Resuscitation efforts for Mom & Baby

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Key Interventions to Prevent Arrest

- Patient in full left-lateral position
- Give 100% & oxygen
- Establish IV access above the diaphragm
- Assess for hypotension
  - Maternal hypotension that warrants therapy
    - SBP<100mm Hg or <80% of baseline
Key Interventions to Prevent Arrest

• Patient not in arrest
  • Crystalloid and colloid solutions increase preload

• Consider reversible causes of critical illness
  – treat conditions that may contribute to clinical deterioration as early as possible
Maternal Cardiac Arrest

First Responder
- Activate maternal cardiac arrest team
- Document time of onset of maternal cardiac arrest
- Place the patient supine
- Start chest compressions as per BLS algorithm; place hands slightly higher on sternum than usual

Subsequent Responders

Maternal Interventions
Treat per BLS and ACLS Algorithms
- Do not delay defibrillation
- Give typical ACLS drugs and doses
- Ventilate with 100% oxygen
- Monitor waveform capnography and CPR quality
- Provide post-cardiac arrest care as appropriate

Maternal Modifications
- Start IV above the diaphragm
- Assess for hypovolemia and give fluid bolus when required
- Anticipate difficult airway; experienced provider preferred for advanced airway placement
- If patient receiving IV/OI magnesium prearrest, stop magnesium and give IV/OI calcium chloride 10 mL in 10% solution, or calcium gluconate 30 mL in 10% solution
- Continue all maternal resuscitative interventions (CPR, positioning, defibrillation, drugs, and fluids) during and after cesarean section

Obstetric Interventions for Patient With an Obviously Gravid Uterus*
- Perform manual left uterine displacement (LUD)—displace uterus to the patient's left to relieve aortocaval compression
- Remove both internal and external fetal monitors if present

Obstetric and neonatal teams should immediately prepare for possible emergency cesarean section
- If no ROSC by 4 minutes of resuscitative efforts, consider performing immediate emergency cesarean section
- Aim for delivery within 5 minutes of onset of resuscitative efforts

*An obviously gravid uterus is a uterus that is deemed clinically to be sufficiently large to cause aortocaval compression

Search for and Treat Possible Contributing Factors (BEAU-CHOPS)
Bleeding/DIC
Emboli: coronary/pulmonary/amniotic fluid embolism
Anesthetic complications
Uterine atony
Cardiac disease (MI/ischemia/aortic dissection/cardio myopathy)
Hypertension/preeclampsia/eclampsia
Other: differential diagnosis of standard ACLS guidelines
Placenta abruptio/previa
Sepsis

AHA 2010 Guidelines: Circulation 2010; 122: S829-S861
Call for HELP!

- Emergency call system (with backup)
- All maternal and neonatal related teams activated immediately and simultaneously
- Obstetric – oriented code team “Code OB”
- Barriers to emergency staff access evaluated

Lipman et al. AM J Obstet Gynecol 2010: 203(2) 179
Lipman et al. Obstet Gynecol 2011 118(5): 1090-4
Patient Positioning

• **Left lateral tilt**
  – Improves maternal B/P, CO and stroke volume
  – Improves fetal oxygenation, non stress test & FHR
  – Chest compressions are feasible but less forceful than in the supine position
Manual Left Lateral Tilt
Manual Left Lateral Tilt
Chest Compressions

- C-A-B
- Hard (5cm depth), fast (100/min), uninterrupted
- Limit pre-shock pause to <5 secs
- Post-shock pause no longer endorsed by AHA
- Intubated: constant chest compressions
- Unintubated: 30 compressions: 2 breaths
- Providers rotate every 2 minutes
Chest Compression

• Chest compressions should be performed
  – Slightly higher on the sternum than normal (adjust for elevated diaphragm & abdominal contents)
  – 2-3 cm higher on sternum (3rd trimester)
• Significant literature recognizes the issue of failed intubation in obstetric anesthesia
  – Major cause of maternal morbidity and mortality
  – Desaturation occurs significantly faster in the pregnant patient
Airway Management

• First-responders w/out advanced airway experience:
  • Jaw thrust, oral airway, bag mask ventilation, not intubation

• Experience personnel
  – Laryngoscopy, intubation, alternative airway devices
  – Avoid compression interruptions

• Oxygenation & ventilation is the primary objective

• Oxygenation takes priority over aspiration prevention
  – Cricoid pressure may not be effective
  – Cricoid pressure can impede ventilation & laryngoscopy
  – AHA 2010 guidelines do not recommend cricoid pressure in non-pregnant patients
IV Access

- Rapid intravascular volume repletion
- Administration of resuscitation drugs
- Difficult peripheral IV access options
  - Intra-osseous
  - Ultrasound-assisted
  - Central venous access
- Access above the diaphragm
Defibrillation

• Defibrillation should be performed at recommended ACLS defibrillation doses
  – Small risk of inducing fetal arrhythmias
  – Some experts raised concern that electric arcing may occur if fetal monitors are attached during defibrillation
    • No evidence to support this
    • Reasonable to remove external or internal fetal monitors
Defibrillation

• If arrest witnessed and defibrillator available
  1. defibrillate
  2. chest compressions
• Same energy requirements in pregnancy
• AED device is the most practical approach
• Pads better than paddles
• Fetal monitors (external, fetal scalp electrode remove/disconnect/not necessary)
Causes of Cardiac Arrest
5Hs + 5 Ts

- Hypoxia
- Hypovolemic
- Hypothermia
- Hypo/hyperkalemia
- Hydrogen ions
- Tension pneumothorax
- Tamponade
- Toxins
- Thrombus, cardiac
- Thrombus, pulmonary
Resuscitation Drugs

• Standard pharmacologic therapy
  – Epinephrine, vasopressin, amiodarone
  – No drugs are contraindicated
  – No dose alterations

• Lipid emulsion if local anesthetic toxicity
## Magnesium Sulfate Toxicity

<table>
<thead>
<tr>
<th>Signs &amp; Symptoms</th>
<th>Magnesium Level</th>
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<tbody>
<tr>
<td>GI symptoms (N/V), skin (flushing) &amp; electrolyte abnormalities (hypophosphatemia, hypersomolar dehydration)</td>
<td>2.5-5mmol/L</td>
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<td>EKG changes (Prolonged PR, QRS and QT intervals)</td>
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<tr>
<td>Neurologic effects (loss of tendon reflexes, sedation, severe muscle weakness &amp; respiratory depression)</td>
<td>4-5mmol/L</td>
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<td>AV nodal conduction block, bradycardia, hypotension &amp; cardiac arrest</td>
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Emergency C/S in Cardiac Arrest

• Resuscitation team leaders should activate the protocol for emergency C/S as soon as cardiac arrest is identified in a pregnant patient
  – By the time baby is delivered, standard ACLS should be underway and reversible causes ruled out
Gravid Uterus potential to cause Aortocaval Compression

- A review of emergency C/S in maternal cardiac arrest before third trimester
  - If fundus extends above the level of the umbilicus aortocaval compression can occur
  *thus emergency C/S should be performed
Why perform Emergency C/S?

- Several case reports of emergency C/S in maternal cardiac arrest
  - indicate return of spontaneous circulation or improvement in maternal hemodynamic status only after the uterus has been emptied
Timing of Emergency C/S

• Very few cases of permortem C/S fall within the recommended 5-minute arrest

• Survival of the mother has been reported with perimortem C/S performed up to 15 minutes after cardiac arrest
Perimortem cesarean delivery performed faster in labor room

- Labor room = 4:25 (3:59-4:50) vs. operating room = 7:53 (7:18-8:57)
- 57% (labor room) vs. 14% (operating room teams) achieve delivery in 5 minutes
- Key tasks occurred more frequently & rapidly in the labor room group
- Transport decreases quality of CPR during simulated maternal cardiac arrest

Lipman et al. Obstet Gynecol 2011;118: 1090
# Maternal Cardiac Arrest

## First Responder

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### Maternal Interventions

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Science Changes

Latest Neonatal Resuscitation Guidelines
No longer an “optional” in the birth setting

1. Compressed air source
2. Oxygen blender to mix oxygen & compressed air with flow meter
3. Pulse oximeter for neonatal use
4. LMA (size 1)
1. **Routine care**
   - vigorous term babies with no risk factors and babies who have responded to initial steps

2. **Post-resuscitation care:**
   - babies who have depressed breathing or activity and/or require supplemental oxygen
   - babies who will require frequent evaluation
   - Some may transition to routine care; others may transfer to ICU nursery
Prior to beginning NRP Flow Diagram

• Ask the OB provider relevant perinatal history
  – What is the gestational age?
  – Is the fluid clear?
  – How many babies are expected?
  – Are there any additional risk factors?
After birth questions

• Is the newborn term?
• Is the newborn breathing?
• Does the newborn have good muscle tone?

• If any answer is “No” the newborn should receive initial steps at the radiant warmer
Suctioning following birth
(including bulb syringe suction)

Suctioning reserved for:

- babies that have obvious obstruction to spontaneous breathing

- babies who require spontaneous positive-pressure breathing
Initial Steps

• Clear airway as necessary
• Dry & remove wet linen
• Reposition
• Stimulate
• Evaluate respirations and heart rate (not color)
Heart Rate & Breathing Evaluation

• HR < 100bpm, or if is apneic or gasping
  – begin positive pressure ventilation

• HR >100 and respirations are labored
  – consider CPAP, especially in preterm infants
Oxygen Concentration

• Term infants
  – begin with 21% O2

• Preterm newborns
  – Begin with somewhat higher flows
Placement of pulse –oximeter probe on the newborn

- Right hand or wrist
  - Measures pre-ductal saturation
Adjust Oxygen to achieve pre-ductal saturations

- Using pulse oximetry,
  - supplemental O2 concentration should be adjusted to achieve target values of pre-ductal SPO2

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<th>After Birth</th>
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<tr>
<td>1 min</td>
<td>60%-65%</td>
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<tr>
<td>2 min</td>
<td>65%-70%</td>
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Indications for Positive-Pressure Ventilation

- Apnea/gasping
- Heart rate below 100 bpm, even if breathing
- Persistent central cyanosis and low O2 sat,
  - despite free-flow oxygen increased to 100%
Integral pressure with PPV devices

• All positive-pressure devices, including the self-inflating bag, should have an integral pressure gauge
  – or attach a pressure gauge (manometer)
MR SOPA

- M: Adjust the mask on the face.
- R: Reposition the head to ensure an open airway. Re-attempt ventilation.
- If not effective,
- S: Suction the mouth and nose
- O: Ventilate with the baby’s mouth slightly open and lift the jaw forward. Re-attempt ventilation
  - If not effective,
- P: Gradually increase pressure every few breaths, (cautiously, and to a maximum of 40 cm H20), until
  - there are bilateral breath sounds and visible chest movement.
  - If still not effective,
- A: Consider airway alternative (endotracheal tube or laryngeal mask airway)
Effective Ventilation comes First!

- Establishing ventilations is the highest priority
- Do not start chest compressions
  - until you have effective ventilation
- HR < 60 bpm despite 30 seconds of PPV,
  - increase O2 100% and begin chest compressions
Intubate

- Intubation strongly recommended when chest compressions begin
  - to ensure adequate ventilation
  - intubation should be completed w/in 30 seconds
  - do not administer free flow O2 during intubation of an apneic infant
Check Pulse

• Interruption of chest compressions to check heart rate may result in a decrease of perfusion pressure in the coronary arteries
  – continue chest compressions and coordinated ventilations for at least 45-60 seconds before stopping briefly to assess the heart rate
Umbilical Vein Access

• If you need to place an emergency umbilical venous catheter
  – continue chest compressions by moving to the head of the bed (near the infant’s head) and continuing the 2-thumb technique
Epinephrine

- Epinephrine indicated if HR remains < 60bpm
  - after 30 seconds of ventilation
  - 45-60 seconds of chest compressions
Epinephrine

- Recommended concentration: 1:10,000 (0.1 mg/mL)

- Recommended route: Intravenous (umbilical vein)
  - Consider endotracheal route ONLY while IV access being obtained

- Give rapidly

- Recommended IV dose: 0.1-0.3 mL/kg of 1:10,000 solution per umbilical vein in a 1-mL syringe.
  - Follow IV dose of epinephrine with 0.5 – 1 mL flush of NSS
Epinephrine

- **Recommended intratracheal dose:** 0.5 – 1 mL/kg of 1:10,000 solution per endotracheal tube in a 3-6 mL syringe.

- Check newborn HR about 1 minute after administering epinephrine (longer if given endotracheally)

- Epinephrine dose may be repeated every 3-5 minutes.
NRP 6th Edition Flow Diagram