Maternal Resuscitation and Postpartum Hemorrhage Workshop

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Objectives

Participants will be able to:

- Describe the modifications of Advanced Cardiac Life Support for the pregnant woman
- Demonstrate maternal resuscitation
- List important causes of postpartum hemorrhage (PPH) and describe how to prevent PPH
- Discuss importance of early recognition and quick response to PPH
- Describe the management of PPH
Overall workshop structure

- Lecture
- Trauma resuscitation simulation
- Estimated blood loss exercise
- Cardiac resuscitation simulation

Also:
Physiology of pregnancy

- Uterus receives 20 to 30 percent of cardiac output
- Aortocaval compression causes 30 percent of cardiac output to be sequestered
- Uterine displacement increases cardiac output by 25 percent
- Masks signs of hypovolemic shock despite up to 1500 ml of blood loss
Physiology of Pregnancy

- Delayed gastric emptying
  ✦ Use cricoid pressure during intubation
- Increased oxygen consumption
  ✦ Maintain oxygen saturation > 92 percent
  ✦ PaCO₂ of 35 to 40 mm Hg could mean respiratory failure
- BUN and creatinine decreased
Basic Life Support (BLS)

- Activate emergency response system
- Circulation
  - Chest compressions
- Airway
  - Open the airway
- Breathing
  - Positive-pressure ventilations
- Defibrillation
  - Assess for ventricular fibrillation or pulseless ventricular tachycardia
Advanced Cardiac Life Support

- **Circulation**
  - Establish IV access above diaphragm
  - Identify rhythm and monitor
  - Administer appropriate drugs

- **Airway**: early use of advanced airway

- **Breathing**
  - Confirm placement and secure device
  - Confirm adequate oxygenation

- **Differential Diagnosis**
  - Search for reversible causes and treat
Fetal Survey

- Fundal height
- Fetal presentation
- Uterine activity
- Fetal heart rate pattern
- Presence of vaginal bleeding
- Membrane status
- Cervical assessment
Maternal Cardiac Arrest

30° of left tilt

Airway

Human Wedge

Chest Compression

Management in field setting
Uterine displacement

Tilt board at 30° angle

Manual two handed
Four-Minute Rule

- Fetus of an apneic and asystolic mother has less than two minutes of oxygen reserve
- After four minutes without return of spontaneous maternal circulation, aim for cesarean incision by five minutes
- Requirements for perimortem cesarean:
  - Obviously gravid uterus (> 20 weeks gestation)
  - Adequate facilities and personnel for procedure and post-op care
Steps in Perimortem Cesarean

- Personal protective devices
- Modified sterile technique
- Midline vertical or modified Joel-Cohen abdominal incision
- Vertical uterine incision
- Dry and warm infant
- Pack uterus, remove lateral tilt, continue CPR
- Repair anatomically, when stable
Amniotic Fluid Embolism (AFE)

- Occurs in one of 20,000 pregnancies
- Maternal mortality historically as high as 85 percent
  - 26.4 percent with ICU management
- Risk factors:
  - Multiparity
  - Tumultuous labor
  - Abruption
  - Intrauterine fetal demise
  - Oxytocin hyperstimulation
Clinical Presentation of AFE

- Restlessness
- Nausea, vomiting
- Respiratory distress
- Cyanosis
- Seizures
- DIC
- Unexpected cardiovascular collapse
- Coma
- Death

Progression can be very rapid
Diagnosis of AFE

- Clinical diagnosis based on symptoms
- Differential diagnosis
  - Massive pulmonary embolism
  - Bilateral pneumothorax
  - Myocardial infarction
  - Uterine rupture or inversion
  - Septic shock
  - Eclampsia
- Stat labs
  - CBC, ABGs, electrolytes, glucose, BUN, creatinine coagulation studies, cardiac enzymes, blood/urine culture, urine protein, lactate, liver function tests, uric acid
Automobile Accidents

- Seatbelt use
  - Declines in pregnancy
  - In pregnancy decreases severe injury/death by 50 percent

- Proper seat belt positioning
  - Lap belt below abdomen and across anterior superior iliac spines
  - Shoulder belt between breasts

- Airbag deployment not associated with increased maternal or fetal injury
Discharge After Blunt Trauma

- Monitor for contractions if EGA > 20 weeks
  - If < six per hour, monitor four to six hours then discharge
  - If ≥ six per hour, monitor 24 hours then discontinue
- Discharge criteria:
  - Resolution of contractions
  - Category I fetal heart rate tracing
  - Intact membranes
  - No uterine tenderness or vaginal bleeding
Postpartum Hemorrhage

- Definition
  - Blood loss > 500 mL or signs/symptoms of hypovolemia
    - decreased blood pressure and urine output
    - increased pulse and respiratory rate
    - pallor, dizziness, or altered mental status

- Severe postpartum hemorrhage
  - Blood loss > 1000 mL

- Prepare for PPH at every delivery
Prevention of Postpartum Hemorrhage:

Active Management of Third Stage of Labor (AMTSL)

• Oxytocin 10 IU IM (or IV in solution)
  ✤ With or soon after delivery
  ✤ More effective than misoprostol

• Continuous, controlled cord traction
  ✤ One to three minute delay in cord clamping does not increase risk of PPH or adverse neonatal outcomes

• Uterine massage after placenta delivers
Cord Traction

Brandt Maneuver
Management of Postpartum Hemorrhage

**Resuscitation**

**Active Management Third Stage**
- Oxytocin after shoulder
- Cut cord one to three minutes, controlled traction
- Uterine massage after placenta

**POSTPARTUM HEMORRHAGE**

**Blood loss > 500 ml, brisk bleeding**
- BP falling, HR rising, or symptoms

**Blood loss > 1000 ml**: Severe PPH
- Transfuse RBC’s, platelets, clotting factors
- Consult anesthesia, surgery

**Blood loss > 1500 ml**: Institute massive transfusion protocol
- Uterine packing
- Balloon tamponade
- Vessel embolization/ligation
- Compression sutures
- Recombinant factor Vlla
- Support BP with vasopressors
- Consider intensive care unit
- Hysterectomy

**Resuscitation**
- Two large bore IVs and oxygen
- Monitor BP, HR, urine output
- CBC, type and cross
Management of Postpartum Hemorrhage

Determine the Cause

THE FOUR T’s

**TONES**
- Soft “boggy” Uterus
  - 70 percent

**TRAUMA**
- Laceration
- Inversion
  - 20 percent

**TISSUE**
- Retained placenta
  - 10 percent

**THROMBIN**
- Blood not clotting
  - 1 percent

**Oxytocin**: 20 IU/L, infuse
- 500 ml in 10 minutes then 250 ml/hr

**Carboprost**: 0.25 mg IM or into the myometrium

**Misoprostol**: 800 mg SL, PO, or PR

**Methylergonovine**: 0.2 mg IM

**Ergometrine**: 0.5 mg IM

* See text for dosing options

**Suture lacerations**
- Drain expanding hematoma
- Replace inverted uterus

**Inspect placenta**
- Explore uterus
- Manual removal of placenta
- Curettage

**Observe clotting**
- Check coags
- Replace factors
- Fresh frozen plasma

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Uterine Massage

Bimanual uterine compression and massage
Insertion of Uterine Tamponade Balloon
**Tone – Uterine Atony**

- Most common cause of PPH
- Initial step
  - Trans-abdominal uterine massage
  - Bimanual massage for severe hemorrhage
- Oxytotic agents
  - Oxytocin
  - Prostaglandins
  - Methylergonovine
Oxytocin  Pitocin®, Syntocinon®

- **Dose**
  - **IV:** 20 IU per liter NS
    - 500 ml in 10 minutes, then 250 ml/hr
    - Can increase rate of infusion or concentration (40 to 80 IU per liter NS if needed)
  - **IM:** 10 to 20 IU

- **Contraindications**
  - None

- **Caution**
  - Overdose or prolonged use can cause water intoxication
Carboprost  Hemabate®, Prostaglandin F-2 α analog

• Dose
  ✦ 0.25 mg IM or into myometrium every 15 to 90 min
  ✦ Maximum dose of 2 mg

• Contraindications
  ✦ Active pulmonary, renal, hepatic, or cardiac disease

• Side effects
  ✦ Diarrhea and vomiting common
Misoprostol  Cytotec® Prostaglandin E1 analog

- Dose:
  - Treatment: 600 to 800 mcg PO/SL or 800 to 1000 mcg PR
  - Sublingual preferred in acute PPH due to faster onset (SL > oral > rectal), although increased side effects
  - Prevention: 600 mcg orally after delivery

- Contraindications: None

- Side effects
  - Pyrexia, shivering, diarrhea, nausea, abdominal pain

- Advantages: Inexpensive, easy to store

- Disadvantages: Oxytocin is more effective and is the preferred drug if available
Methylergonovine

- **Dose**
  - 0.2 mg IM
  - May repeat every two to four hours

- **Contraindications**
  - Hypertension and pre-eclampsia

- **Side effects**
  - Nausea, vomiting, hypotension
Trauma

- Lacerations
- Hematoma
- Inversion
- Rupture
Cervical Laceration
Vulvar Hematoma
Uterine Inversion

- Rare
  - Important to recognize quickly
- Suspect if shock disproportionate to blood loss
- Replace uterus immediately
- Watch for vasovagal reflex
Uterine Inversion: Recognition
Uterine Inversion: Replace Through Cervix
Uterine Inversion: Restitution
Tissue

- Examine placenta/membranes
- Diagnosis of exclusion after addressing Tone and Trauma
- Placenta may be invasive
  - Accreta, Increta, Percreta
  - If known invasion, deliver in facility with blood bank, surgical capabilities
- Adequate analgesia if exploration needed
Manual Extraction

- Digital exploration of the uterus
- Removal of retained membranes and placental fragments
- Use analgesia
word Fragments should not be capitalized

delete the words "unless severe PPH"

AEE1, 11/18/2013
Thrombin -- Etiologies

• Pre-eclampsia, HELLP syndrome
• ITP, TTP, von Willebrand’s, hemophilia
• Medications (aspirin, heparin)
• Disseminated intravascular coagulation
  ✦ Excessive bleeding (consumption)
  ✦ Amniotic fluid embolism
  ✦ Sepsis
  ✦ Placental abruption
  ✦ Prolonged retention of fetal demise
Management of Coagulopathy

- Treat underlying disease process
- Serially evaluate coagulation status
- Replace appropriate blood components
- Support intravascular volume
- Use massive transfusion protocol if blood loss > 1500 mL or ongoing and symptomatic
PPH Summary

- AMTSL should be used in every delivery
- Intervene before patients have symptoms or altered vital signs
- Initial response to PPH:
  - Team approach, call for help
  - Bimanual massage
  - Two large bore IVs, oxytocin
- “4 T’s” mnemonic for the causes of PPH: Tone, Trauma, Tissue, Thrombin
THE BRASSS-V DRAPE
A low cost calibrated plastic blood collection drape.
Measuring Blood Loss in PPH

<table>
<thead>
<tr>
<th>Blood Loss (n = 434)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean ± SE</strong></td>
</tr>
<tr>
<td><strong>Range</strong></td>
</tr>
<tr>
<td><strong>Median</strong></td>
</tr>
<tr>
<td><strong>Mode</strong></td>
</tr>
<tr>
<td><strong>Acute PPH</strong></td>
</tr>
<tr>
<td><strong>Acute severe PPH</strong></td>
</tr>
</tbody>
</table>

Goudar, Eldavitch, Bellad, 2003
Advantages of Brasss-V

• Simple and practical
• Low cost: (Plastic)
• Accurate:
• Objective
• Can be used in a wide range of settings
• Provides a hygienic delivery surface
Stopping the Bleeding: Balloon Tamponade

- A balloon (inflated with saline/water) exerts pressure to stop bleeding from within the uterus in 5-15 mins.

- Is very effective (≥85%) when uterotonics fail. Can prevent need for laparotomy and hysterectomy. *(Reported success rates for the control and management of PPH with uterine tamponade are quite high and range between 70-100%)*

- Easy to use

- Can effectively be used in low resource settings

- Safer alternative to uterine packing
Commercially Available Balloon Tamponades in Use

- **Sengstaken–Blakemore**
  - $220 for two devices

- **Bakri**
  - $250 per device

- **Rusch hydrostatic**
  - $77 (quoted £50)

- **BT-CATH**
  - $200 per device

These commercially available devices are prohibitively expensive

Source: Georgiou C. Balloon tamponade in the management of postpartum haemorrhage: a review. BJOG 2009;116:748-757
The Innovative Condom Tamponade Unit

A condom still saves lives even during Childbirth!

Developed in Bangladesh by Ashkter and Team

The Condom /Catheters Unit can be assembled in a few minutes and cost of components is ≤ U.S.$5
Inflate Condom with water till no further bleeding is occurring (usually about 300-500 mls)

Apply clamp to keep water within Condom after inflation
The Condom Tamponade Emergency Pack
Preparing and using the Condom Tamponade
E.g. Protocol Guide

1. Place condom over balloon end of Foleys catheter

2. Using suture / string tie lower end of condom snugly below level of the balloon as shown. Tie should be tight enough to prevent leakage of water but should not strangulate catheter and prevent inflow of water into condom. Check for leakage by inflating ballon with about 20cc water.

3. Using an aseptic technique place the condom end high into uterine cavity by digital manipulation or with aid of speculum and forceps

4. Inflate CT by connecting open/outlet end of catheter to giving set connected to infusion bag or use clean water with aid of large syringe. (Will need to cut the giving set at level of yellow rubber to enable it fit into catheter)
New Intra-Operative Surgical Techniques

A variety of new intra-operative techniques are now available to effectively control bleeding from the uterus: They either act to produce tamponade by compressing the uterus and apposing its anterior and posterior walls or to effectively reduce blood flow to the uterus. These techniques include:

- **Uterine Compression sutures**: e.g.
  - B-Lynch Brace Sutures
  - Cho Sutures
  - Square sutures

- **Arterial ligation/pelvic devascularization**

- **Selective Arterial embolization (Uterine Artery)**

- **Use of Topical Haemostatic agents**
The B-Lynch Suture

Step 1: Using Absorbablearge suture.
In-out-over...In-out-over...In-out-tie

B-Lynch Suture #2

B-Lynch Suture #3

Modifications of this procedure are also available:
Example Suture is “fixed” by taking bites through Myometrium at the fundus
UTERINE COMPRESSION SUTURES

• SQUARE

Multiple square sutures are Passed intramurally and tied at Various points.

• VERTICAL

A Straight needle is passed anterior to posterior and passed over fundus and ligated anteriorly.

The Compression Sutures

**Advantages:**
- Preserves future fertility and menstrual function
- Simple and quick to perform

**Disadvantages**
- Uterine wall ischaemia / Necrosis
Selective Artery Embolisation

• Evolved from other angiographic embolisation techniques (Since 30 Years)

• Gelatin Sponges are injected into the bleeding vessel until stasis of flow in target vessel is achieved. Access is gained via femorals to internal iliac and subsequently the uterine arteries
Selective Artery Embolisation

Advantages
Preserves Fertility
Useful in Haemorrhage associated with Placenta praevia

Disadvantages
• Requires 24hr availability of radiological expertise.
• Patients must be stable
• Complications include: Necrosis of uterine wall, contrast adverse effects, local haematoma formation
## Success rates of the new Technological measures in the management of PPH

<table>
<thead>
<tr>
<th>Method</th>
<th>Number of Cases</th>
<th>Success Rates (%)</th>
<th>95% CI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Lynch/compression sutures</td>
<td>108</td>
<td>91.7</td>
<td>84.9–95.5</td>
</tr>
<tr>
<td>Arterial embolization</td>
<td>193</td>
<td>90.7</td>
<td>85.7–94.0</td>
</tr>
<tr>
<td>Arterial ligation/pelvic devascularization</td>
<td>501</td>
<td>84.6</td>
<td>81.2–87.5</td>
</tr>
<tr>
<td>Uterine balloon tamponade</td>
<td>162</td>
<td>84.0</td>
<td>77.5–88.8</td>
</tr>
</tbody>
</table>

There was no statistically significant difference between the four groups ($P = 0.06$).
Non-Pneumatic Anti-Shock Garment (NASG)

• NASG is a simple device that counteracts shock and decreases blood loss by applying direct counter pressure to the lower parts of the body.

• Developed by NASA 20+ yrs ago

• Useful as a first aid tool that Keeps woman alive during prolonged transportation to reach help (CEOC).