

Obstetrical Emergencies: Maternal Resuscitation

Simulated Drills April 2013



Maternal Resuscitation Drill

What's the Need?

- Maternal cardiac arrest is a rare and devastating obstetric emergency
- Literature suggests obstetric (OB) health care personnel possess limited knowledge regarding the differences in resuscitation methods for pregnant patients (Farinelli & Hameed, 2012)
- In obstetrics, poor interprofessional teamwork and communication has contributed to adverse events and critical incidents (Taylor-Alderman, 2012)

Maternal Resuscitation Drill

Why Now?

- The frequency of cardiac arrest in pregnancy is on the rise
 - Research indicates a rise from 1 in 30,000 pregnancies to 1 in 20,000.
- More women are seeking pregnancy at a later age: approximately 1 in 12 births in 2008 were to women aged 35 years and older
- Advances in medical care have improved survival and quality of life, leading to successful pregnancies in women with serious underlying medical conditions

Improving Maternal and Fetal Outcomes

What can we do?

- Maternal and fetal outcomes improve when there is knowledge of:
 - Risk factors for cardiac arrest
 - Physiologic alterations of pregnancy
 - BLS/ACLS Protocols
 - CPR adaptations during pregnancy
 - Maternal/Fetal Assessment
- Research has shown participating in a simulation-based drill improves communication, response time and decision making during a maternal cardiac arrest

(Farinelli & Hameed, 2012; Suresh, Mason, Munnur, 2010)

Causes of Cardiac Arrest in Pregnancy

Thromboembolism	Anaphylactoid syndrome of pregnancy (previously amniotic fluid embolism)
Pregnancy-induced hypertension (including preeclampsia and eclampsia)	Hemorrhage: <ul style="list-style-type: none">•Placental abruption•Placenta previa•Uterine atony•Disseminate intravascular coagulation
Sepsis/infection	Cerebrovascular accident
Trauma	Asthma
Iatrogenic: <ul style="list-style-type: none">•Medication allergy or error•Anesthetic complication•Hypermagnesemia	Preexisting heart disease: <ul style="list-style-type: none">•Congenital•Acquired (cardiomyopathy)

Physiologic Changes During Pregnancy: Cardiovascular System

- Cardiac output increases by 50%
- Blood volume increases by 30-50%
- Heart rate increases by 15-30%
- Blood flow to uterus is 6-7 liters/min in the last trimester
- Systemic vascular resistance decreases by 20% to accommodate increased blood volume
- Red blood cell volume increased by only 30% causing physiologic anemia
- Arterial BP decreases
- Decreased venous return due to gravid uterus leads to supine hypotension
- Increased aorto-caval compression

Physiologic Changes During Pregnancy

Respiratory System

- Increase in respiratory rate
- Oxygen consumption increases by 20% to accommodate maternal and fetal needs
- Increased Pharyngeal Edema (increases difficulty in accessing and maintaining airway)
- Functional residual capacity (FRC) decreases by 20%
- Decreased chest wall compliance

Physiologic Changes During Pregnancy

Gastrointestinal System

- Intestinal motility slowed
- Relaxed lower esophageal sphincter (increases risk of reflux and aspiration)
- pH of gastric fluid decreases=>if there is aspiration, more damage to lungs

Physiologic Changes Effects on CPR

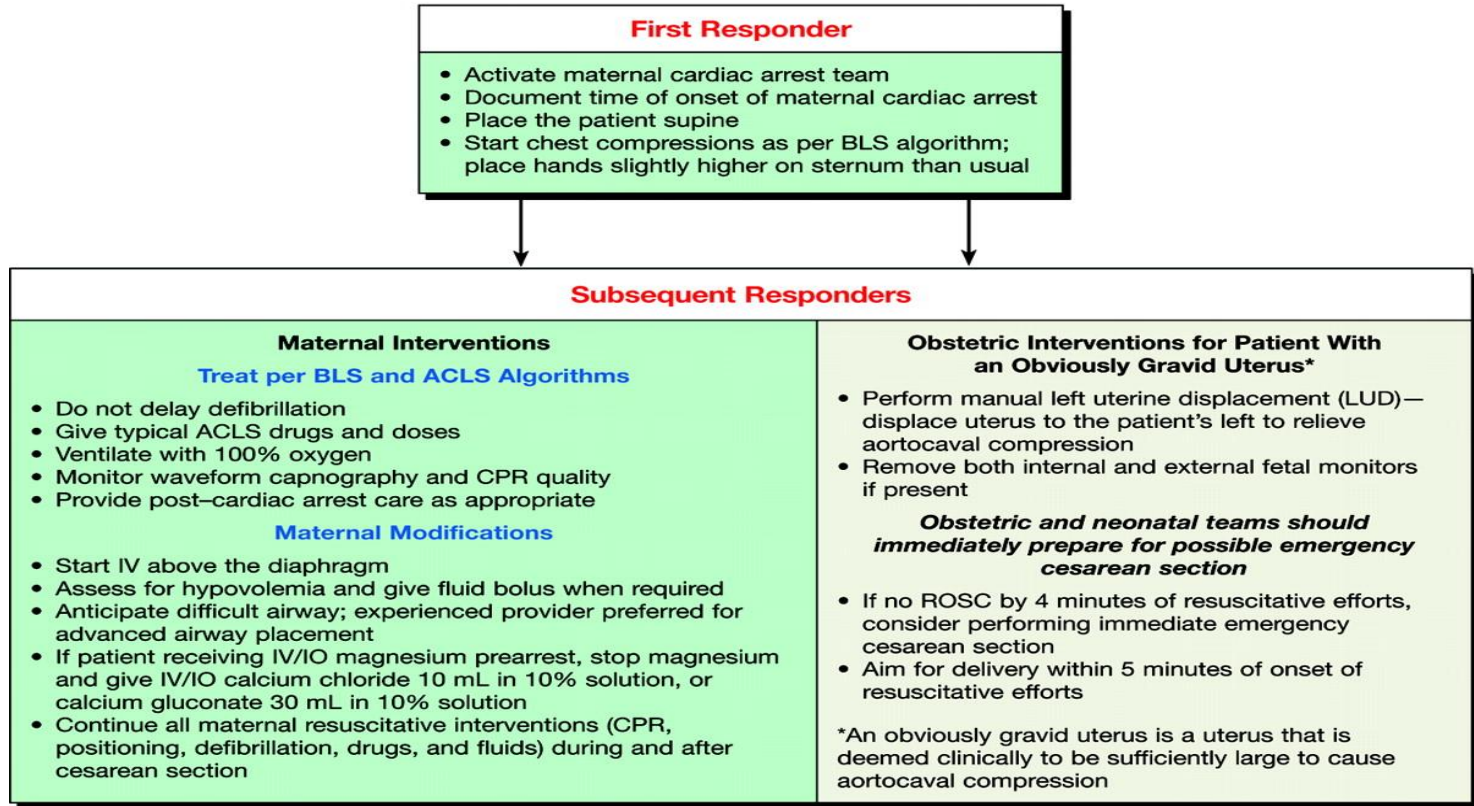
Physiologic Changes	Effect on CPR
Cardiac output	Increased circulatory demand
Blood volume	Dilutional anemia with decreased O ₂ carrying capacity
Aorto-caval compression	Lateral uterine displacement required
Decreased vascular resistance	Requires more vasopressin (will decrease uteroplacental perfusion)
Pharyngeal Edema	Smaller endotracheal tube needed
Increased respiratory rate	Increased development of hypercarbia
Oxygen consumption	More rapid development of hypoxia
FRC	More rapid development of hypoxia
Chest wall compliance	More difficult intubation, increased ventilation pressures, more difficult chest compressions

Guidelines for Cardiac Arrest in Pregnancy

- “Successful resuscitation of a pregnant woman and survival of the fetus requires prompt and excellent CPR with some modifications in basic and advanced cardiovascular support techniques” (Vanden Hoek et al. , 2010)

Maternal cardiac arrest algorithm.

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

Modifications in Resuscitation for the Pregnant Woman

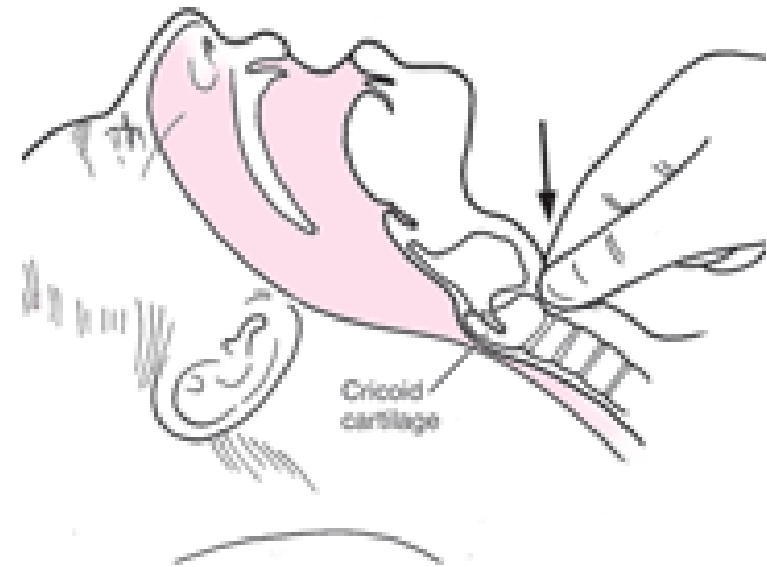
- Airway Management
- Uterine Displacement
- Deeper Chest Compressions
- Delivery of fetus within 5 minutes

Modifications in Resuscitation: Airway Management

- Jaw thrust with continuous cricoid pressure
- Reduce ventilation volumes
 - Monitor O₂ saturation closely
- Early intubation
- Smaller endotracheal tube
 - 0.5-1 mm smaller (#7 or # 6.5)

What is Cricoid Pressure?

- Pressure applied to cricoid cartilage pushing trachea posteriorly, compressing esophagus against cervical vertebrae
- Reduces gastric inflation and risk for regurgitation and aspiration
- Generally requires 3rd rescuer who is not providing chest compressions or ventilation



Modifications in Resuscitation: Uterine Displacement

- Fixed, hard wedge
- “Human Wedge”
- Uterine Tilt: Manual displacement
 - 1-Handed Technique
 - 2-Handed Technique
- Why: Displacing the uterus decreases compression of the pregnant woman’s abdominal aorta, inferior vena cava and iliac arteries
 - Helps to improves maternal hemodynamics of blood pressure, cardiac output, and stroke volume

(Vanden Hoek et al. , 2010)

Patient in a 30° Left-Lateral Tilt Using a Firm Wedge to Support Pelvis and Thorax.



(Vanden Hoek et al. , 2010)

Left Uterine Displacement with 2-Handed Technique



(Vanden Hoek et al. , 2010)

Left Uterine Displacement with 1-Handed Technique



(Vanden Hoek et al. , 2010)

Modifications in Resuscitation: Chest Compressions

- Additional pressure (accommodates lateral-tilt position)
- Deeper chest compressions
- Hand placement: slightly above midpoint of the sternum
- Once intubated: rate of 100 times per minute with minimal interruptions

Why:

- Chest wall compliance decreased
- Diaphragm elevated

Modifications in Resuscitation: Emergency Cesarean

- Resuscitation team leaders should activate the protocol for an emergency cesarean delivery as soon as cardiac arrest is identified
- Initiate C-Section within 4 minutes of maternal arrest with delivery of fetus within 5 minutes
- Research of perimortem cesareans reported sudden and dramatic improvements in pulse less pregnant patients following uterine evacuation

(Farinelli & Hameed, 2012; Vanden Hoek et al. , 2010)

Perimortem Caesarean: Things to Consider

- Gestational age less than 20 weeks: an emergency hysterotomy likely will not improve the situation
- Gestational age 20 to 23 weeks: an emergency hysterotomy may improve maternal survival, although survival of the fetus is unlikely
- Gestational age greater than 24 weeks: emergent cesarean will likely rescue both mother and infant

Additional Resuscitation Modifications

- Immediate request for presence of NICU team
- IV above the level of the uterus
- Current recommended drug dosages for use in resuscitation of adults should also be used in resuscitation of the pregnant patient.
- Defibrillation should be performed at the recommended ACLS defibrillation doses
 - Remove fetal and maternal monitors before defibrillation

References

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