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ERASMUS+ PROGRAMME - COOPERATION PARTNERSHIPS IN VOCATIONAL EDUCATION AND TRAINING - KA220 - COOPERATION PARTNERSHIPS

ROUTINE PROJECT

MATERNAL COLLAPSE

E-learning

MUNI MED
MEDIZINISCHE UNIVERSITÄT WIEN
TECHNISCHE UNIVERSITÄT DRESDEN
UKC MARIBOR

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Authors: Masaryk University, Medical University of Vienna, University Medical Centre Maribor, Dresden University of Technology,

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Introduction

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 at any stage in pregnancy and up to 6 weeks after birth. [1] It is a life-threatening event and it has wide range of causes. [1; 2]
True incidence of maternal collapse is unknown [1;3] To put this into perspective, according to the British CAPS study the incidence could be 2.78 per 100 000 maternities and mortality rate 42%.[2]

Potentional causes of obstetric cardiac arrest “4 H´s and 4 T´s”

Maternal collapse causes may be or may not be pregnancy related. [1] Complications of anaesthesia caused almost 25 % of cardiac arrest in prospectvie british CAPS study. [2] Amnionic fluid embolism is rare, but dreaded complication of pregnancy. In the USA amnionic fluid embolism is assumed as leading cause of peripartum cardiac arrest. [7]
Major peripartal haemorrhage is also one of leading cause of maternal collapse and remains the leading cause of maternal death in the world. It is followed by indirect causes of deaths and then by hypertensive disorders. [1;2;7]

4 H´s		**4 T´s**	
Hypoxia	Pulmonary embolism Eclampsia Failed intubation/aspiration Anaphylaxis Heart failure	Tamponade	Aortic dissection Cardiomyopathy
Hypovoleamia	Haemorrhage Sepsis Anaphylaxis High regional block Aneurysm rupture Arrythymia Splenic/hepatic rupture Spont.rupture of uterus?	Thrombosis	Amnionic fluid embolism Pulmonary embolism Air embolism Myocardial infarction
Hypo/hyperkalemia	hypoglycaemia hypermagnesemia	Toxins	Local anestethics Magnesium Illicit drugs
Hypothermia		Tension pneumothorax	

Figure 1. Causes of maternal collapse from Green-top Guideline No. 56. BJOG [1]

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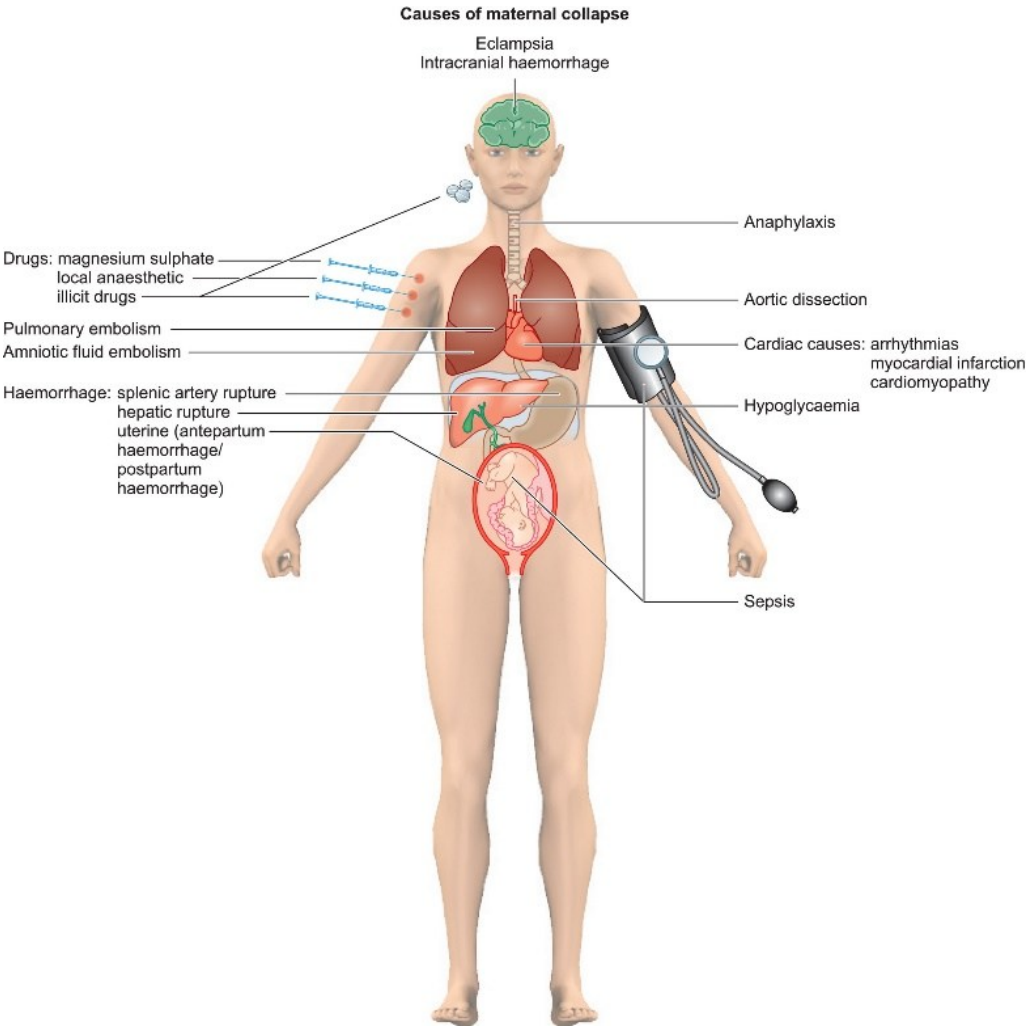

Prevention of cardiac arrest in the deteriorating patient from ERCG 2021[5]

- Use a validated obstetric early warning scoring system when caring for the ill-pregnant patient
- Use a systematic ABCDE approach to assess and treat the pregnant patient.
- Place the patient in the left lateral position or manually and gently displace the uterus to the left to relieve aortocaval compression.
- Give oxygen guided by pulse oximetry to correct hypoxaemia.
- Give a fluid bolus if there is hypotension or evidence of hypovolaemia.
- Immediately re-evaluate the need for any drugs being given.
- Seek expert help early _ obstetric, anaesthetic, critical care and neonatal specialists should be involved early in the resuscitation.
- Identify and treat the underlying cause of cardiac arrest, e.g. control of bleeding, sepsis.
- Give intravenous tranexamic acid 1 g IV for postpartum haemorrhage. (blood loss more than 500 ml)

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Key modifications to the algorithm of BLS/ALS required in pregnancy

- Relieving aortocaval compression
- Early intubation by a skilled operator
- Peri-mortem caesarean section

Relieving aortocaval compression

The gravid uterus reduced venous return and aortocaval compression significantly impairs CPR. That´s why manual displacement of uterus to the left is crucial if over 20 weeks pregnant or the uterus is palpable above the level of the umbilicus. [1;4]

Early intubation by a skilled operator

Prompt and effective airway management is critical to successful resuscitation. Intubation of trachea protects from aspiration of stomach contents and facilitates effective ventilation of mother.
It is also important to be aware of the higher risk of difficult intubation in obstetric patient. Therefore, intubation should be performed by the most experienced available operator. [1;3;4]

Peri-mortem caesarean section

- **Peri-mortem caesarean section should be performed to aid maternal resuscitation if no response to CRP within 4 min, aiming for delivery within 5 min of collapse**. [4]
- **Peri-mortem caesarean section should be performed on any patient over 20 weeks pregnant (or the uterus is palpable above the level of the umbilicus) if immediate (within 4 min) resuscitation is unsuccessful.** [4]

When timing emergency caesarean delivery during maternal cardiac arrest you should think of the fact that adults begin experiencing anoxic brain damage 4 to 6 min into a cardiac arrest. And that´s why the four minute rule is recommended. [1; 9;11]

Studies show that shorter arrest-to-delivery times are linked to better maternal-fetal outcomes. [9; 10;11] As Benson et al report in their review fetal and maternal outcome worsen stepwisely. There is no unique or discontinuous drop in survival at 4–5 min. [11] Both maternal and neonatal injury free survival rates diminished steadily as the time interval from maternal arrest to birth increased. Fetal survival rates are highest when delivered within 5 minutes postarrest, particularly at gestational ages beyond 24 to 25 weeks. [10;11]

Retrospective evaluation of cases of perimortem caesarean also shows, that aproximately 90% of deliveries during perimortem cesareans took longer than 1 min, so when decision to deliver is made, care providers should proceed directly to caesarean delivery during maternal cardiac arrest. [9;11]

- **Peri-mortem caesarean section should be performed where maternal collapse occurred with CPR continuing.** [1;4]

Time should not be wasted moving the patient or abdominal preparation. Antiseptic solution may be poured on the patient´s abdomen and **only equipment needed to start peri-mortem caesarean is scalpel**.

Resuscitative efforts should be continued during cesarean delivery including manual displacement of uterus. [1; 9;10]

- **The surgeon should use and abdominal incision to facilitate the most rapid access. [1]**

The vertical incision provides better visualization of the abdomen and pelvis and is considered to be faster. The choice of incision, whether vertical or Pfannenstiel, is left to the performing physician's discretion. And you should performed technique which you are the most comfortable with. [1; 9; 10]

- **Protocol for maternal cardiac arrest and pack with equipment for an emergency caesarean should be prepared according to instituional preferences and practise. At least presence of scalpel at resuscitation trolley is recommended in all areas where maternal collapse may occur.** [1; 4; 10]
- **In an intrapartum cardiac arrest obstetrician may conduct a vaginal examination and consider assisted vaginal delivery. [9]**

Obstetric caregivers involved in an intrapartum cardiac arrest resuscitation may conduct a vaginal examination, and if the cervix is found to be fully dilated and the fetal head is at an appropriately low station, immediate assisted vaginal delivery can be considered. [9]

Algorithm

1) Confirm cardiac arrest
2) Call for hellp (resuscitation team, obstetric team, neonate team)
3) Relieve aortocaval decompresion
4) Commence CPR according to standar ALS guideline and evaluate potentional causes (4 T´s and 4 H´s)
5) Note time, allocate roles
6) Maintain airway and ventilation (see below)
7) Circulation (see below)
8) Perform perimortem caesarean section (see above)

Obstetric cardiac arrest algorithm from UK Resuscitaion council avaible at:
https://www.resus.org.uk/sites/default/files/2021-08/Maternal%20Cardiac%20Arrest%20QRH%20OAA%20V1.1.pdf

Airway and Breathing (A & B):

There are many physilogical and anatomical changes during pregnancy which could affect airway and breathing managment:

- Lower gastro-oesophageal tone and delayed gastric emptying increased aspiration risk
- Weight gain, enlarged breasts and oedema of mucosa complicated tracheal intubation
- Functional residual capacitiy is decreased, but oxygen demand is increased and hypoxia develops quickly.

Implications for managment are:

- Manual displacement of the uterus to the left

- Ensure airway patency – head tilt, attempt to advance the lower jaw
- Provide high-flow oxygen (10-15l/min)
- Early intubation (see above)

Circulation (C):

There are changes during pregnancy leading to:

- increased cardiac output
- higher heart rate
- peripheal vasodilataion
- aortocaval compression in supine position decreses preload
- increased plasma volume.

Implications for managment are:

- Manual displacement of the uterus to the left
- Secure at least one IV access (above diaphragm) for medication administration
- CPR 30:2
- Assess rhythm (as soon as possible and then every 2 minutes)
    - if shockable 1 shock and immediately resume CPR
        - after third shock 300mg Amiodarone
    - if non-shockable resume CPR
- Give adrenaline every 3-5 min
- Think of reversible causes (see 4 H´s and T´s above)
- Perimortem caesarean section (see above)

Defibrilation and drugs (D)

- Defibrillation should be performed for a shockable rhythm with the same energy levels as for a non-pregnant patient
- Repeat adrenaline every 3-5 min
- After third shock 300 mg amiodarone, after fourth shock consider an additional 150 mg amiodarone
- 1 g of tranexamic acid in case of haemorrhage
- Calcium chloride 10% 10ml iv for hypermagnesemia, hypocalcemia or hyperkalemia

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