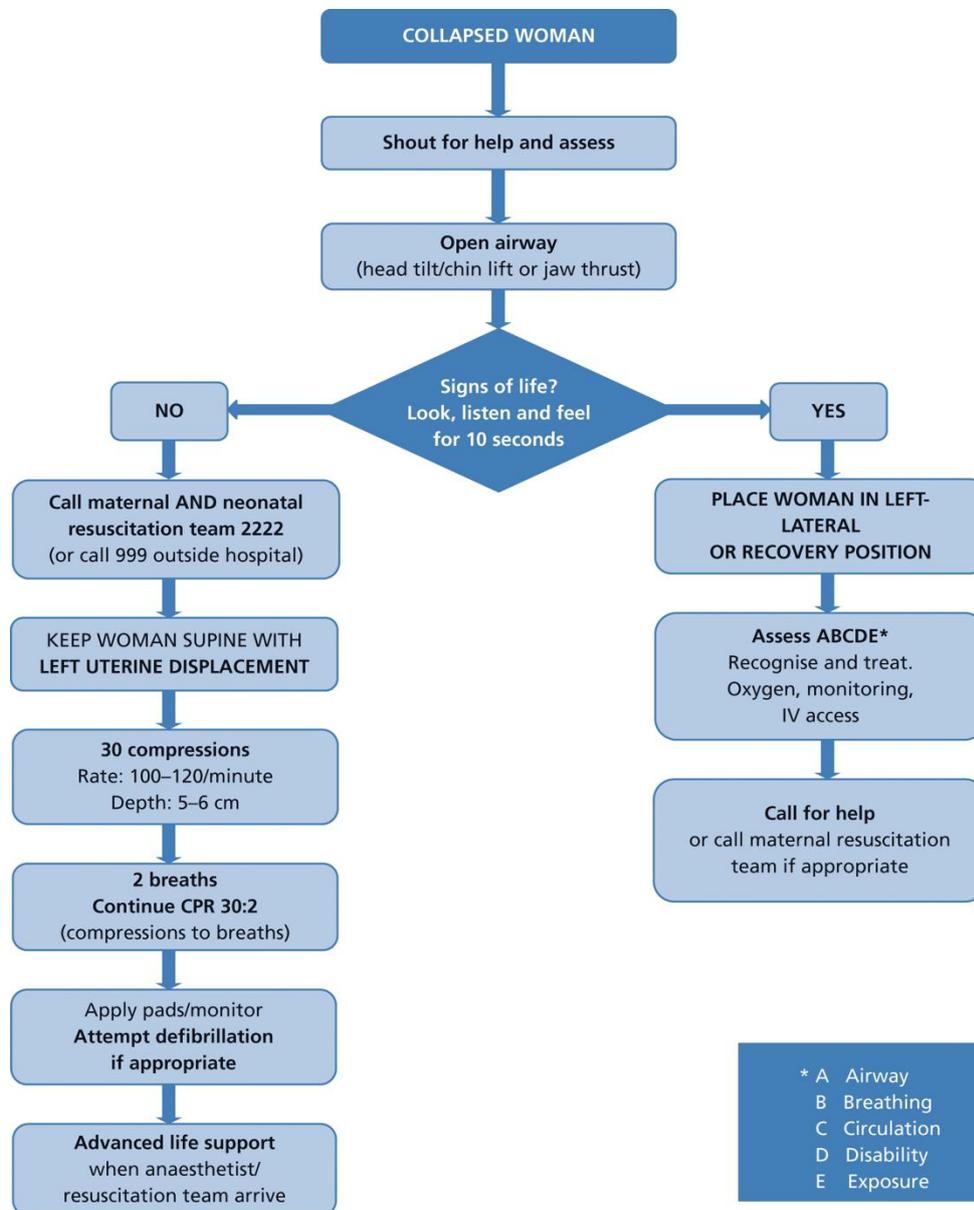
4 "H's" (Table based upon from Resuscitation Council (UK) Guidelines and PROMPT material ^{1,3})	
Hypoxia	Anaphylaxis Failed/difficult intubation Pulmonary Oedema Pulmonary Embolism Pulmonary Aspiration Seizures (Eclamptic/Non-eclamptic) Sepsis
Hypovolaemia	Anaphylaxis Aortic Dissection Massive Haemorrhage (splenic, hepatic, uterine, trauma) Septic Shock Total spinal Neurogenic shock
Hyper/hypokalaemia/calcaemia/magnesaemia (Metabolic)	Eclampsia/HELLP Syndrome Amniotic Fluid Embolism Hypo/Hyperglycaemia Magnesium Toxicity Nifedipine overdose (hypocalcaemia)
Hypothermia	Trauma Exposure during transfer Drowning
4 "T's"	
Thromboembolism/Embolism	Myocardial Infarction Pulmonary Embolism Cerebrovascular Event Air embolism
Toxins	Anaphylaxis High Spinal Block Local Anaesthetic Toxicity Magnesium Toxicity Suicide
Tension Pneumothorax	Trauma
Tamponade	Aortic Dissection Peripartum Cardiomyopathy Trauma

Recognition of Cardiac Arrest

Maternal collapse is where severe respiratory or circulatory distress leads to a sudden change in level of consciousness or cardiac arrest if left untreated, during any stage of the pregnancy and up to 6 weeks post-partum⁵. Any woman who is unresponsive and with abnormal breathing, should be treated as a cardiac arrest. The Maternal cardiac arrest team should be summoned immediately

(2222) and basic life support (BLS) commenced according to the BLS algorithm below. The Maternal cardiac arrest team may also be summoned prior to cardiac arrest i.e. for maternal collapse or peri-arrest patient³.

BLS Algorithm (PROMPT) based on Resuscitation Council (UK) Guidelines³



Any precipitating causes of arrest should be treated whilst following the BLS/ALS algorithm.

Maternal Cardiac Arrest Team Members

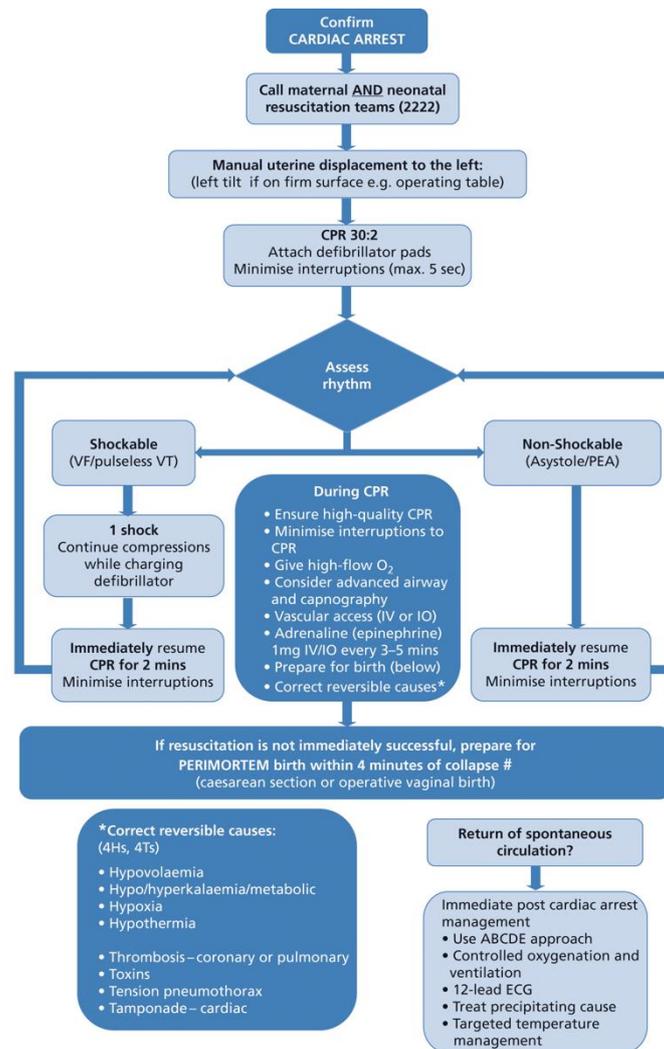
The following personnel will receive the Maternal Cardiac Arrest emergency alert

- Senior coordinating midwife
- Senior resident obstetrician (ST3-7)
- Senior resident anaesthetist (ST3-7) with obstetric experience
- Obstetric Anaesthetic Resident
- ODP

- Adult cardiac arrest team (Medical registrar, ICU resident, Clinical site manager)
- Neonatal Resuscitation Team

The cardiac arrest trolley must be brought to the site of the arrest and all team members are responsible for knowing the site of their nearest trolley for their work place. Advanced life support ALS should commence according to the algorithm as soon as additional team members arrive.

ALS Algorithm (PROMPT) based on Resuscitation Council (UK) guidelines¹



UKOSS 2017: Recent evidence suggests that shorter collapse-to-birth intervals are associated with better outcomes

Additional treatment information for specific causes of Maternal Cardiac Arrest can be found in the following clinical guidelines

- Anaphylaxis
- Local Anaesthetic Toxicity
- High Spinal Block/Total Spinal
- PET/Eclampsia including Magnesium Toxicity
- Amniotic Fluid Embolism
- General anaesthesia in obstetric anaesthesia
- Massive Obstetric Haemorrhage

ALS Algorithm additional information¹

Defibrillation energy levels are the same for the pregnant patient as well as the non-pregnant patient.

Drugs: there is no alteration in drugs or doses

Left Uterine Displacement: In late pregnancy the uterus receives 10% cardiac output. When the pregnant patient lies supine, compression of the aorta and inferior vena cava by the uterus decreases cardiac output by 25-30%^{6,7,8}. **The uterus must be displaced to the left in order to reduce aortocaval compression** during resuscitation. This can be achieved by **manually** moving the uterus to the **left**. *A wedge of pillows under the right hip **should not** be used as this compromises effective chest compressions.* Left tilt may be employed if the woman is on an operating table¹.

Early Tracheal Intubation: Is always indicated due to the high risk of aspiration of gastric contents in the pregnant woman. Intubation will also assist with the ventilation required to meet the high oxygen demands and physical restriction to ventilation in later pregnancy. Early intubation may be difficult due to position, airway oedema, other patient factors and aspiration⁵. Equipment for intubation should be immediately available on the cardiac arrest trolley in maternity areas. Equipment for difficult intubation should be easily accessible within maternity areas⁵. *However, attempts at intubation should not override oxygen delivery.* A two-handed technique of bag-mask ventilation with 100% oxygen is preferred whilst awaiting early tracheal intubation^{6,7,8}.

Perimortem Caesarean Section/Operative Vaginal Delivery (if 2nd Stage)

Successful resuscitation from cardiac arrest is unlikely to be successful without delivery of the baby^{2,10}. This is due to the combination of aorto-caval compression and cardiac output demands of the pregnant uterus. Perimortem Caesarean Section should be initiated as soon as initial resuscitative measures are unsuccessful ie within 4 minutes of cardiac arrest in order that cardiac output may be re-established within 5 minutes^{5,9,10}. Do not move patient to deliver fetus. **The operator should use the incision technique which will facilitate most rapid access**³. Although the classical approach provides the quickest access the operator may be more familiar with a low incision which as a consequence becomes the most rapid mode of delivery. A Perimortem Caesarean Section kit should be easily accessible on the Cardiac Arrest Trolley. The kit should consist of a fixed blade, two clamps and surgical packs such that transfer to theatre is not necessary until after the baby is delivered³.

Out of hospital cardiac arrest: In cases of cardiac arrest outside of the main hospital setting e.g. home or midwife-only led units, staff should commence CPR, displace the uterus to the left and rapidly transfer the patient into the hospital via the emergency services. Ideally, a prealert to the maternal cardiac arrest team should be placed so that perimortem caesarean section/operative vaginal delivery occurs as soon as possible after arrival.

Massive Haemorrhage and Neonatal Team: A Code Red Massive Obstetric Haemorrhage call should be activated at the time of decision to proceed to fetal delivery. The uterus is likely to be atonic and

return of spontaneous circulation may precipitate abnormal coagulopathy from major haemorrhage⁵.

Further Care

Relatives should be kept fully informed of events by senior staff. One member of staff should become a relative liaison to explain events and liaise between family and 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 clinical director should be informed. Refer to “Maternal Death” guidelines for further information. Leave lines, endotracheal tubes and other invasive medical devices in situ until advice from the coroner sought.

Staff Debrief

All staff involved in a maternal cardiac arrest should be involved in a formal debrief. This can be in the form of a ‘hot’ and then later ‘cold’ debrief. This should be organised by senior midwifery and medical staff. Further support through counselling should be offered.

The family should also receive a debrief at an appropriate time⁵.

Governance

All cases of maternal cardiac arrest will be reported to the following governance bodies

- Risk Manager for Woman and Child Health
- DATIX form
- MBRRACE (If resuscitation unsuccessful)

Cases will be investigated and learning, recommendations or action plans will be cascaded to all staff groups by all relevant professional groups (obstetric, midwifery, and anaesthetic). Assurance of implementation of the audit action plan will be undertaken by the Directorate Clinical Risk manager.

References

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4. Knight M, Nair M, Tuffnell D, Shakespeare J, Kenyon S, Kurinczuk JJ (Eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care: Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2013-2015. Oxford: National Perinatal Epidemiology Unit, University of Oxford 2017.
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9. Katz V, Balderston K, DeFreest M. Perimortem caesarean delivery: Were our assumptions correct? *Am J Obs & Gyne* 2005; **192**: 1916-21.
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