



### CSOP 027 – Resuscitative Hysterotomy

Version No: 2.1

Effective date 24/04/2024

#### **APPROVALS**

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Next Review Date:	April 2026		

#### **HISTORY**

Effective Date	Version No.	Summary of Amendment
March 2017	1.0	Creation of Document
March 2020	1.1	2 further references, nos 4 and 5. Additional section on “general points” page 4
October 2021	2.0	Full rewrite with new literature review, addition of general points, more detail on indications and management, review by Obstetric Consultant.
February 2024	2.1	Latest MBRRACE-UK data, BAPM guidance, RH when unsurvivable maternal condition, no cut off time, preparation for RH section, offline post RH, review by ambulance service maternity leads.



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#### REFERENCES

Document Reference Number	Document Title
1	Chu JJ, Johnston TA, Geoghegan J, on behalf of Royal College of Obstetricians & Gynaecologists. Maternal collapse in pregnancy and the puerperium. Green-top guideline no. 56. BJOG 2020;127:e14-e52. <a href="https://obgyn.onlinelibrary.wiley.com/doi/epdf/10.1111/1471-0528.15995">https://obgyn.onlinelibrary.wiley.com/doi/epdf/10.1111/1471-0528.15995</a>
2	ERC Guidelines 2021: Cardiac arrest in special circumstances. Resuscitation 2021;152-219. <a href="https://www.resuscitationjournal.com/article/S0300-9572(21)00064-2/fulltext">https://www.resuscitationjournal.com/article/S0300-9572(21)00064-2/fulltext</a>
3	Resuscitation Council/Obstetric Anaesthetist's Association. Obstetric cardiac arrest <a href="https://www.resus.org.uk/sites/default/files/2021-08/Maternal%20Cardiac%20Arrest%20QRH%20OAA%20V1.1.pdf">https://www.resus.org.uk/sites/default/files/2021-08/Maternal%20Cardiac%20Arrest%20QRH%20OAA%20V1.1.pdf</a>
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8	Beckett VA, Knight M, Sharpe P. The CAPS study: incidence, management and outcomes of cardiac arrest in pregnancy in the UK: a prospective, descriptive study. BJOG 2017;124:1374-1381.
9	MBRRACE-UK. Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2019-2021 <a href="https://www.npeu.ox.ac.uk/assets/downloads/mbrance-uk/reports/maternal-report-2023/MBRRACE-UK_Maternal_Compiled_Report_2023.pdf">https://www.npeu.ox.ac.uk/assets/downloads/mbrance-uk/reports/maternal-report-2023/MBRRACE-UK_Maternal_Compiled_Report_2023.pdf</a>
10	MBRRACE-UK Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity data brief 2020-2022. <a href="https://www.npeu.ox.ac.uk/mbrance-uk/data-brief/maternal-mortality-2020-2022">https://www.npeu.ox.ac.uk/mbrance-uk/data-brief/maternal-mortality-2020-2022</a>
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13	Lopez-Zeno JA, Carlo WA, O'Grady JP, Fanaroff AA. Infant survival following delayed postmortem cesarean delivery. Obstet Gynecol. 1990 Nov;76(5 Pt 2):991-2. PMID: 2216275.

#### Definitions/Acronyms:

Abbreviations/Acronym	Definitions
RH	Resuscitative hysterotomy (perimortem caesarean section)
ROSC	Return of spontaneous circulation
CCP	Critical Care Paramedic
ED	Emergency Department
CPR	Cardio Pulmonary Resuscitation
MTC	Major Trauma Centre



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### 1. Purpose

The purpose of this SOP is to outline the decision-making process and technique for undertaking a Resuscitative Hysterotomy (RH) and to highlight differences in cardiac arrest management in pregnancy. This SOP should be read in conjunction with supporting literature (see references).

### 2. Scope

RH should be considered in cardiac arrest in pregnancy >20 weeks or (in multiple pregnancy or when gestation is unknown when the fundus of the uterus is palpable at/above the level of umbilicus) AND when basic and/or advanced life support does not result in early return of spontaneous circulation (ROSC).

The primary aim of RH is to optimise maternal resuscitation by removing aorto-caval compression, improving the effectiveness of CPR and cardiac output.

The 2020-22 MBRRACE-UK report documented the most common causes of maternal death as thrombosis and thromboembolism, COVID-19, cardiac disease, and neurological conditions.

#### Indications for RH

To be performed when:

- Gestation assessed to be >20 weeks (i.e. uterus palpable at or above umbilicus)
- Ongoing resuscitation/CPR
- The rhythm has been assessed and a shock provided if indicated
- BLS/ALS has not resulted in ROSC after 4 minutes of cardiac arrest
- HEMS Doctor on scene - double CCP crews should instigate rapid transport to the nearest appropriate receiving hospital.

The Royal College of Obstetricians and Gynaecologists (UK) recommend that if there is no response to correctly performed CPR within 4 minutes of maternal collapse, or if resuscitation is continued beyond this, then RH should be undertaken to assist maternal resuscitation. Ideally delivery should be achieved within 5 minutes of arrest.

The literature does not support a maximum duration of resuscitation prior to RH and clinicians will need to decide this on a case-by-case basis. With increasing time in cardiac arrest, the chances of survival decline for both mother and baby. The fetus physiologically tolerates hypoxia in utero and



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during labour and birth so will often have a more favourable outcome than the mother. There is weak data around neurologically intact survival after out of hospital cardiac arrest and timing to RH and this mainly consists of case reports or case series. In the UK, neurologically intact survivors have been reported after out of hospital cardiac arrest up to 15 minutes before RH in the mother and up to 36 minutes before delivery in the baby. International case reports describe maternal survivors with normal neurological status up to 29 minutes (ref 12) and newborn survivors with normal neurological status up to 47 minutes (ref 13) between presumed onset of OHCA and RH. Further research is being undertaken to establish more robust guidelines in the future.

Prehospital clinicians should consider not only duration of cardiac arrest, but also gestation (more gravid uterus causes greater aortocaval compression and more likely to benefit from RH), whether the likely cause of arrest is reversible, and whether there is a strong chain of survival eg the arrest was witnessed, effective bystander CPR has been provided, a shockable rhythm or PEA on presentation etc.

In rare cases, where the pregnant patient has an unsurvivable injury/condition and is in the third trimester of pregnancy but has had an intact chain of survival, RH may be considered for the survival of the unborn baby. RH is contraindicated for reasons of newborn survival in babies of extreme preterm gestation (below 24 weeks) where survival is unlikely.

### *Assessing fundal height*

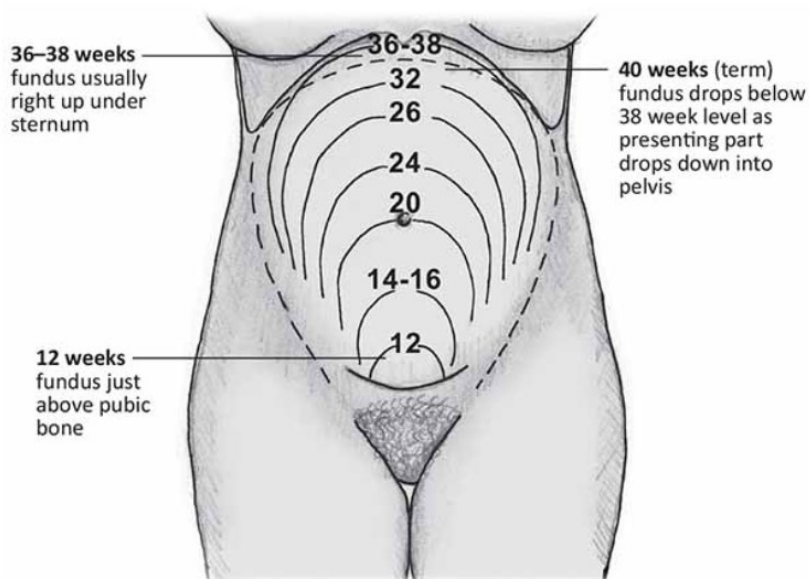
Fundal height can be used to estimate the gestation in an unconscious woman. At 12-14 weeks the uterus becomes palpable out of the pelvis in the lower abdomen; at 20-22 weeks the fundus (i.e. the 'top') of the uterus is at the level of the umbilicus; and by 38 weeks the uterus reaches the costal margin. Palpating with a cupped hand and feeling for a mass in a circular motion is advised. In women with increased Body Mass Index, extra pressure into the abdomen will be required to palpate fundal height.



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Fundal height diagram from [https://www.stepwards.com/?page\\_id=10721](https://www.stepwards.com/?page_id=10721)

In multiple pregnancies, the fundus may be higher. If the fundus is at or above the umbilicus, RH should be considered to improve the likelihood of the resuscitation being successful.

If the fundal height is below the umbilicus, there are no obstetric interventions that will improve outcome for either the mother or baby. RH should not be performed in these patients. The patient should be managed as a standard medical or traumatic cardiac arrest.

### Maternal anatomy/physiology and changes to resuscitation

The standard algorithm for adult life support should be followed for pregnant patients including drug doses and defibrillation. In addition, if gestation is 20+ weeks or the uterus is palpable at or above the level of the umbilicus then manual displacement of the uterus must be performed to offset the negative impact of aorto-caval compression and allow effective chest compressions in the supine position. This requires a single practitioner to push or pull the uterus across to the left with one or two hands. Other techniques are unlikely to be effective so are not recommended: tilting the patient will reduce the efficacy of chest compressions and placing items under the right hip may not provide sufficient left lateral tilt of the uterus. Relief of aortocaval compression must be maintained continuously throughout resuscitative efforts including if ROSC is achieved before the uterus is emptied.



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Image from Jeejeebhoy, Farida & Morrison, Laurie. (2013). Maternal Cardiac Arrest: A Practical and Comprehensive Review. Emergency medicine international. 2013. 274814. 10.1155/2013/274814.

**From the patient's right side:** Using a 1 handed technique to push the uterus upwards and leftwards off the maternal vessels (Figure A)

**From the patients left side:** Using a two-handed technique, cup and lift the uterus leftwards and upwards off the main vessel (Figure B)

The LUCAS2/3 mechanical CPR device is licensed for use in pregnant patients. Care must be taken to position the cup correctly on the sternum. Placement is likely to be difficult if the fundus is above the umbilicus. The patient will need to be supine with manual displacement of the gravid uterus to the left side. Mechanical CPR may be a useful adjunct after the RH procedure.

### Airway

- There is an increased risk of regurgitation and aspiration due to relaxation of the oesophageal sphincter by pregnancy hormones, delayed gastric emptying and increased intragastric pressure from the pregnant uterus. Early intubation with a cuffed endotracheal tube is preferred over a supraglottic airway device, with early decompression of the stomach by an orogastric tube.
- Intubation may be more difficult due to soft tissue oedema and the use of a smaller diameter endotracheal tube should be considered.
- Rapid desaturation may occur during intubation attempts due to a reduced functional residual capacity. Ensure adequate pre-oxygenation and consider nasal apnoeic oxygenation.
- In patients with hypovolaemia, PHEA with drugs should be avoided until volume replacement has been established.
- If surgical cricothyroidotomy is indicated, a vertical incision may be necessary if landmarks cannot be palpated.



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### Breathing

- Hypoxia is more likely in pregnant women due to increased oxygen consumption and reduced functional residual capacity. High flow oxygen must be administered to all pregnant patients who are unwell.
- The diaphragm rises by up to 4cm as the uterus enlarges. Thoracostomy and chest drain insertion should be performed high (in the 3<sup>rd</sup> or 4<sup>th</sup> intercostal space) to reduce the risk of abdominal or diaphragmatic mispositioning.

### Circulation

- After 20 weeks (fundal height at level of umbilicus) the pregnant uterus will compress the aorta and inferior vena cava in a supine position, which leads to a reduction in venous return and therefore cardiac output. This can be prevented by laying the patient in the left lateral position (akin to the recovery position). If spinal immobilization is essential, then the scoop stretcher should be used with a left lateral tilt of 15 degrees by inserting blankets/firm support underneath the right side of the scoop. However, in cardiac arrest when chest compressions are necessary, the preferred technique is the supine position with manual displacement of the uterus ideally to the left (using a member of staff to push or pull the uterus across with their hands).
- Blood may be shunted from the uterine and placental circulation into the maternal circulation to compensate for maternal hypovolaemia to the detriment of the fetus. Significant haemorrhage (>1.5 litres) may occur before signs of hypovolaemia become evident. Tachycardia and low normal blood pressures should raise suspicion for hypovolaemia and the need for fluid resuscitation.
- The uterine circulation is entirely dependent on the maternal blood pressure so a target systolic blood pressure of at least 90mmHg must be maintained by fluid resuscitation.
- There is significantly increased vascularity of the pelvis which means pelvic fractures may easily cause life-threatening blood loss. Pregnant patients with a suspected unstable pelvic fracture should have a pelvic binder applied as per standard management.
- If intraosseous access is required, the humeral site (above the diaphragm) should be used rather than the tibia. Avoid femoral trauma lines due to compression by the gravid uterus.





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### 3. Cardiac arrest management

#### Medical cardiac arrest

- Confirm cardiac arrest
- Lie patient flat and apply manual displacement of uterus to the left
- Commence CPR
- Apply defibrillation pads and assess cardiac rhythm. – defibrillate if shockable rhythm with standard energy levels and pad placement.
- Maintain airway and ventilation with 100% oxygen
- IV access above the diaphragm, and drugs as per ALS
- Consider and treat all reversible causes. Give an early bolus of crystalloid.
- If known >20 weeks pregnancy or uterus palpable at/above umbilicus start RH after 4 minutes of witnessed cardiac arrest if no return of spontaneous circulation. This should occur even if all reversible causes have not yet been excluded and regardless of the underlying rhythm.
- If the patient has been in prolonged prehospital arrest before the arrival of the critical care team and ALS has already been established by the ambulance crew then RH may need to be performed without further delay.

#### Traumatic cardiac arrest

- Confirm cardiac arrest
- Lie patient flat and apply manual displacement of uterus to the left
- Commence CPR
- Apply defibrillation pads and assess cardiac rhythm. – defibrillate if shockable rhythm
- Intubation and ventilation with 100% oxygen
- Consider bilateral thoracostomies in 3rd/4th ICS
- Splint long bone fractures/pelvis and provide external haemorrhage control
- IV access above the diaphragm and fluid resuscitation
- Perform resuscitative thoracotomy if indicated (first procedure)
- If known >20 weeks pregnancy or uterus palpable at/above umbilicus start RH after 4 minutes of witnessed cardiac arrest if no return of spontaneous circulation.
- If the patient has been in prolonged prehospital arrest before the arrival of the critical care team and ALS has already been established by the ambulance crew then RH may need to be performed without further delay.



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### Preparation for RH

Consider the requirement for early mobilisation of additional critical care resources. Identify a lead clinician for the mother and a lead clinician for the baby/babies.

Preparation for RH requires briefing the team and family, ensuring bystanders are removed for the distressing surgical procedure, minimising contamination of scene where possible (eg using incopads to collect blood) and having equipment ready.

Maternal resuscitation must be ongoing during the procedure and a separate team should be prepared with neonatal life support equipment. The NLS location should ideally be on a firm flat surface off the floor to optimise thermoregulation and in a slightly removed location, eg another room, to avoid distraction of each team. Family members should be able to access the room where Newborn Life Support is taking place if they wish to.

### Technique for RH

1. Use a scalpel to make a midline vertical incision from umbilicus to symphysis pubis through skin, subcutaneous fat, the linea alba between the rectus abdominus muscles, and then parietal peritoneum into the abdominal cavity. Aim to incise the parietal peritoneum as high as possible (i.e. as near to the umbilicus as possible) in order to avoid the bladder.
2. Note the bladder which lies over the lower segment of the uterus. Make a vertical incision in the upper segment of the uterus with a scalpel (i.e. in the midline at the front of the uterus). The uterine wall in the upper segment will be 2-4 cm thick. Insert gloved fingers to protect the baby and extend the incision upwards & downwards as necessary with scissors. Try to avoid injury to the fundus of the bladder, which can reach the upper margin of the lower segment. If the placenta is in the way, cut through it. Once most of the muscle fibres have been cut, it can be helpful to stretch the uterine incision with the fingers to provide a wide, open access point.
3. Take care to avoid cuts to the baby if possible. Locate a presenting part of the baby (head, bottom, or foot) and lift out of the uterus. Avoid delivering an arm first. Use fundal pressure to aid delivery. Avoid compressing the fetal abdomen during delivery.
4. Clamp the cord twice at 15cm (using umbilical cord clamps from maternity pack or Spencer Wells forceps) and cut immediately between the two clamps with paramedic shears.
5. Pass the baby to a member of the team for NLS resuscitation.
6. Apply direct pressure to the edges of the uterine incision if there is any bleeding.
7. Have one attempt to remove the placenta by gentle controlled traction on the cord combined with fundal pressure. Rotate placenta as it delivers so the membranes form a 'rope' to aid removal. Wipe any remaining membranes out of the uterus with a swab. If the



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placenta does not deliver after one attempt, then it should be left in-situ and the uterus packed with swabs. If the placenta is removed, keep in a clinical waste bag.

8. Pack the open abdomen with large gauze swabs/haemostatic gauze.
9. Continue maternal resuscitation.
10. Catastrophic bleeding post-delivery is unlikely in patients who are in cardiac arrest but it is useful to monitor the wound and for any external vaginal loss. Uterotonics should not be routinely administered to the patient who is in cardiac arrest. Tranexamic acid and uterotonics (carried by ambulance service) should be administered if significant maternal haemorrhage occurs after delivery. PHEA will be required if sustained ROSC occurs. Obstetric haemorrhage is normally treated with packed red blood cells in preference to fresh frozen plasma.

Once the baby is delivered, simultaneous resuscitation of both mother and baby must occur. The baby should be handed to a second clinician/team who is trained to begin newborn resuscitation.

The mother and baby should be triaged to the nearest emergency department able to effectively treat both obstetric emergencies and neonates. Where the arrest is the result of trauma, transportation to a MTC with these facilities is required.

ROLE on scene may be appropriate if all reversible causes have been managed. In this situation the following procedure should be followed:

- deceased mother is to be transported directly to the local mortuary by ambulance (unless instructed otherwise by the police e.g homicide) with appropriate ROLE documentation.
- The abdomen may be closed temporarily using cling film or sutures as required (to contain abdominal contents).

### 4 Post incident debrief

This type of incident is likely to be one of the most stressful incidents attended by pre-hospital teams. A number of organisations investigate maternal deaths including Her Majesty's Coroner, the Maternity and Neonatal Safety Investigation Programme (MNSI), and MBRRACE-UK.

Take time to debrief those on scene/at hospital in accordance with usual practice and use the opportunity to consider if any of the ambulance staff or TAAS personnel need to be signposted towards additional support. Crews should stay offline to debrief and ensure completion of



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documentation (including TAASbase entry with print out from defibrillator/monitor, surgical skills form) before continuing their clinical shift. In hours the on-call clinical supervisor should be contacted if this has not already been done.

The following reporting systems must also be used:

- The incident should be reported via the TAAS incident reporting system.
- An ambulance service safeguarding referral must be completed for the baby and any existing children.
- The Consultant Midwife EMAS or Maternity Lead WMAS should be contacted via email, by the relevant base manager, as soon as possible after the event to support staff welfare, initiate a patient safety review, ongoing internal / external investigations (e.g MNSI) and liaison with the acute maternity services.

### 5. Procedure without pregnancy

It has been noted historically that RH has been performed in some cases due to a misdiagnosis of pregnancy in cardiac arrest when the patient had fibroids or ascites. If a pregnancy is not found after opening the abdomen, resuscitation should continue, and the case should be reported for incident investigation.

### 6. Contacts

Contacts available on External clinical contacts list on Sharepoint.

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