

Perimortem Cesarean Delivery (PMCD)

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Abstract: This review describe a simple approach to perimortem caesarean section (PMCS) that can be used by a doctor in the resuscitation room or pre hospital environment when faced with a mother of more than 20 weeks of gestation in cardiac arrest. It explores the indication and contraindication to the procedure, the physiological associated factors, equipments needed, protocol for sudden cardiac arrest, causes of maternal cardiac arrest , technical aspects of the procedure and reviews of recent literature on maternal and fetal outcomes. PMCS is essential to give both mother and baby the best chance of survival.

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I. Introduction

Perimortem caesarean delivery (PMCD) is a caesarean section done after the cardiac arrest of a mother. A resuscitative hysterotomy also referred to as a perimortem caesarean section (PMCS) or perimortem caesarean delivery (PMCD) , is a hysterotomy performed to resuscitate a women in middle to late pregnancy who has entered cardiac arrest combined with a laprotomy, the procedure results in a caesarean section that removes the fetus , thereby abolishing the aortocaval compression caused by the pregnant uterus . This improves the mother's chances of return of spontaneous circulation and May potentially also deliver a viable neonate.

Definition

A caesarean section performed either during maternal cardiac arrest or during impending maternal cardiac arrest the primary goal of which is to increase the chance of successfully resuscitating the mother and potentially , improving fetal survival.

History

The idea of PMCD is more than two thousand years old. According to greek mythology, Asklepios , the god of medicine and healing was delivered by his father Apollo from the womb of his dead mother Koronis . The term caesarean comes from the word "Caesar" a law in Roman period (715- 763 BC) according to which if pregnant woman died , the child must be brought out of her abdomen to allow woman and children to be buried separately on religious ritual grounds.

The credit of first maternal survival from a PMCD goes to Jacob who was a farmer in Switzerland and performed caesarean section is by Pliny the Elder, relating to the birth in 237 BC of Scripio Africanus, the Roman general who defeated Hannibal.

A series from Berlin in 1864 recorded just three infant survivals from 147 postmortem caesarean section.

A perimortem caesarean section (PMCS) could save her life, and the life of her baby, when performed in the right circumstances.

Primary goal of PMCD is to increase the chance of successfully resuscitating the mother and potentially improving fetal survival.

Incidence:

Maternal cardiac arrest is a rare event occurring in approximately 1 in 30000 pregnancies. Cardiac arrest and maternal death occurs in 50% to 60% cases. An analysis of causes of PMCD in UK, that was the confidential enquires into maternal deaths in UK (1970-1996), The most Common indication for PMCD were road traffic accidents and asphyxia due to inhaled vomits.

Purpose or perimortem C- Section (PMCS)

- Primary goal is improvement of maternal resuscitation
- PCS decreases the uterine compression on the IVC thus increasing venous return, resulting in improved maternal cardiac filling pressure.

- PCS also allows improved respiratory mechanics, as the diaphragm is lowered after the procedure.
- The primary purpose of a PMCS is to improve the chance of the mother's survival and this should remain the focus at all time.

Indication:

- No Return of spontaneous circulation (ROSC) after 4 mins of cardiac arrest.
- Unsuccessful chest compression.
- Obvious non survivable mother injury with viable fetus.

Contraindication

- ❖ Less than 4 min since maternal cardiac arrest (unless mother has known unsurvivable condition)
- ❖ ROSC achieved after initial resuscitation measures.
- ❖ Known gestation less than 20-24 weeks
- ❖ Prolonged time interval since arrest (eg: >15 min, as outcome is likely to be poor.)
- ❖ Fetal survival has been reported up to 30 min post maternal cardiac arrest.

Pregnancy associated specific condition with sudden cardiac arrest:

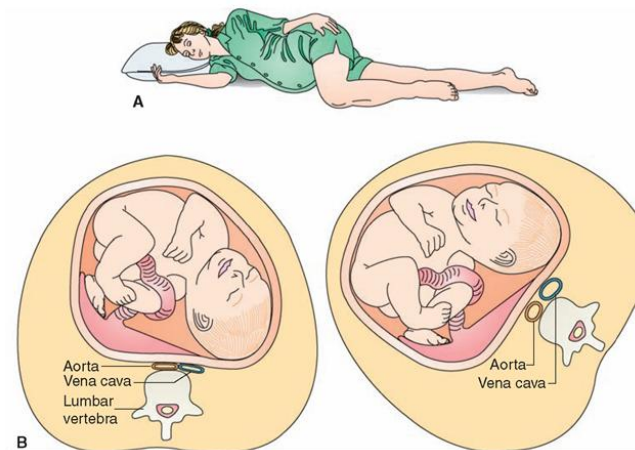
- Amniotic fluid embolism
- Maternal trauma , inflicted or accidental
- Gestational hypertensive disorder
- Sepsis
- Iatrogenis
- Pre existing heart disease
- Anesthetic accidents
- Massive APH

Physiological changes in late pregnancy

- ❖ Blood volume and cardiac output increase by 30-40% above the nonpregnant state by 28 weeks.
 - This hypervolemic state is protective for the mother, as fewer red cells are lost during hemorrhage.
 - Clinical signs of maternal shock manifest only after 40% of maternal blood volume is lost.
- ❖ Late pregnancy is very susceptible to hypotension from compression of the inferior vena cava (IVC) in the supine position by the enlarged uterus.
- ❖ The enlarged uterus causes elevation of the diaphragm by about 4 cm and results in a decrease in the functional residual capacity by about 20%.

Physiological considerations during maternal cardiac arrest

As a primary intervention, the uterus should be manually displaced to the patients left side after 20th week's gestation (where the top of the uterus is palpable at or above the umbilicus) and “**pulling has been shown to be better than pushing**”. The Resuscitation council (UK) now only recommends left lateral tilt of 15degree to 30 degree if the patient is on a dedicated tilting table. Delivery of the fetus and placenta improves venous return and cardiac output, facilitating closed chest compression, reducing oxygen consumption making ventilation easier and it can also allow internal cardiac massage by compression of the heart against the anterior chest wall.

Fig: 1 position of the mother**Maternal cardiac arrest**

The cause for maternal cardiac arrest may be related to pregnancy, or may be non-pregnancy related and may be,

- Traumatic
- Non-traumatic

1. Non-traumatic:

In non traumatic, advanced life support (ALS) guidelines should be followed 2–4 of the reversible causes of cardiac arrest,

- Thromboembolic,
- Hypoxic
- Hypovolaemic (haemorrhagic and septic) causes are most likely in the pregnant patient.
- Intracranial haemorrhage and obstetric causes such as eclampsia and amniotic fluid embolus also need to be considered.

2. Traumatic :

In traumatic cardiac arrests, the pathological mechanism is likely to differ from non-traumatic cardiac arrests, and treatment of the likely reversible causes should be initiated. This may include intubation and ventilation to reverse hypoxia, chest decompression to address possible tension pneumothorax, giving fluids (blood and blood products) to address hypovolaemia, and thoracotomy as indicated. If available, a traumatic cardiac arrest protocol should be followed.

Maternal advantages

PMCD can be considered as an important step in the resuscitation process of collapsed, near term pregnant women. It increases the efficiency of CPR which can be more perfectly done. It also relieves vena caval obstruction thus increasing the venous return to the heart. Mother receives 30% more blood after PMCD which was sequestered by utero placental circulation. **Timing of PMCD**

Sudden cardiac arrest is a rare and usually unexpected event in obstetric unit and PMCD is an extremely rare procedure. Immediate action is critical for both mother and baby. Intact maternal and infant survival is possible only with prompt action.

Maternal neurological injury commences 6 minutes after cessation of cerebral perfusion after cardiac arrest. If PMCD performed within 5 minutes, it helps in effective CPR attempts as well as remarkably improves the chances of intact neurologic maternal survival.

The baby should be delivered within next one minutes if alive and viable. The gestational age for fetal viability varies according to the resources available for neonatal resuscitation and the discretion of the delivering physician.

The ideal time interval between 4 and 5 minutes from the arrest to delivery has been advocated by the Katz et al and the American college of obstetrician and gynecologist.

How long after arrest do you have to perform a PCS?

- ❖ Perform a PCS as soon as possible after maternal cardiac arrest.
- ❖ After 4 minutes of maternal arrest there is a precipitous decline in fetal neurologic outcome and survival.

Despite decreased utility after 4 minutes for fetal survival, resuscitative hysterotomy will continue to hold benefits to the mother.

Personnel

Maternal cardiac arrest will require three teams and a team leader to co ordinate,

- Resuscitation team for mother
- Team performing caesarean section
- Resuscitation team for baby
- The ideal team would include an emergency physician , obstetrician, assistant, senior midwife, neonatologist or pediatrician and support nurse , anesthetist or critical care physician, airway nurse or operating department practitioner, drugs and monitoring nurse, intravenous access practitioner. An interventional radiologist may be involved subsequently to control postpartum bleeding.

Recommended equipments set for PMCS

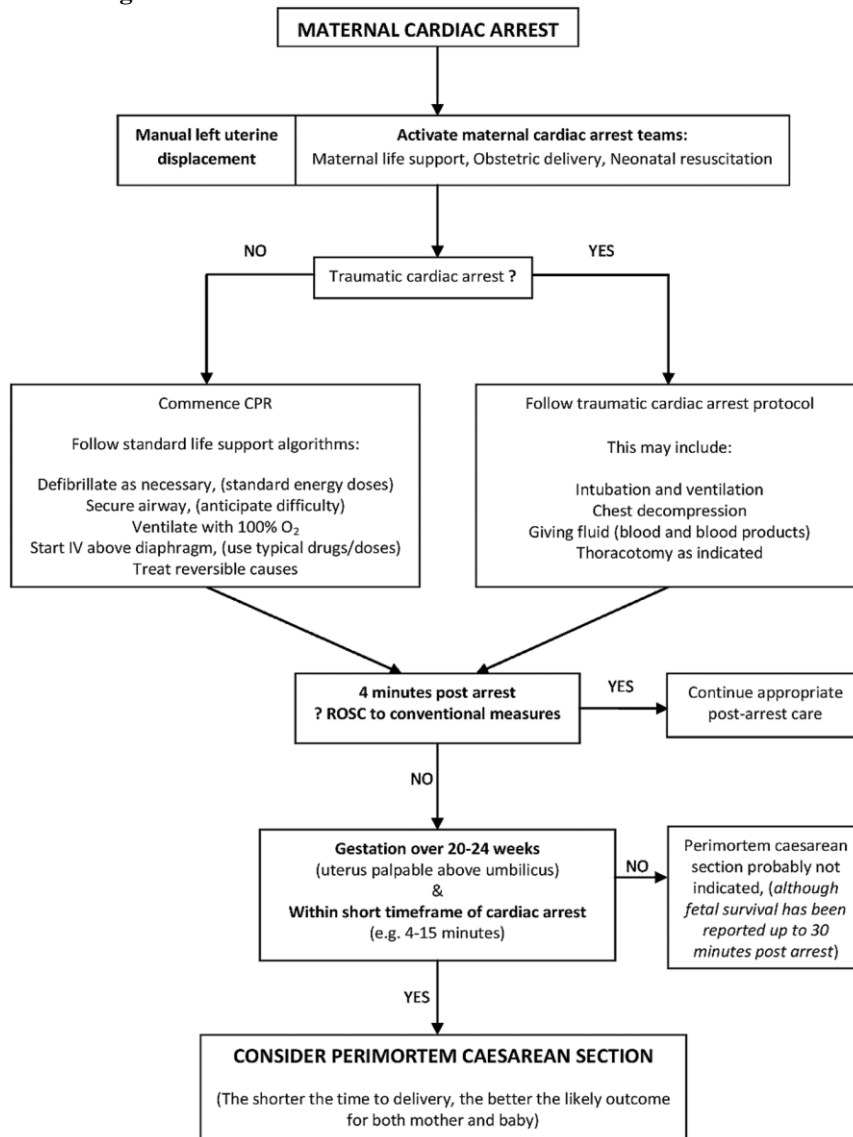
S.no	Set of Equipments	Articles
1.	Personal protective equipments	➤ Double gloves, face mask, apron or gown
2.	Caesarean section equipments	<ul style="list-style-type: none"> ➤ Scalpel- blunt ended to minimize injury to fetus ➤ Retractors – Assistant hands can retract if not available. ➤ Clamps /hemostats ➤ Gauze swabs ➤ Suction ➤ Large sutures – absorbable ➤ Needle holder ➤ Antiseptic solution and clean linen/incontinence pads.
3.	Neonatal resuscitation equipment	<ul style="list-style-type: none"> ➤ Dry linen, neonatal bag valve mask ➤ Baby warmer, neonatal airway supplies, appropriately sized suction, equipments for umbilical venous access, resuscitation drugs.

Procedure

- ❖ CPR measures should be taken immediately when the maternal cardiac arrest occurs.
- ❖ Delivery must be initiated after 4 minutes of arrest and fetus should be delivered within next 1 minutes. CPR should be continued throughout the procedure.
- ❖ It is desirable to obtain a written consent from the near relatives of the patients after explaining the advantages of PMCD. Delivery must be done in the quickest possible way and time must not be wasted.
- ❖ Preparing a sterile field or instrument tray or doing USG to confirm fetal heart movement.
- ❖ Low transverse incision in the uterus is preferable to minimize blood loss.
- ❖ Infants born by PMCD are likely to have respiratory and circulatory depression at birth; hence availability of trained staff for neonatal resuscitation is desirable.

❖ **Steps**

1. Assemble people and resources
2. Assemble supplies
3. Incising through the peritoneum
4. Entering the uterus
5. Extracting the infant
6. Resuscitate mother/repair damage
7. Resuscitate the infant.

Fig: 1 Protocol to follow in the event of maternal cardiac arrest**Take a home point**

- ❖ Think of PCS as a resuscitative hysterotomy primarily aimed at saving the life of the mother.
- ❖ If you think PCS will improve maternal resuscitation, act quickly to start and complete the procedure.
- ❖ The optimal surgical approach for a PCS is via a large vertical incision.

Legal and ethical consideration

The emergency physician has the legal right and responsibility to provide the unborn fetus with every possible chance of survival when there is no hope of maternal survival.

Enhancing health care team outcome

- ❖ Performing perimortem cesarean requires a great deal of clinical judgment and is best done with a multidisciplinary team that includes NICU and labor and delivery nurses.
- ❖ Outcomes and attitudes alike have changed as survival rates have increased and legal matters have shifted in favor of Good Samaritan involvement.

II. Conclusion

Perimortem cesarean section is an important procedure which can save the life of fetus as well as can improve the chance of maternal recovery. The optimal time for doing PMCD is between four and five minutes which gives best results in terms of intact maternal and neonatal survival. A decision for PMCD should be taken promptly in suitable cases without wasting time in preparation, fetus should be taken out with quickest possible

incision. CPR should be continued throughout the procedure. The staff members should have training and drilling for such occasional but unfortunate events.

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