MANAGEMENT OF OBSTETRIC EMERGENCIES

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*I have no conflicts to disclose*

LEARNING OBJECTIVES

At the conclusion of this activity, participants should be able to:

1. Identify conditions that lead to maternal hemorrhage and fetal distress.
2. Predict obstetric management techniques.
3. Internalize anesthetic management of maternal and fetal emergencies.

“If you can keep your head when all about you are losing theirs, it’s just possible you haven’t grasped the situation.”

Jean Kerr

Vigilance is great, but you have to remember that studies show the half-life of vigilance is about 15 minutes.

Author unknown

PREVENTABILITY

A comprehensive review of maternal deaths in a single state found that 40% could have been prevented.

- None of the deaths due to AFE or CVA were considered preventable.
- Almost all deaths due to hemorrhage or chronic disease were preventable.

Obstet Gynecol 2005;106:1228
**PREVENTABILITY**

Hemorrhage protocols on L&D can improve safety and reduce blood utilization by resolving bleeding at an earlier stage:
- Admission risk assessment
- Accurate measurement of blood loss
- Early use of uterotonic agents
- Early involvement of OB and anesthesia staff
- Transfusion of fixed ratios of products

Am J Obstet Gynecol 2011;205:368

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**HEMORRHAGE**

Antepartum: Placenta previa/accreta/percreta
- Placental abruption
- Uterine rupture

Postpartum: Uterine inversion
- Uterine atony
- Genital tract trauma

Hemorrhage causes 10% of maternal deaths in the U.S. and 35% worldwide.

Obstet Gynecol 2010;116:1302

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**PLACENTA PREVIA, ACCRETA, and PERCRETA**

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**Risk Factors in Obstetric Patients for Transfusion vs. No Transfusion**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
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<tbody>
<tr>
<td>Placenta accreta / placenta percreta</td>
<td>∞</td>
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<tr>
<td>Placenta previa</td>
<td>34</td>
</tr>
<tr>
<td>Placental abruption</td>
<td>16</td>
</tr>
<tr>
<td>Intrauterine fetal demise</td>
<td>8</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>7</td>
</tr>
<tr>
<td>Preeclampsia/eclampsia</td>
<td>7</td>
</tr>
<tr>
<td>Multiple gestation</td>
<td>6</td>
</tr>
<tr>
<td>Magnesium therapy</td>
<td>3</td>
</tr>
</tbody>
</table>

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“Lots of people confuse destiny with bad management.” Kin Hubbard

To avoid “bad management”, we should know:
- Risk factors
- Diagnostic criteria
- Obstetric management
- Anesthetic management
PATIENT RISK FACTORS FOR ABNORMAL PLACENTATION

Uterine fibroids
Prior cesarean section
History of postpartum hemorrhage
Multiparity

MAJOR RISK FACTOR:
PREVIOUS CESAREAN DELIVERY + PLACENTA PREVIA

<table>
<thead>
<tr>
<th>Number of Prior C/S</th>
<th>% With Accreta</th>
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<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>61</td>
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<td>4</td>
<td>67</td>
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</table>

Obstet Gynecol 2006;107:1226

PREVIA AND PREVIOUS C/S

When a placenta previa is present, what is the association between the number of prior cesarean deliveries and morbidity?
Morbidity in the mother increases by:
RR 1.9 with 1 prior C/S,
RR 9.6 with 2 prior C/S, and
RR 33.6 with ≥ 3

• Morbidity in the newborn was unaffected.
Obstet Gynecol 2007;110:1249

DIAGNOSIS

Placenta Previa
• Painless, bright red vaginal bleeding
• Ultrasound for location of placenta

Accreta/Percreta
• Antepartum: suspicious ultrasound (specific signs) → MRI (degree of invasion)
• At delivery: placenta does not separate

OB MANAGEMENT

Placenta Previa
• Cesarean delivery: elective (if stable) or urgent (if hemorrhaging)

Accreta/Percreta
• Scheduled cesarean hysterectomy
• Multi-disciplinary preop care conference
• May need surgeons with experience in bowel or urological surgery for percreta

OB MANAGEMENT

• At the time of delivery, if extensive placenta accreta is documented, the obstetrician can opt to leave the placenta in situ.
• Conservative therapy reduces hysterectomy from 85→15%, DIC from 39→5% and transfusion by half, but requires close follow-up for increased risk of infection.
• Methotrexate may be used for involution.
Obstet Gynecol 2004;104:531
ANESTHETIC MANAGEMENT FOR PREVIA

- Examine the airway in case emergent GETA is required and provide aspiration prophylaxis.
- Ask OB about involvement with any previous cesarean scar on ultrasound (risk of accreta).
- Consider a second large-bore IV line and have fluid warmers (Level I) available.
- Assure that blood is type and cross-matched.
- What type of anesthetic?

A review of 514 women with placenta previa found:
- No difference between general or regional anesthesia in anesthetic or operative complications.
- General anesthesia was associated with higher EBL and transfusion and lower postop Hgb.
- Greatest risk factor for hysterectomy was prior C/S.

Am J Obstet Gynecol 1999;180:1432

ANESTHETIC MANAGEMENT FOR PREVIA

A retrospective review of 350 consecutive cases of placenta previa (60% using regional anesthesia, 40% using GETA) found:
- ↓ EBL with regional vs. GETA
- ↓ transfusion with regional
- No difference in incidence of hypotension
- Two spinals were converted to GETA 2° C-hyst
- Two GETA patients had thrombotic ex

Br J Anaesth 2000;84:725

ANESTHETIC MANAGEMENT FOR ACCRETA, PERCReTA

- Look for risk factors preop (hx C/S, previa).
- Type of anesthetic? Consider duration, blood loss, availability of help.
- If recognized at delivery, get additional IV access, pressure/warming systems, and blood products into the operating room.
- Have pressors and invasive monitoring capability available.

FIBRINOGEN & PPH

- Low fibrinogen level in early PPH predicts transfusion ≥ 4 PRBC and/or Hgb ↓ 4 g/dL
- Fibrinogen ≤ 2 g/L has a positive predictive value of 100% for severe PPH.
- For each 1 g/L decrease, risk of severe PPH significantly increases (OR 2.6).
- FFP has 2.0 g/L, cryoprecipitate has 3.8 g/L
- Tranexamic acid has not proven effective.


TRANSFUSION IN PPH

Is an ↑ FFP:RBC transfusion ratio of benefit in severe PPH?
- 4-year review of 142 severe PPH cases (1.1% of all deliveries)
- High FFP:RBC transfusion ratio was associated with lower odds of needing advanced interventional procedures – embolization, B-Lynch suture, hysterectomy

Anest Analg 2013; 116: 155
**USE OF CELL SALVAGE**

- Use a leukocyte depletion filter to remove particulate and bacterial contaminants; it cannot clear all fetal cells.
- Use a separate suction device after delivery.
- Cell salvage may decrease the incidence of infectious and non-infectious complications of banked blood transfusion.
- "...no single serious complication leading to poor maternal outcome has been directly attributed to use of cell salvage”
- Supported by national bodies in U.S. and Britain.

*Anaesth Int Care* 2010;38:492

**CELL SALVAGE FOR AFE**

Case report: Healthy G6P2 having semi-elective cesarean with spinal anesthesia for twins complained of chest pressure, became apneic and unresponsive with no BP. She stabilized after CPR and transfusion → cell salvaged blood became available but immediately after infusion → profound ↓ BP and ↓ O2 saturations → further resuscitation and rFactor VII to stabilize.

- Should we avoid cell-salvage in cases of AFE?

*Anesth Analg* 2013; 117: 449

**INTERVENTIONAL RADIOLOGY**

A Jehovah’s Witness patient presented with placenta percreta invading the bladder. After uterine and iliac catheters were placed in IR, cesarean was performed. Placenta was extensively adherent to uterus and penetrating bladder wall. Uterine artery embolization was performed and the placenta left in place. At 3 months the uterus was empty by ultrasound. Methotrexate was considered but not necessary.

*Obstet Gynecol* 2005;105:1247

**INTERVENTIONAL RADIOLOGY**

This case report of a Jehovah’s Witness parturient with placenta accreta describes use of IR as part of multi-modal management that includes:

- Optimize Hct with iron and erythropoieten.
- Place IR balloon catheters prior to the O.R.
- Plan immediate hysterectomy and inflate balloons if blood loss is excessive.
- Have cell saver capability if patient accepts.


**PLACENTAL ABRUPTION**

**RISK FACTORS FOR ABRUPTION**

- Hypertension, chronic or pregnancy-induced
- Age > 35 years
- Multiparity
- Smoking
- Cocaine use
- Abdominal trauma
- Premature rupture of membranes
- Hx of previous abruption
**DIAGNOSIS OF ABRUPTION**

- Vaginal bleeding with abdominal pain
- Uterine hypertonicity
- Fetal distress
- Retroplacental clot on ultrasound

The presentation can be quite variable and difficult to diagnosis.

**OB MANAGEMENT OF ABRUPTION**

- Evaluate maternal stability (vital signs, coagulation studies)
- Evaluate fetal well-being and maturity
  
  THEN...

- If severe fetal distress and/or maternal instability → urgent cesarean section
- If stable mother and fetus → induction of labor and vaginal delivery

**ANESTHETIC MANAGEMENT OF ABRUPTION**

- Assure large-bore IV access and blood availability.
- Regional techniques are appropriate if maternal volume status and coags normal.
- If GETA is indicated, consider induction with etomidate or ketamine.
- Have several oxytocics available for treatment of uterine atony.

**OXYTOCIC CHOICES**

<table>
<thead>
<tr>
<th>DRUG &amp; DOSE</th>
<th>SIDE EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitocin® 20-80 U/L infusion (oxytocin)</td>
<td>Vasodilation when given as an IV bolus, hyponatremia</td>
</tr>
<tr>
<td>Methergine® 0.2 mg IM (methylergonovine)</td>
<td>Diffuse vasoconstriction, pulmonary and systemic HTN, coronary vasospasm, nausea</td>
</tr>
<tr>
<td>Hemabate® 0.25 mg IM (prostaglandin F2α)</td>
<td>Bronchospasm, pulmonary HTN, hypoxia, nausea, diarrhea</td>
</tr>
<tr>
<td>Cytotec® (200-800 mcg) PR, PO (misoprostol)</td>
<td>Fever at high doses, GI upset</td>
</tr>
</tbody>
</table>

**OXYTOCIN**

- 40 women for elective cesarean were randomized to IV oxytocin 10 U or IV methergine 0.2 mg. Ten non-pregnant, non-anesthetized volunteers also received 10 units IV oxytocin.
- Surprisingly, methergine produced only mild HTN (MAP 91→102).
- In parturients and volunteers, oxytocin produced ↑ HR (28-52 beats), ↓ MAP (30 mmHg) and ST segment changes accompanied by chest pain.
- Don’t use oxytocin as an IV bolus!
  
  Br J Anaesth 2008;100:683
MISOPROSTOL (CYTOTEC®)

- A synthetic PGE₁ analog originally approved in the U.S. for prevention of gastric ulcers.
- It has advantages over other prostaglandins:
  - Less expensive
  - Easier to store, stable at room temperature
  - Rare side effects except at high doses
- Repeated intra-vaginal or sublingual doses of 25 mcg are given for induction of labor.
- Much higher doses (200-800 mcg) are used for termination of pregnancy or postpartum hemorrhage.

UTERINE RUPTURE

RISK FACTORS FOR UTERINE RUPTURE

Previous uterine surgery such as cesarean or myomectomy now account for only 50% of ruptures
Abdominal trauma – seat belt, fall
Uterine trauma - forceps, curettage
Grand multiparity
Fetal macrosomia or malposition

ACOG GUIDELINES FOR VAGINAL BIRTH AFTER CESAREAN (VBAC)

- Uterine rupture occurs in 1% of LCT uterine incisions and 4-9% of classical.
- To encourage more patients to attempt VBAC, ACOG revised their practice guidelines to be less restrictive: “Respect for patient autonomy supports that patients should be allowed to accept increased levels of risk…”

Obstet Gynecol 2010;115:450

DIAGNOSIS OF UTERINE RUPTURE

- Fetal distress (1)
- Shoulder pain
- Cessation of uterine contractions on an IUPC
- Vaginal bleeding
- Abdominal pain
- Ultrasound measurement of lower uterine segment thickness, <2.3 mm is associated with a higher risk of complete uterine rupture.

Am J Obstet Gynecol 2009;201:320

MANAGEMENT OF UTERINE RUPTURE

- Obstetricians must decide on repair versus hysterectomy.
- Anesthetic management depends on ease of repair, but be prepared for GETA, invasive monitoring, warming, transfusion, and volume replacement.
A 34-year-old woman with seven previous cesarean deliveries and a history of scant prenatal care presented at 32 weeks of gestation with constant, vague lower abdominal pain that had worsened over the past day. A CT scan was done.

UTERINE INVERSION

Risk Factors: Inappropriate fundal pressure
Excessive traction on the cord

Diagnosis: Perineal or vaginal mass
Massive hemorrhage
Shock and hypotension

ANESTHETIC MANAGEMENT OF INVERSION

• Uterine relaxation:
  NTG (50-500 µg), terbutaline, GETA
• Analgesia:
  Pre-existing epidural, ketamine, GETA
• Volume resuscitation
• Uterine contraction with oxytocics once the uterus is replaced

NITROGLYCERIN

Pros: Rapid onset, short duration
Minimal side effects (HA, ↓ BP)
Clinically effective

Cons: Mechanism?
Dose? Reported 50-1500µg
Requires dilution
UTERINE ATONY:
Accounts for 80% of all PPH.

RISK FACTORS FOR UTERINE ATONY
- Multiple gestation
- Macrosomia
- Polyhydramnios
- Grand multiparity (>5)
- Maternal age > 40
- Volatile anesthetics
- Exposure to oxytocin
- Chorioamnionitis
- Tocolytic agents
- Previous PPH

But...> 60% have no risk factors.
Anesth Analg 2010;110:1368

PREDICTING SEVERE PPH
Predictors for severe postpartum hemorrhage:
- Delay in manual exam of the uterus > 20 min
- Delay in administration of oxytocin > 10 min
- Delay in calling for add’l help from OB and anesthesiology > 10 minutes
- Epidural analgesia was protective; perhaps by facilitating exam and uterine massage?
Obstet Gynecol 2011;117:21

OB MANAGEMENT OF UTERINE ATONY
- Bimanual uterine compression and massage
- Infusion of oxytocin
- Evaluation for retained placenta
- Use of other oxytocics
UTERINE COMPRESSION SUTURES

A review of 28 patients who had uterine compression sutures (B-Lynch suture) placed to control hemorrhage due to uterine atony found 82% avoided hysterectomy and 7 had subsequent uncomplicated term pregnancies.

Obstet Gynecol 2007;110:68

ANESTHETIC MANAGEMENT OF ATONY

1. Volume resuscitation: large bore IVs, T&C, fluid warmers, invasive monitors
2. Analgesia: pre-existing epidural, ketamine, GETA
3. Oxytocics: know their side effects!
5. Consider notifying Interventional Radiology, obtaining Factor VIIa (NovoSeven®).

RECOMBINANT FACTOR VII

Results from a registry of 110 cases using rFVIIa to treat postpartum hemorrhage found:
• 83% had received > 5 U PRBC before rFVIIa.
• Median dose was 92 μg/kg (high?).
• 64% responded to the first dose, 76% overall.
• 91% were alive at 28 days.
• There were 2 thromboembolic events (DVT, PE).
• Must normalize temperature, base deficit, calcium and factors as much as possible prior to use.

Anesth Analg 2009;109:1908

FETAL DISTRESS

rFACTOR VIIa
• During AFE, high circulating tissue factor concentrations can combine with VIIa to form intravascular clots.
• A review of 44 cases of AFE compared those who received VIIa to those who did not.
• Death or permanent disability were more common when VIIa was given (RR 2.2) compared to full recovery.

Anesthesiology 2011;115:1201
CAUSES OF NON-REASSURING FETAL HEART TONES IN LABOR

- Umbilical cord prolapse
- Umbilical cord compression → variable decelerations
- Uteroplacental insufficiency → late decelerations
- Fetal head compression → early decelerations

WHAT IS FETAL DISTRESS?

Obstetricians now use the term non-reassuring fetal heart tones (NRFHT) followed by a further description of the findings (eg, deep variable decelerations) because:

- The term “fetal distress” is imprecise.
- Fetal monitoring has a low predictive value of neonatal outcome (99% false positive!).
- “Birth asphyxia” is nonspecific and should not be used for medicolegal reasons.

Obstet Gynecol 2005;106:1469

NEW TERMINOLOGY

ACOG and NICHD produced new guidelines on terminology for monitoring fetal heart rate.

- Category I = normal, no intervention needed.
- Category II = needs close observation.
- Category III = abnormal and predictive of fetal acidosis. Delivery should be expedited.
- Definition of Category III: a sinusoidal pattern, absent variability and either recurrent late decels, recurrent variable decels or bradycardia.

Obstet Gynecol 2009;114:192

NORMAL UMBILICAL CORD BLOOD GASES

<table>
<thead>
<tr>
<th></th>
<th>VEIN</th>
<th>ARTERY</th>
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</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.34</td>
<td>7.28</td>
</tr>
<tr>
<td>PO₂</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>PCO₂</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>Base deficit</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

INTERPRETATION OF UMBILICAL CORD GASES

PREDICTIVE VALUE OF CORD GASES

The threshold for pH and base deficit that predict adverse neonatal sequelae:
- pH < 7.0
- Base deficit ≥ 12 mmol/L

The metabolic component (base deficit) is the most important variable associated with subsequent neonatal morbidity and encephalopathy.
**PREDICTIVE VALUE OF CORD GASES**

*ACOG Committee Opinion, November 2006:*

Moderate and severe newborn encephalopathy and respiratory complications...increase with an umbilical arterial base deficit of 12-16 mmol/L.

Moderate or severe newborn complications occur in 10% of neonates who have this level of acidemia and the rate increases to 40% in neonates who have an umbilical arterial base deficit greater than 16 mmol/L.”

*Obstet Gynecol* 2006;108:1319

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**CLOSED CLAIMS ANALYSIS**

An analysis of claims for newborn brain injury from the ASA Closed Claims Project database found that anesthesia might have contributed in ~30%:

- 50% some delay by anesthesia was alleged.
- 17% maternal condition was involved.
- 8% poor communication contributed.

*Anesthesiology* 2009;110:131

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**OBSTETRIC MANAGEMENT OF NRFHT**

Initiate attempts at intrauterine resuscitation:

- Change maternal position.
- Administer supplemental oxygen.
- Maintain/improve maternal circulation.
- Give a tocolytic for hypertonicity.
- Start an intrauterine infusion to relieve cord compression.

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**UMBILICAL CORD COMPRESSION**

Variable decelerations vary in duration, depth and shape from contraction to contraction.

They are often associated with decreased amniotic fluid: oligohydramnios, ruptured membranes.

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**OBSTETRIC MANAGEMENT OF CORD COMPRESSION**

- Change maternal position.
- Stop oxytocin if in use.
- Begin amnio-infusion to increase fluid.
- Use fetal scalp stimulation or sampling to assess well-being.

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*Obstet Gynecol* 2010;116:1232
**ANESTHETIC MANAGEMENT OF CORD COMPRESSION**

Anticipate need for expedited delivery
- Perform a preop evaluation.
- Consider aspiration prophylaxis.
- Place an epidural catheter or “optimize” if epidural in place.
- Treat hypotension if indicated.

**UTEROPLACENTAL INSUFFICIENCY**

Late decelerations begin after the onset of the contraction and end after the contraction is over.

Uteroplacental insufficiency may be associated with:
- Postdates gestation
- Hypertension
- Diabetes
- Intrauterine growth retardation
- Abruptio placentae

**MANAGEMENT**

- Improve oxygen delivery to fetus
  - Maternal O₂ supplementation
  - Lateral position
  - Stop oxytocin and consider a tocolytic
  - Expedite delivery
- Consider aspiration prophylaxis and early placement of an epidural catheter.
- General vs. regional anesthesia for cesarean section depends on urgency.

**CONCLUSIONS**

- Anticipate problems!
- Cultivate a good relationship and communicate with your obstetricians.
- Be available and prepared:
  - An emergency O.R. is always set up
  - Transfusion and monitoring capability
  - Flexible anesthetic plan