Post-Mortem C-Section: A How-to-Guide to Section or Not to Section: The Peri-Mortem C-Section in the ED

Peri-mortem Cesarean section in the ED is one of the most heroic procedures in the EM scope of practice. Peri-mortem C-section is exceedingly rare, and the decision to embark on this procedure must literally be made within seconds to minutes. The speaker will discuss the controversy surrounding this procedure from both the emergency medicine and surgical perspectives. Indications and contraindications will be discussed. The procedural approach to peri-mortem section, as well as post-procedure complications also will be covered.

- Discuss the controversies of peri-mortem C-section from both ED and trauma surgery points of view.
- List the indications and contraindications.
- Learn how to perform rapid gestational dating by ultrasound.
- Discuss how to perform a peri-mortem C-section.

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(+)No significant financial relationships to disclose
Perimortem Cesarean Section: Why, When, and How

Disclosures - None!

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To section or not to section...

- You will know why to perform a PMCS
- You will know when to perform a PMCS
- You will know how to perform a PMCS

Goals

- **WHY**: Discuss the indications to perform a perimortem cesarean section, and why this is an important skill for EP’s to have.
- **WHEN**: Describe the timeline that should be followed if this procedure is to be successful.
- **HOW**: Explain for the non-surgeon how to perform a perimortem cesarean section.
Cesarean Section Through the Ages

Modern History
OAKLAND / Bittersweet family moment / Baby delivered as mother was dying gets to leave hospital
October 04, 2005 | By Henry K. Lee, Chronicle Staff Writer

Daphne Cruz left the hospital Monday, less than three weeks after doctors pulled her from her dying mother’s womb after a freak accident in Oakland.

Daphne was born by emergency cesarean section on Sept. 15, the day her mother, Adriana Cruz, 32, died after being crushed against a wall by her sport utility vehicle in the city’s Fruitvale district.

Although doctors at Highland Hospital in Oakland had to perform CPR on the full-term baby after her birth, she didn’t suffer any trauma, authorities said as they marveled how a new life emerged from a mother’s tragic death.

Perimortem C-section demands quick trip to OR

Ob/Gyn News, April 15, 2006 by Betsy Bates

• "A cesarean section by you in the emergency room 2 minutes after a patient is brought in by ambulance is no better than a C-section by the side of the road by EMTs [emergency medical technicians]," said Dr. Quirk, professor and chairman of obstetrics, gynecology, and reproductive medicine at the State University of New York at Stony Brook.
The Debate

• Never in the ED. Non-experts performing a procedure they cannot repair.
  • No time to get to the OR.
• Lack of consent from patient and family.
  • This is an emergent procedure like any other life-saving intervention.
• Fear of litigation.
  • To date, there are no judgements against physicians performing PMCS.

Why

• To save the life of the mother.
• To save the life of the baby.
To Save the Life of the Baby: PMSC for Fetal Salvage

Emergent delivery may yield a fetus of viable gestational age in the setting of fatal maternal injury or disease.

To Save the Life of the Mother: PMSC for Resuscitation

• By reducing the hemodynamic burden of the uterus, the hemodynamic status of the mother can be improved in cardiopulmonary arrest.
Physiology

More Volume Under
Less Pressure

- Blood pressure: decreases 10-15 mm Hg
- Heart rate: increases 10-15 bpm
- SVR: decreases by 10-15%
- Cardiac output: increases by 30-50%
- Blood volume: increases by 30-50%
- Hematocrit: decreases to 32-34%
Physiologic Pitfalls in Pregnancy: D-O-A-P

- **Dilutional anemia**: blood volume increases 30% causing lower O2 carrying capacity
- **Oxygen consumption**: demand is high and reserve is low causing rapid onset of hypoxia
- **Aortocaval compression**: uterus can impede 30% of cardiac output
- **Progesterone effects**: aspiration risk and mucosal edema

**D-O-A-P**
- **Dilutional anemia**: replace volume loss
- **Oxygenation**: high oxygen content, increased minute ventilation and TV
- **Aortocaval compression**: pelvic tilt or manual uterine distraction
- **Progesterone effects**: anticipate a difficult airway and aspiration
Aortocaval Compression

- IVC may be completely obstructed in the supine position.
- Uterus receives 30% of cardiac output.
- Compression occurs at 20 weeks.
- CPR only produces about 10% normal CO.

Emptying the Uterus

- Roughly 25-50% increase in circulating blood volume.
- Improved ability to ventilate.
- Compressions are more effective.

Sources:
- Atta E Cardiopulmonary Arrest in Pregnancy, Ob and Gyn Clin of NA 2007; 34: 585-597
- Boehm, J. CPR in the Hospital Under Unusual Circumstances; AHA 200
Perimortem cesarean delivery: Were our assumptions correct?

- 38 cases of PMSC during CPR identified 1985-2004.
- 34 surviving infants.
- 13/20 mothers with reversible causes of arrest survived to discharge.
- No “maternal deterioration” with PMCS.

The Surviving Babies

<table>
<thead>
<tr>
<th>Age Group</th>
<th>All Survivors</th>
<th>No Deficit</th>
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<tbody>
<tr>
<td>0-5m</td>
<td>12</td>
<td>8</td>
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<td>6-10m</td>
<td>4</td>
<td>1</td>
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<tr>
<td>11-15m</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>&gt;15m</td>
<td>7</td>
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The Surviving Mothers

<table>
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<tr>
<th>Time (min)</th>
<th>ROSC</th>
<th>No change</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>6-10</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>&gt;15</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Causes of Maternal Arrest

- Trauma: 5
- Cardiac: 8
- Embolism: 7
- Mag overdose: 3
- Sepsis: 8
- Anesthesia: 3
- Eclampsia: 5
- Uterine rupture: 1
- ICB: 6
**Trauma Patients**

- “Numerous reports of postmortem sections performed on trauma victims who were brought to emergency rooms at lengthy periods of time after injury.”

- 5/8 of the trauma patients were arrests in the field after MVA.

**Infant Survival After Cesarean Section for Trauma**

- 441 admissions of pregnant trauma patients yielding 32 emergent (but not perimortem) cesarean sections from nine Level 1 centers.

- 15 (45%) babies survived.

- 13 (40%) had no FHT’s; none survived

- Potential survivors (>26w and +FHT’s)
  - 15/20 (75%) survived
  - 3/5 fetal deaths had minor maternal trauma

- 23 (72%) of mothers survived.
Trauma

- Outcomes may be similar as in non-trauma patients. Role of PMCS for mom remains unclear.
- If there is no fetal heartbeat, unlikely to salvage the infant.
- If there is a fetal heartbeat, go to PMCS!

When

- THE FOUR MINUTE RULE: commencement of section within FOUR minutes with delivery of the infant by FIVE minutes.
Perimortem Cesarean Delivery Katz et al. Obstet Gyn 1986; 68
Case Reports 1900-1985

The Other ‘When’: Gestational Age
Dating by Ultrasound?

• NOT necessary if the patient is obviously greater than 26 weeks.

• May be helpful in the patient 20-26 weeks, or when body habitus prevents a clinical assessment.

ULTRASOUND SHOULD NOT DELAY INITIATION OF THE PMCS

Tips for ULS

• Make sure the machine is on OB settings.

• Know how to operate the "OB calcs".

• Go for the head. Easily recognizable. Will be in the pelvis most of the time.
BPD and HC

- Can assess maternal cardiac activity
- Can assess fetal cardiac activity
- Can assess for reversible causes of PEA
- Can determine gestational age

**SHOULD NOT DELAY INITIATION OF THE PROCEDURE**
How

Perimortem cesarean section for the non-surgeon
Nobody chooses to have their baby in the ED...

- Nonsterile
- Poor lighting
- Needed supplies are seldom used/hard to find
- No specialized equipment
- No OB/Gyn

Step By Step

- Assemble people and resources
- Assemble supplies
- Incising through the peritoneum
- Entering the uterus
- Extracting the infant
- Resuscitate mother/repair damage
- Resuscitate the infant
People/Resources

- This will vary by hospital/location.
- Know your resources ahead of time.
- Know the attitudes and opinions of your consultants.
- Agree on the policy ahead of time.

Perimortem Cesarean Section Pack

- #10 scalpel
- scissors
- suction
- retractors
- packing
- suture
- supplies for baby
If no pack available...

- Thoracotomy tray
- Cricothyrotomy tray
- Chest tube tray--clamps
- Incision and drainage kit--#11 blade, clamp

Scalpel

- #10 or #22
- #11 is in most I+D kits-try to avoid
- Incising through to the peritoneum
- Disposable scalpels NOT in packs with steel instruments because of the autoclave!
**Scissors**
- Used to extend the uterine incision.
- Should be LARGE.
- Should be blunt ended to minimize injury to the fetus.
- Usually not available outside the OR unless requested.

**Retractors**
- Rarely available outside the OR unless part of some surgical tray/kit.
- Assistants can serve to retract if no retractors are unavailable.
Suction

• As much suction as possible!
• Blood and amniotic fluid will flood and obscure your field.
• UNIVERSAL PRECAUTIONS

Clamps

• To clamp the cord
• Cord clamps-available separately or as part of an OB emergent delivery pack
• Large surgical clamps-not mosquitoes.
Supplies for Baby

- Resuscitation surface: infant warmer, surface with plenty of dry linens near an oxygen source.
- Infant mask and anesthesia bag/ambu bag.
- Dedicated person to dry, stimulate, warm the infant.

Getting Started

- Information.
  - TIME from maternal arrest
  - Gestational age
  - Underlying disease process
- Assign roles.
  - The most experienced individual leads.
  - Designate who the infant will be handed off to.
- KEEP CPR GOING!
- Prep the abdomen and drain the bladder, although these tasks should
Classic vs Low Transverse

- Popular since the 1940s
- Associated with lower rates of mortality
- Lower transverse incision
- Lower uterine segment is thinner and less vascular
- Uterine rupture less likely in future labors
- Less likely to cause fecal contamination of the peritoneum
- MUCH slower than a classical approach
Midline Incision

- What the most experienced operator is most comfortable with.
- For non-surgeons, GO MIDLINE.
- Follow the linea nigra

Incision

- Skin
- Subcutaneous fat
- Fascia/Rectus sheath
- Peritoneum
- Uterus
Incision

- Incise with a #10 blade down to the uterus.
- Have suction available.
- Expect a large amount of bleeding.
- Incise from the umbilicus to the symphysis pubis.
- Avoid the bladder!

Uterus

- Make a small vertical incision in the lower uterine segment.
- Lift the uterine wall away with two fingers.
- Extend the incision superiorly with scissors up to the umbilicus.
Incising the Uterus

- May encounter the placenta which is commonly anterior
- **CUT STRAIGHT THROUGH THE PLACENTA**
- This will create more bleeding

Extracting the Infant

- Find the head-disengage from the pelvis if necessary.
- Premature infants more likely to be breech.
- **FUNDAL PRESSURE.**
Extract the Placenta

• Separate the placenta from the wall of the uterus.
• Uterine/fundal massage.

Repairing the Wound

• Not extensively described in EM literature/procedure books.
• Must be done if the PMCS is performed for resuscitation.
Locking stitch

Repairing the Wound

- Absorbable suture on a large needle.
- Start at the lower uterine segment and work cephalad.
- The fundus may require two layers.
- Close the peritoneum.
- Staple the skin.
The Baby

- Dry, stimulate, warm, position.
- Supplemental oxygen.
- Positive pressure ventilation.
- Start compressions for HR less than 60.

To section or not to section...

- You now know **why** to perform a PMCS
- You now know **when** to perform a PMCS
- You now know **how** to perform a PMCS
• Do it for the mom, do it for the baby.
• Perform within FOUR minutes of maternal arrest.
• Look for reversible causes of the arrest—use the ultrasound.
• Vertical incision umbilicus to pubis, incise the uterus, fundal pressure, and close the wound.

2. Cesarean Birth J O’sullivan The Ulster Medical Journal, Volume 59, No 1 pp1-10 April 1990
11. Perimortem Cesarean After Utilization of Surgeon-Performed Trauma Ultrasound. H Phelan J Trauma 2208:64 E12-E-14

To Section or Not to Section: Cesarean Delivery in the Emergency Department

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