Perimortem Cesarean Section

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SPECIAL CONTRIBUTION

THE CORE CONTENT OF EMERGENCY MEDICAL SERVICES MEDICINE

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2.5.0.1.1 Management of perimortem cesarean section.
3.5.2.1.1 Treatment of postpartum hemorrhage.
4.5.2.1.1 Perioperative care of maternal-fetal infections.

Harwood-Nuss’ Clinical Practice of Emergency Medicine

Roberts and Hedges Clinical Procedures in Emergency Medicine
Beginning with the end in mind...

1. We should be familiar with and ready to perform a perimortem cesarean section (PMCS)

2. PMCS is a recommended component of resuscitation for pregnant patients in cardiac arrest after 20-24 weeks gestation

3. PMCS is beneficial in saving the life of the baby and the mother
Background

THIS WASN’T INVENTED YESTERDAY...

Cesarean Section

Term based on the postmortem section

In human culture since ancient times
- Greek mythology
- Hindu, Egyptian, Roman and other European folklore
- Ancient Chinese etchings depict the procedure on apparently living women

715 BC – Roman king Numus Pomptius decreed:

No child should be buried within its mother

Later translated into the law of Caesar, leading to term cesarean section

Postmortem Section

Described widely in the middle ages to aid with baptism & burial
- Reinforced by royal and religious decrees

Later performed in an attempt to save the infant and mother
- 1800s – debate over pros and cons
- Reports of infants surviving
Maternal Causes of Death

PRE-MODERN TIMES
Sepsis
Dehydration
Hemorrhagic shock

MODERN TIMES
Trauma
Cardiac disease
Embolism

- Literature review of PMCS cases
  - 1879 to 1985
  - N=269; 188 infants (70%) survived
- Coined term: Perimortem Cesarean Section
- Most surviving infants delivered ≤5 min from maternal death
- All but one neurologically intact infant delivered within 15 min
- Recommended performance of PMCS within 4 min of maternal arrest, with delivery by 5 min, in any case of fetal viability
  “4-Minute Rule”

Follow-up review of 38 cases from 1985 to 2004
Supported original recommendations
Potential Benefits of PMCS

Great vessels compressed by uterus
- Reduces cardiac output by 2/3

Cardiopulmonary resuscitation
- Normally:
  - 1/3 normal cardiac output
- Pregnant mother:
  - 10% normal cardiac output

Emptying the uterus
- Compression of inferior vena cava
  - Venous return
  - Uterine blood flow redistributed to other organs → ↑ 25% cardiac output
- Functional residual capacity → ↑ oxygenation
  - Together, improves effectiveness of CPR and may lead to successful resuscitation of mother after delivery of the infant
12 cases of sudden improvement in mother’s condition when uterus emptied

Perimortem cesarean delivery: Were our assumptions correct?
Vera Katz, MD,*†, Keith Balsersee, MD,*† Melissa Delfree, MD*†

13 of 38 mothers discharged in good condition

Review of all maternal cardiac arrests in Netherlands, 1993-2008
8 of 12 mothers regained cardiac output after PMCS
  - Only 2 survived
  - None performed within 5 minutes – timing may have contributed

Review of 94 cases of PMCS
PMCS beneficial to mother in 32% of cases
No demonstrated harm in any case
PMCS in the Field

Case Conference

39 yo female, 39 wks, myocardial infarct
EM resident as Flight Physician
Assisted by a physician neighbor
Infant survived to 1 year
Mother did not survive

31 yo female, 37 weeks gestation
Motor vehicle collision into a building
EM Resident as Flight Physician
Neither mother nor infant survived
21 yo female, ? wk, motor vehicle collision
Flight Physician
Ultrasound:
- No maternal / positive fetal cardiac activity
CPR ongoing for 25 min
Neither mother nor infant survived

PMCS in the field by non-MD providers?
Outside nursing & paramedic scope of practice
Consider state & local regulations
Develop a policy and procedure
Even if MD on the scene, consider:
- Experience & training
- Transport distance to hospital

Indications for PMCS
When to Perform PMCS?

Widely supported within 4 to 5 minutes of maternal arrest beyond 20-24 weeks

Cardiac arrest in pregnancy and perinatal cesarean delivery: case report and discussion

Perinatal Course: Cases Reports and Recommendations

What do the guidelines say?

Determine fetal viability first?

Issues:
- Delay to time-dependent PMCS (potential benefit to baby and mother)
- Cases of good fetal neurological outcome in spite of no fetal heart tones
- Ultrasound / doppler difficult to perform with CPR
- Fetus may have periods of bradycardia
The “4-Minute Rule”

Challenging to apply unless maternal cardiac arrest is witnessed

In ED or field, may not have appropriate resources available in a timely manner

PMCS should still be considered beyond the first 5 minutes

- Multiple neurologically intact infants have survived after more than 25 minutes of maternal death

Education in PMCS

- Advanced Life Support in Obstetrics (ALSO)
- Managing Obstetric Emergencies and Trauma (MOET)
- Advances in Labour and Risk Management (ALARM)

MOET course in Netherlands

- Increase from 0.36 to 1.6 PMCS per year

Performing Perimortem Cesarean Section
Management of Maternal Cardiac Arrest

Begin CPR immediately
Manually displace uterus


Perimortem Cesarean Section

A simple procedure!

Can be performed with limited equipment

Once the decision to perform PMCS has been made, the operator should proceed without delay
Suggested Equipment List

<table>
<thead>
<tr>
<th>Essential Equipment</th>
<th>Optional Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalpel with No. 10 blade</td>
<td>Antiseptic solution</td>
</tr>
<tr>
<td>Toothed forceps</td>
<td>2 Medium-sized Richardson retractors</td>
</tr>
<tr>
<td>Bandage scissors</td>
<td>Bladder retractor</td>
</tr>
<tr>
<td>Bulb syringe</td>
<td>Foley catheter</td>
</tr>
<tr>
<td>2 Umbilical clamps</td>
<td>Needle driver</td>
</tr>
<tr>
<td>Towels</td>
<td>No. 0 or No. 1 delayed-absorbable (e.g. chromic) suture on a large needle</td>
</tr>
<tr>
<td>Suction device with suction catheter</td>
<td></td>
</tr>
<tr>
<td>Packing gauze</td>
<td></td>
</tr>
</tbody>
</table>

Perimortem Cesarean Section

1, 2, 3, 4 steps

Step 1 – Skin incision

Suggested:

Vertical incision
Step 2 – Displace the Bladder
Retract the abdominal wall and displace the bladder

Step 3 – Incise the Uterus
Small vertical incision into the lower uterine segment
Use bandage scissors to extend the incision toward the fundus while shielding the fetus with your hand

Step 4 – Deliver the Infant
Deliver the infant from a vertex position
The baby is out!

Suction mouth and nose with bulb syringe

Clamp cord x 2

Assess, clean, and warm infant

What now? *(Depending on resources and ROSC)*

Consider removing placenta

Pack or suture closed the uterus
No. 0 or N. 1 delayed-absorbable sutures
Locking one-layer closure

Consider direct pressure on aorta

Ethical and Legal Considerations
Legal Considerations

**Could I be charged with battery if consent is not obtained?**

- Since PMCS was described in 1986, no physician in the United States has been held liable for performing PMCS, even when against the wishes of the mother's family.
- Failing to perform PMCS would result in near certain death for infant and mother.


Legal Considerations

**Could I be sued for not doing a PMCS?**

- At least two cases identified where lawsuit against physicians and hospital staff for failure to perform a PMCS.


Ethical Considerations

**Even if PMCS is successful, will we deliver an infant that has persistent neurological deficits?**

- A review of all case reports of PMCS over 25 years identified no reported cases where an infant surviving beyond the early neonatal period had significant neurological disability.
- Multiple neurologically intact infants have survived following PMCS even after prolonged maternal resuscitation.
Peer-reviewed resuscitation guidelines may be the simplest recourse for EM physicians in deciding to perform a PMCS.

In situations of nonsurvivable maternal trauma or prolonged pulselessness, there is no reason to delay performing PMCS (Class I, LOE C).

Perform PMCS within 4 min of maternal cardiac arrest if no ROSC.
- May be considered sooner in cases of obvious nonsurvivable injury (Class IIa, LOE C).

**In Summary...**

1. We should be familiar with and ready to perform a perimortem cesarean section (PMCS).

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