

# Resuscitation efforts for Mom & Baby

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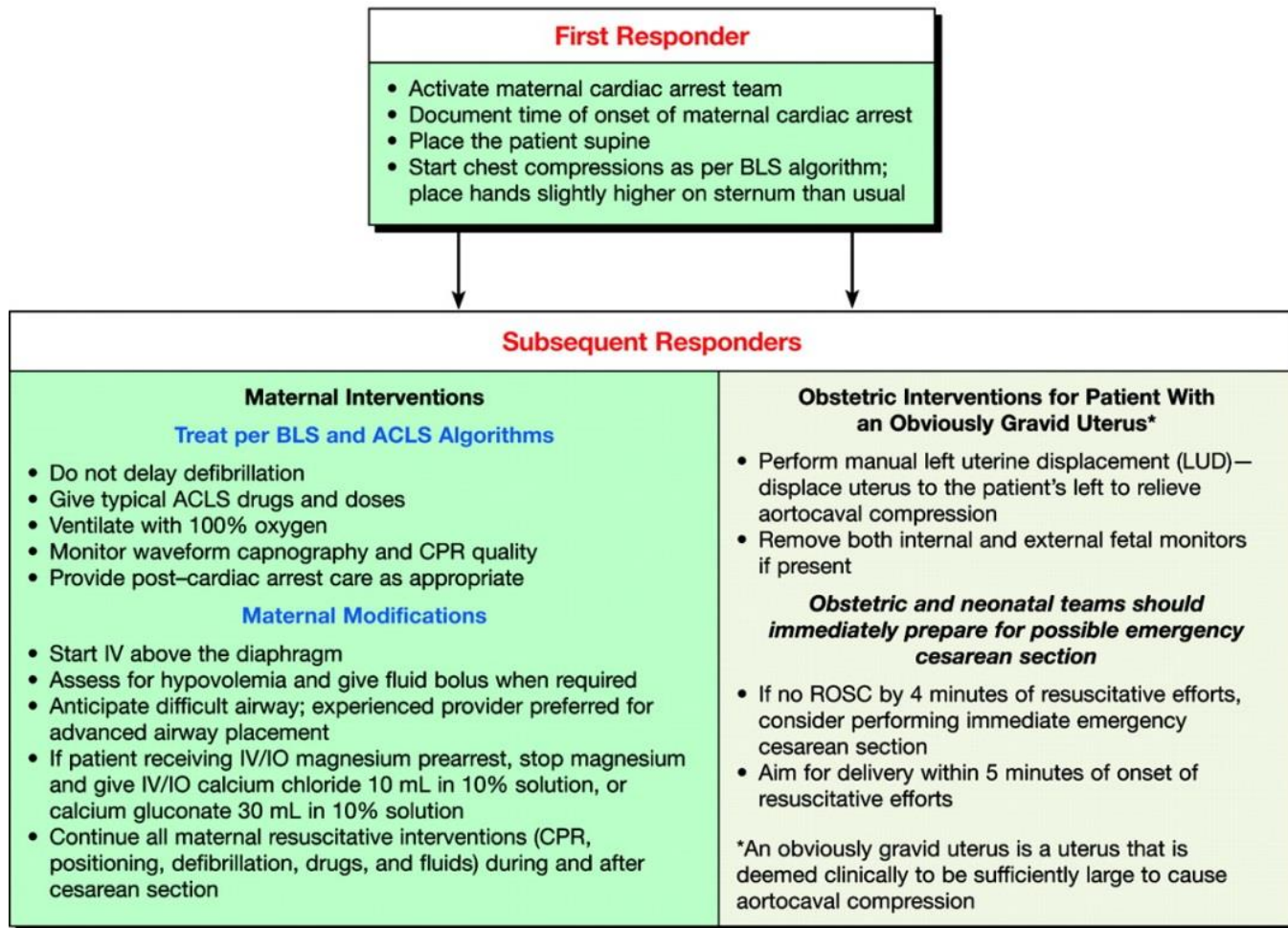
# Key Interventions to Prevent Arrest

- Patient in full left-lateral position
- Give 100% & oxygen
- Establish IV access above the diaphragm
- Assess for hypotension
  - Maternal hypotension that warrants therapy
    - SBP < 100 mm 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



## Search for and Treat Possible Contributing Factors (BEAU-CHOPS)

**B**leeding/DIC  
**E**mbolism: coronary/pulmonary/amniotic fluid embolism  
**A**nesthetic complications  
**U**terine atony  
**C**ardiac disease (MI/ischemia/aortic dissection/cardiomyopathy)  
**H**ypertension/preeclampsia/eclampsia  
**O**ther: differential diagnosis of standard ACLS guidelines  
**P**lacenta abruptio/previa  
**S**epsis

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 (3<sup>rd</sup> trimester)



# Airway

- 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
- Hypovolemia
- 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

Signs & Symptoms	Magnesium Level
GI symptoms(N/V), skin(flushing) & electrolyte abnormalities (hypophosphatemia, hypersomolar dehydration)	
EKG changes (Prolonged PR, QRS and QT intervals)	2.5-5mmol/L
Neurologic effects (loss of tendon reflexes, sedation, severe muscle weakness & respiratory depression)	4-5mmol/L
AV nodal conduction block, bradycardia, hypostension & cardiac arrest	6-10mmol/L

# Emergency C/S in Cardiac Arrest

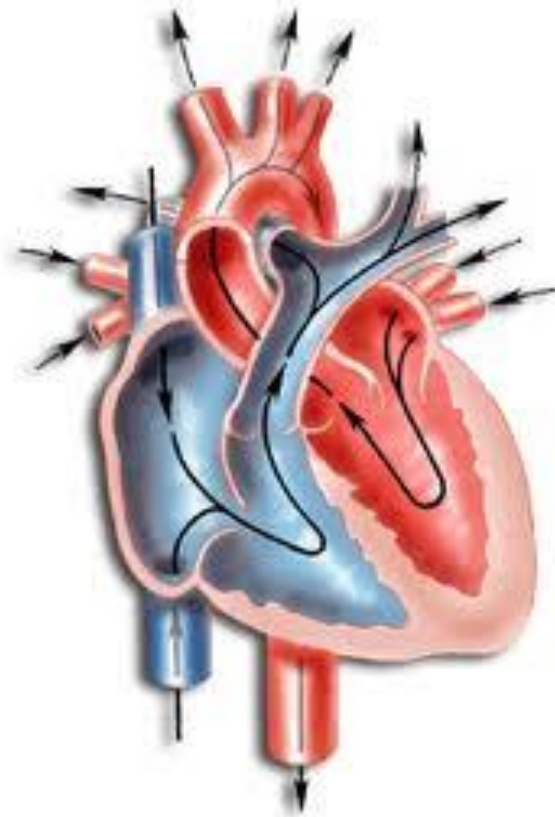
- Resuscitation team leaders should activate the protocol for emergency C/S as soon as cardiac arrest is identified in a pregnant patient
  - By the time baby is delivered, standard ACLS should be underway and reversible causes ruled out

# 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. Anesth Anal 2013; 116(1): 162-7

Lipman et al. Obstet Gynecol 2011;118: 1090-

# 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/IO magnesium prearrest, stop magnesium and give IV/IO 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

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**S**epsis

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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)

# 2 levels of Post-Resuscitation Care

## 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% O<sub>2</sub>
- 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 O<sub>2</sub> concentration should be adjusted to achieve target values of pre-ductal SPO<sub>2</sub>

## Targeted Pre-ductal SPO<sub>2</sub> After Birth

1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

# Indications for Positive-Pressure Ventilation

- Apnea/gasping
- Heart rate below 100 bmp, 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 **m**ask on the face.
- **R:** **R**eposition the head to ensure an open airway. Re-attempt ventilation.
- If not effective,
- **S:** **S**uction the mouth and nose
- **O:** Ventilate with the baby's mouth slightly **o**pen and lift the jaw forward.  
Re-attempt ventilation
  - If not effective,
- **P:** Gradually increase **p**ressure every few breaths, (cautiously, and to a maximum of 40 cm H<sub>2</sub>O), until
  - there are bilateral breath sounds and visible chest movement.
  - If still not effective,
- **A:** Consider airway **a**lternative (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 O<sub>2</sub> 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

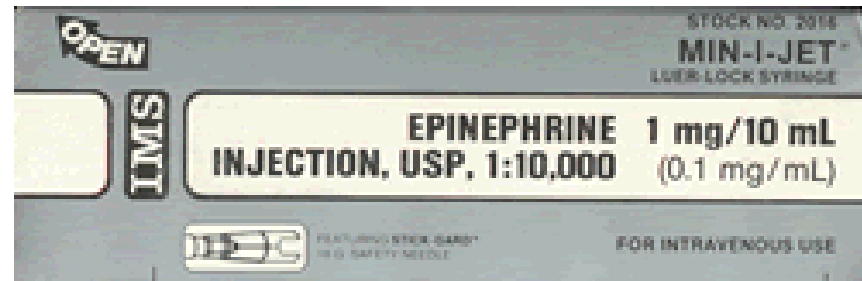


# Umbilical Vein Access

- 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  $< 60$ bpm
  - 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 6<sup>th</sup> Edition Flow Diagram

