Antepartum Hemorrhage

*Placenta Previa*

*Placenta Acreta*

*Placenta Abruptio*

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Disclosures

- I have no financial relationships with any commercial interests
- No relevant financial relationships exist
Objectives

- Discuss **abnormal conditions** that increase a pregnant woman’s risk for hemorrhage
- Review the **physiological changes** of pregnancy that **mask** the severity of hemorrhage
- Describe the importance of **multidisciplinary care teams** aimed to provide comprehensive care
- List the **hemorrhage bundle** elements aimed to prevent hemorrhage and minimize maternal morbidity and death
Placenta Anatomy and Physiology: Temporary – Time Limited – Disposable – Shared

- Circulation by 17\textsuperscript{th} day of gestation
- Placenta completely develops and functions by 10\textsuperscript{th} week but continues forming until the end of the 16\textsuperscript{th} week of gestation.
- 3 weeks after fertilization, small projections appear and form the chorionic villi.
- These villi erode the walls of the maternal blood vessels and open sinuses where maternal blood pools.
- It is a temporary endocrine organ and has a blood flow of 1000 mL per minute.
Placenta Anatomy and Physiology

- The maternal surface has **15-20 cotyledons** each containing major branches of the umbilical blood vessels.

- The **villi** hang in the **intervillous space** inside the uterine wall that is filled with mom’s blood. This is where the exchange of nutrients, oxygen, and waste products occur.

- It serves as an organ for **respiration, nutrition, excretion**, and protection as well as secreting **hormones** to stabilize pregnancy.
(Normal) Placenta “Stats” at Term

- Weight: 400-470 gm
- Diameter: 20-22 cm
- Thickness: 2.5 cm
- Umbilical cord length: 49-52 cm
- Umbilical cord thickness: 2.5 cm

stethnews.com
Abnormal Placentas

- Abnormal structures
- Abnormal shapes
- Placental malperfusions
- Extrachorialis placentas
- Infarcts/Calcifications
- Accreta family of abnormalities
Placental Abruption

- Premature separation of a normally implanted placenta
- Occurs in 1% of all births
- Abruption is a leading cause of antepartum hemorrhage
Placental Abruption

- Abruption can be occult or visible
- Abruption of more than 50% of the placenta is associated with fetal death
Abruption: Grading

0  Asymptomatic – a small clot is discovered

1  Vaginal bleeding, uterine tetany & tenderness possible, no signs of maternal shock or fetal distress

2  External vaginal bleeding may or may not be present, no signs of maternal shock, signs of fetal distress present

3  External bleeding may not be present. Marked uterine tetany, persistent abdominal pain, maternal shock and fetal demise present

Coagulopathy possible in up to 30% of cases

Konje JC, & Taylor DJ, High risk pregnancy 2000
Risk Factors for Placental Abruption

- Prior abruption
- Smoking
- Cocaine use
- Trauma
- Hypertension

- Thrombophilias
- AMA
- PPROM
- Intrauterine infections
- Hydramnios (>2,000 ml)
Clinical Presentation of Placental Abruption

- What are the two hallmark signs and symptoms of placental abruption?
Diagnosis of Placental Abruption

- Diagnosis is generally clinical
- U/S may or may not be helpful depending on the extent of the abruption and duration
  - An acute retroplacental or preplacental hemorrhage may not be detected on U/S
  - **If** abruption is not detected on U/S → it may be there
  - **If** abruption is detected on U/S → it’s diagnostic
Management of Placental Abruption

- Management based on **fetal status** and **labor status**

- Initial evaluation should include:
  - Kleihauer-Betke Test?
    - if RH negative → administer RhoGAM
  - Continuous fetal monitoring
  - Large bore IV, Type and crossmatch
  - Foley catheter??

- If the etiology is not trauma or cocaine, watch B/P, **pre-eclampsia** is the next leading cause of abruption
Fetal Monitoring
Fetal Monitoring


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Chronic vs Traumatic Abruption

library.med.utah.edu

neundimension.tistory.com
Vasa Previa
Vasa Previa

- Rare, potentially catastrophic complication.
- Often associated with a velamentous insertion of the umbilical cord.
- Fetal vessels run through the fetal membranes.
- Vessels are at risk of rupture with consequent fetal exsanguination.
- Affects 1:1,300 to 8,300 pregnancies.
Yikes!

midwifemuse.wordpress.com
Velamentous Insertion
Placenta Previa

- Placenta previa refers to the presence of placental tissue overlying or proximate to the internal cervical os

- The main complication of placenta previa is bleeding

- Several forms of the disorder have been described

Sakornbut E 2007
Types of Placenta Previa

All of these are considered placenta previa
Placenta Previa

www.pregmed.org
Risk Factors for Placenta Previa

- What is the biggest risk factor for placenta previa?
  - Number of prior cesarean sections –
  - Incidence is 10% after 4 or more C/S

- Additional independent risk factors include:
  - Smoking
  - Residence at higher altitudes
  - Male fetus
  - Multiple gestation
  - Hx of uterine curettage
  - AMA and multiparity
Clinical Manifestations of Placenta Previa

- **Painless** vaginal bleeding in 70 to 80% of patients
- Only **10 to 20%** of women present with uterine contractions associated with bleeding
- Initial bleed @ 34 weeks
- Emergent or Scheduled C/S @ 36 weeks
- Absence of abdominal pain and uterine contractions is the **distinguishing feature** between placenta previa and placenta abruptio

Sakornbut E 2007
Acute Care Woman with Symptomatic Placenta Previa (24-37 weeks)

- Admit to L&D
- Two IVs with large bore needle (16-18 gauge)
- Stabilize X24 hours if possible
  - NPO
  - Strict bedrest
  - Continuous FHR monitoring
  - Type and screen
  - RhoGAM if RH negative
  - Steroids
  - Tocolytics are controversial
Indications for Delivery

- An abnormal fetal heart rate tracing unresponsive to standard measures
- Life threatening refractory maternal hemorrhage
- Bleeding after 34 weeks in the presence of known or suspected fetal pulmonary maturity – consider delivery
- Individualized management
Placenta Accretta

- In placenta accreta, the placenta appears contiguous with the bladder wall

Miller DA et al 1997
Placenta Accreta

MRI Helps Detect Placenta Accreta

MRI shows placenta overlying the cervix, with irregular outer contour and an abnormal appearance, indicating uterine invasion.

MRI shows placenta overlying the cervix, with a normal, smooth outer contour. There is no evidence of uterine wall invasion.
**FIGURE 1** Ultrasound is an excellent screening test for accreta, with a sensitivity of 77%–93% and a specificity of 71%–91%.
Risk Factors for Placenta Accreta

- If placenta previa is present → 13% risk
- Placenta previa plus 1 prior C/S → 25-30%
- Placenta previa plus 1 ≥ 2 prior C/S → 50%

- Additional risk factors include: previous uterine surgery, previous D&C, previous multiple pregnancy, AMA, > 3 prior pregnancies

Placenta Accreta: Preparation and Delivery

- **Preplan**
  - Surgical consent
  - Labs – consider Fe Sucrose
  - Betamethasone at 33+ weeks

- Planned preterm cesarean hysterectomy – placenta in situ
- Interventional radiology, GYN/Onc surgical team
- MTP in OR
- Surgical instruments for a cesarean hysterectomy

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**BOX 3 PA EMERGENCY ORDER SET**

1. Contact the obstetric provider and labor and delivery manager for patient assessment and recommendations upon active vaginal bleeding. If physicians determine woman needs to have surgery, transport woman to the main OR.
2. Respond to deteriorating condition (breathing/circulation) and/or a full arrest.
3. Call specialty consults (trauma surgeon, anesthesia, urology, neonatologist, interventional radiology, and gynecology-oncology).
4. Response to woman needing blood:
   a. Call blood bank—Type and cross for 4 units. Have another 4 units on hold in blood bank.
   b. If no IV access already established, insert two 18-gauge peripheral IVs, one with blood tubing and normal saline.
   c. Call blood bank if a massive transfusion protocol needs to be activated per physician request (for every cross match: 1 unit of platelets, 1 unit of FFP, consider cryoprecipitate).
5. Call Main OR and speak to charge nurse (request hybrid room or room with C-arm capability).
   a. OR preop nurse/charge RN to confirm consents and conditions of admission signed.
   b. Call for cell saver perfusionist.
   c. Call for neonatal code cart.
   d. Have tranexamic acid and uterotonic available in OR.
6. Response to symptomatic hypotension:
   a. Lower head of bed to flat if position tolerated by woman.
   b. Initiate IV fluid bolus of 0.9% sodium chloride.
   c. Obtain a STAT hemoglobin and hematocrit.
7. Call NICU to bring Isolette to main OR.
8. Transfer woman to OR on an OR gurney with stimus.
9. Call pharmacy to obtain Factor VII if needed.

**Physician Signature**

Note. FFP = fresh frozen plasma; IV = intravenous; OB = obstetric; OR = operating room; PA = placenta accreta; preop = preoperative; RN = registered nurse; STAT = immediate.
C-hyst required for this woman. First pregnancy, no history of uterine surgery. Cesarean was for “failure to progress.” MD recognized issue, performed an unplanned C-hyst. Woman received only 2 units of blood products.
Kristin Terlizzi tells her story……

21 days later Kristen developed DIC and required emergency surgery to remove:
• placental tissue
• repair her bladder
• re-implant her ureter
• remove her uterus, cervix and appendix.

She hemorrhaged during surgery and required transfusion of 26 units of blood products

• Maternal death for women with placenta accreta can be as high as 1 in 16.
Because of the unpredictability of vaginal birth, I would prefer a scheduled cesarean section birth for myself or my partner.

- Develop and conduct inter-professional and inter-disciplinary education around the short- and long-term risks of cesareans.

- Patient/Family Support Bundle, Council on Patient Safety in Women’s Health Care

  - CMQCC Resource: Risk Considerations for Primary Cesarean

  - YouTube: Patient Story: Kristen Terlizzi
    https://www.youtube.com/watch?v=RMnQZUqQhjU
Uterine/Placental Issues

- Prior myomectomy or classical cesarean section: Deliver ~ 36-37 weeks
- Placenta previa: Deliver ~ 37 weeks
- Placenta accreta: Deliver ~ 34-35 weeks
- Vasa previa: Deliver ~ 35 weeks
Placental Abnormalities Antenatal Testing

- Placenta previa
  - Weekly at 32 weeks

- Vasa previa
  - Weekly at 32 weeks (unless admitted)
Background Information

- Mary Smith
- 22 yo G$_3$P$_0$ at 39 weeks
  - Transfer to clinic at 36 weeks
  - Breech presentation, declined version, desired primary cesarean
  - OB Hx significant for D&C X’s 2
    - 2$^{nd}$ trimester Molar Pregnancy 2 years prior
  - BMI = 55 (Class III)
  - She is a Jehovah's Witness and has a signed refusal of blood products
    - She had given specific permission to allow for intraoperative cell saver blood and human albumin
<table>
<thead>
<tr>
<th>Generally Refused</th>
<th>Possibly Accepted</th>
<th>Accepted</th>
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<tbody>
<tr>
<td>PRBC</td>
<td>Albumin</td>
<td>Crystalloid</td>
</tr>
<tr>
<td>FFP</td>
<td>Cryoprecipitate</td>
<td>Synthetic colloid</td>
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<tr>
<td>Platelets</td>
<td>Clotting factors</td>
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<tr>
<td>Autologous banked blood</td>
<td>Hemoglobin based blood substitutes</td>
<td>Gelatins</td>
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<tr>
<td></td>
<td>Cell salvage</td>
<td>DDAVP</td>
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<tr>
<td></td>
<td>Hemodilution</td>
<td>EPO-alpha</td>
</tr>
<tr>
<td></td>
<td>EPO-beta</td>
<td>Darbepoietin-alpha</td>
</tr>
<tr>
<td></td>
<td>Recombinant factors</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(e.g. VIII and IX, rVIIa)</td>
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</tbody>
</table>
Obstetric Mortality: Jehovah’s Witness

- Women who are Jehovah’s Witnesses have an estimated risk of 6 - 65 times increased risk for maternal death.
- 130 times increased for maternal death because of obstetric hemorrhage.

Possibly accepted for volume resuscitation

- Where are these items kept on your unit?
- How long will it take to get to the patient?
  - Specialized staff
  - Main operating room

Hextend hetastarch

Albumin

Cell salvage
Tranexamic acid (TXA)

- For women with established PPH
  - Not responsive to medications or treatments
  - Considered an adjunct treatment
  - Most effective if used within first 3 hours
  - Dose: 1 gram – infuse with piggyback normal saline
  - may repeat in 30 minutes if bleeding persists

Postoperative Course

- Transfer to ICU
- Extubated POD #2
- Weak but stable
- Hbg 6.3, Hct 19.7
  - Iron—IV (sucrose)
  - Rh-Erythropoeitin
  - Heparin
- Discharged home POD #8
Contributors to Patient Survival

- Availability of Cell Salvage
- Staff Communication in the OR
- Expert anesthesia staff to secure difficult airway and establish arterial line
- Obstetricians sequential use of procedures
- Ongoing assessment and evaluation of patient response to treatment
Jehovah’s Witness Blood Product and Technique Informed Consent/Decline Checklist

My signature below indicates that I request no blood derivatives other than the ones which I have designated in this consent be administered to me during this hospitalization. My attending physician, ________________M.D. has reviewed and fully explained to me, the risks and benefits of the following blood products and methods for alternative non-blood medical management and blood conservation available to me. My attending physician, ________________M.D. has also fully explained to me the potential risks associated by not authorizing blood and/or non-blood management during this hospitalization.

<table>
<thead>
<tr>
<th>COMPONENTS OF HUMAN BLOOD</th>
<th>ACCEPT</th>
<th>DO NOT ACCEPT</th>
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<tbody>
<tr>
<td>Red Blood Cells</td>
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<tr>
<td>Fresh Frozen Plasma</td>
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<td>Platelets</td>
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<tr>
<td>Cryoprecipitate</td>
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<td></td>
</tr>
<tr>
<td>Albumin</td>
<td></td>
<td></td>
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<tr>
<td>Plasma Protein Fraction</td>
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</table>

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<th>INTRAVENOUS FLUIDS WHICH ARE NOT COMPONENTS OF HUMAN BLOOD</th>
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<tr>
<td>Hetastarch</td>
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<tr>
<td>Balanced Salt Solutions</td>
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</table>

<table>
<thead>
<tr>
<th>MEDICATIONS WHICH CONTAIN A FRACTION OF HUMAN BLOOD</th>
<th>ACCEPT</th>
<th>DO NOT ACCEPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhogam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erythropoietin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Immunoglobulin</td>
<td></td>
<td></td>
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<tr>
<td>Tisseel</td>
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<thead>
<tr>
<th>TECHNIQUES FOR BLOOD CONSERVATION / PROCESSING</th>
<th>ACCEPT</th>
<th>DO NOT ACCEPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemodilution</td>
<td></td>
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<tr>
<td>Cell Saver</td>
<td></td>
<td></td>
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<tr>
<td>Autologous Banked Blood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiopulmonary Bypass</td>
<td></td>
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<tr>
<td>Chest Drainage Autotransfusion</td>
<td></td>
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<tr>
<td>Plasmapheresis</td>
<td></td>
<td></td>
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<tr>
<td>Hemodialysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
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ACOG defines OB hemorrhage as:
cumulative blood loss ≥1000 mL
accompanied by s/sx of hypovolemia within 24 hrs after birth (including intrapartum blood loss) regardless of mode of birth.

- Even with proper management can occur in
  - ~ 4% of vaginal births and ~ 6% of cesarean birth
  - As a result: 1/20 women will experience PPH

- Early or Primary (≤ 24 hr after birth)
  - Highest risk in the first hour after delivery because large venous areas are exposed after placental separation

- Late or Secondary (>24 hr to 6 weeks after)
  - Caused by infection, placental site subinvolution, retained placental fragments, or coagulopathies (DIC)

Etiologies of Obstetric Hemorrhage

**Antepartum**
- Uterine rupture
- Placental abruption
- Placenta Previa
- Vasa Previa

**Intrapartum**
- Uterine rupture
- Placental abruption

**Postpartum**
- Uterine atony
- Retained Placenta
- Lower genital tract lacerations (cervix, vagina, perineum)
- Upper genital tract lacerations (uterine rupture)
- Placenta accreta, increta, percreta
- Uterine inversion
- Inherited coagulopathy (Von Willebrand Disease)
- Acquired coagulopathy (abruption, AFE, retained dead fetus syndrome)
Hormones and Mediators

- Human Chorionic Gonadotropin
- Human Placental Lactogen
- Estrogen
- Progesterone
- Relaxin
- Prostaglandins
- Prolactin
Cardiovascular

Normal Cardiac Adaptation during Pregnancy

**Cardiac Changes**

**Stroke Volume**
- ↑ 30-50%

**Heart Rate**
- ↑ 20% (~10-20 beats)

**Anatomic Changes**
- ↑ Uterus

**Vascular Resistance**
- ↓ SVR  ↓ PVR

---

**Cardiac Output**

- Pregnant
- Weeks of gestation
- Postpartum
Hematologic
Normal Hematologic Events Associated with Pregnancy

Blood Volume Changes

**Total Volume**
- ↑ 35% (~ 2,000ml)

**Plasma Volume**
- ↑ 50% (~ 1,600ml)

**RBC Mass**
- ↑ 17% (~ 350mL)

- Plasma Volume
- Total Blood Volume
- Cardiac Output
- RBC Volume

% Change

Weeks of gestation:
- Pregnant
- 8, 12, 16, 20, 24, 28, 32, 36, 40
- Postpartum

UCSF Benioff Children's Hospitals
Hematologic continued:
Clotting Factors During Pregnancy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Change</th>
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<tbody>
<tr>
<td>Fibrin</td>
<td>Increases 40% at term</td>
</tr>
<tr>
<td>Plasma fibrinogen</td>
<td>Increases 50% (300 – 600) mg/dl</td>
</tr>
<tr>
<td>Coagulation factors I, VII, VIII, X, XII</td>
<td>Increases markedly</td>
</tr>
<tr>
<td>Von Willebrand factor antigen</td>
<td>Increases markedly</td>
</tr>
<tr>
<td>Coagulation factor XI</td>
<td>Decreases 60% - 70%</td>
</tr>
<tr>
<td>Coagulation factor XIII</td>
<td>Decreases slightly</td>
</tr>
<tr>
<td>Coagulation factors II, V</td>
<td>Increases slightly or unchanged</td>
</tr>
<tr>
<td>Protein S (anticoagulant) activity</td>
<td>Decreased</td>
</tr>
<tr>
<td>Clotting and bleeding time</td>
<td>Unchanged</td>
</tr>
<tr>
<td>Prothrombin time</td>
<td>Increases slightly or unchanged</td>
</tr>
<tr>
<td>Partial plasma thromboplastin time</td>
<td>Increases slightly or unchanged</td>
</tr>
<tr>
<td>Fibrin degradation products</td>
<td>Increased (D–Dimer increased)</td>
</tr>
<tr>
<td>Platelets</td>
<td>Unchanged (150 K – 500K)</td>
</tr>
</tbody>
</table>
Hematologic

Factors V, VII, VIII, IX, X, XII

Fibrinolysis

Fibrinogen

Prothrombin
**Primary Hemostasis**
Damage occurs to tissue or blood vessels
Platelets stick to damaged area and form a PRIMARY clot

**Secondary Hemostasis**
This involves: intrinsic
extrinsic
common pathway

https://www.youtube.com/watch?v=R8JMfbYW2p4
What is DIC?

- Underlying disorder
- Activates coagulation cascade
  - Blood clot formation
  - Coagulation factors become depleted
  - Results in uncontrolled bleeding
    - Death
Disseminated Intravascular Coagulation

Society on Thrombosis and Hemostasis defines “DIC as:

An *acquired* syndrome characterized by the *intravascular activation of coagulation* with loss of localization arising from different causes. It can originate from and cause damage to the *microvasculature* which if sufficiently severe can produce organ dysfunction.

- Accompany certain obstetrical conditions
- Varied clinical presentation and prognostic course
- An “effect“ of other disease processes
- Treatment will be focused on *removal of the causative agent*
Etiology of DIC

- Infection
- Cancer
- OB/Gyn Complications
OB Complications

Placental Tissue
After Birth

- Coagulation is initiated to prevent hemorrhage at placentation
- Platelet plugs and fibrin clots for to provide hemostasis
  - Fibrinogen and platelet counts decrease
If patient has been supine blood clots may have collected
• Push to express while supporting lower uterine segment
Bimanual Uterine Compression

• Obtain help!
  ▪ Second large-bore intravenous catheter.
  ▪ Begin blood transfusions. In an extreme emergency, type O Rh-negative.
  ▪ Explore the uterine cavity manually.
  ▪ Thoroughly inspect the cervix and vagina after adequate exposure.
  ▪ Insert a Foley catheter to monitor urine output.
Physiology Review: Hemostasis

Failure or deficiencies in any of the components can lead to varying degrees of uncontrolled hemorrhaging or clotting.

Primary components:

- Vascular endothelium
- Circulating platelets
- Circulating proteins
Vascular System: Blood Vessels

Daily Function

- Endothelium
  - Controls vessel permeability
  - Controls blood flow rate
    - vasoconstriction
  - Produces and releases substances that inhibit or stimulate platelets, coagulation, and fibrinolysis
Endothelium

Anatomy

- Endothelium
- Single layer of endothelial cells, lining vessels
- Coated by glycocalyx (protein and mucopolysaccarides)
- Protects basement membrane
- Negatively charged, repels circulating proteins and platelets
- Secretes substances to keep the blood vessel in a nonreactive environment
Vascular System
Anatomy of the blood vessels

- Subendothelium
  - Smooth muscle and connective tissue with collagen fibers
  - Basement membrane
    - Collagen – stimulates platelets
    - Tissue Factor (TF) – activates coagulation & fibrin formation
  - Connective tissue
    - Elastic fibers – provide support around vessels
Coagulation Cascade Pathway

The Role of Tissue Factor

- Tissue damage
- Tissue factor is released
  - Tissue factor is a protein found in tissue
  - Factor VII binds with Tissue factor
    - Signal factor X, thrombin,
Hemostatic Trigger

Once vessel damage occurs, action begins!

- Arteries and arterioles vasoconstrict
- Smooth muscle cells contract to reduce blood flow
- The endothelium becomes thrombogenic
  - Platelets and coagulation proteins are activated
  - VWF is secreted
  - Fibrinolysis initiated
Bone Marrow Stem Cells

- Proerythroblast
  - Polychromatic erythroblast
  - Erythrocytes
- Myeloblast
  - Progranulocyte
  - Granulocytes
  - Basophil
  - Eosinophil
  - Neutrophil
- Hemocytoplast
- Megakaryoblast
  - Megakaryocyte
  - Activated platelets
  - Platelets

Leukocytes
- Granulocytes
- Agranulocytes
- Lymphocyte
- Monocyte
Platelets: The 3A’s

- **Platelet Adhesion**
  - Injury
  - Platelets contact subendothelium
  - vWF
  - Fibrinogen
  - Platelets bind with subendothelium

- **Platelet Activation**
  - Adhere and activate
  - Change shape
  - Release proteins and coag factors
  - Localized vasoconstriction

- **Platelet Aggregation**
  - Platelet agonists attract more platelets
  - Activated platelets combine with adhered platelets
  - Thrombin
  - Fibrinogen
  - Platelet plug formed

- **Role of Platelets in Hemostasis**
The population we serve
Pathophysiology of DIC

1. **Disseminated Fibrin Thrombi**
   - Obstructed blood flow
   - End organ ischemia / necrosis

2. **Activation of kinin system**
   - Vascular permeability
   - Hypotension
   - Shock
Pathophysiology of DIC

3. Activation of the complement system
   - Red cell and platelet lysis
   - ↑ vascular permeability
   - Shock

4. Release of cytokines (IL 1 & 6) and TNF

5. Plasma-induced lysis of fibrin
   - FDP’s
   - Depletion of Coag factors
   - Hemorrhage and shock
Pathophysiology of Hypovolemic Shock

- Tissue hypoperfusion → metabolic acidosis → inflammatory mediators → tissue and vascular injury → multiple organ failure
The Nurse Detective
Etiology of DIC
Underlying OB conditions associated with DIC

- Intrauterine Fetal Demise: 25%
- Placental abruption: 37%
- PPH / Hypovolemia / MBT: 29%
- Severe Pre E / HELLP: 14%
- Acute Fatty Liver: 8%
- Amniotic Fluid Embolism: 6%
- Sepsis: 6%

100 %
Intrauterine Fetal Demise 25%

**Mechanism**
- Release of
  - Necrotic tissue and Thromboplastin
- ▼ Plasma fibrinogen
- FDP’s circulate

**Diagnosis**
- U/S ➔ Confirm fetal demise
- Baseline coagulation tests
  - Platelet count
  - PT
  - aPTT
  - Fibrinogen

**Management**
- Deliver fetus and placenta
- If DIC is Present
  - Volume
  - Blood products
  - Supportive care
Placental Abruption 37%

**Mechanism**
- Release of procoagulant substances
- Activation of fibrinolytic enzyme pathway

**Diagnosis**
- Vaginal bleeding
- Abdominal pain
- Uterine tenderness
- Uterine contractions
- Coagulation tests

**Management**
- Delivery v/s Expectant
- If DIC is Present
  - Volume
  - Blood products
  - Supportive care
Clinical Presentation

- Peripheral cyanosis
- Renal impairment
- Drowsiness
- Confusion
- Coma
- Cardiorespiratory failure
- Large and small vessel thrombosis
- Ischemia
- End organ damage
Bleeding from unrelated sites

- Venipuncture sites
- Epistaxis
- Ecchymosis
- Purpura
- Petechiae
- Hematomas
Diagnosis of DIC

- Obvious with massive hemorrhage
- Lab tests
  - CBC, Plts
  - Fibrinogen, FDP’s
  - PT, aPTT
  - D Dimer
- Rotem
Risk Factors for PPH

**Maternal Hx**
- High parity
- History of PPH
- Previous uterine surgery

**Labor Factors**
- Chorioamnionitis
- Rapid or prolonged labor
- Augmented labor
- Preeclampsia
- Prolonged third stage

**Pregnancy Factors**
- **Uterine overdistension**
  - Macrosomia
  - Polyhydramnios
  - Multiple gestation

- **Placental abnormality**
  - Previa
  - Accreta
  - Abruption
<table>
<thead>
<tr>
<th>Description</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td>No previous uterine incision</td>
<td>History of previous PPH</td>
<td>Placenta previa/Low lying placenta</td>
<td></td>
</tr>
<tr>
<td>No known bleeding disorder</td>
<td>Prior cesarean birth(s) or uterine surgery</td>
<td>Suspected placenta accreta</td>
<td></td>
</tr>
<tr>
<td>No history of PPH</td>
<td>Multiple gestation</td>
<td>Active bleeding (greater than show) on admission</td>
<td></td>
</tr>
<tr>
<td>≤ 4 previous vaginal births</td>
<td>Large uterine fibroids</td>
<td>Hematocrit &lt; 30</td>
<td></td>
</tr>
<tr>
<td>Singleton pregnancy</td>
<td>Chorioamnionitis</td>
<td>Known coagulopathy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Magnesium sulfate</td>
<td>Active anticoagulation therapy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Preeclampsia</td>
<td>Platelets &lt;100,00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rapid or prolonged labor</td>
<td>EBL on admission &gt;1500</td>
<td></td>
</tr>
<tr>
<td>Antibody positive on prenatal type &amp; screen</td>
<td></td>
<td>Other factors designated by physician</td>
<td></td>
</tr>
<tr>
<td>□ Verify Type &amp; Screen on prenatal record</td>
<td>□ Order Type &amp; Screen on admission</td>
<td>□ Order Type &amp; Crossmatch X 2 unit on admission</td>
<td></td>
</tr>
<tr>
<td>□ Send HOLD CLOT on admission</td>
<td>□ Review hemorrhage protocol</td>
<td>□ Review hemorrhage protocol</td>
<td></td>
</tr>
<tr>
<td>□ Order T&amp;S if not on available on record</td>
<td></td>
<td>□ Notify anesthesia and blood bank of patient risk</td>
<td></td>
</tr>
</tbody>
</table>
Stage 2 – Continued bleeding ≤1,500ml

Meds/ Procedures
- 2nd IV access 18 gauge

Blood Bank
- Send additional Labs
- DIC Panel
CMQCC Toolkit Version 2.0

OB Hemorrhage Emergency Management

Stage 3 – Blood loss >1,500ml or 2 units PRBC’s or unstable VS or suspicion of DIC

Meds/ Procedures
• Activate MTP

Blood Bank
• Transfuse aggressively
• Near 1:1 PRBC to FFP
• 1 PLT apheresis pack (per 4-6 units PRBC’s)
### Clinical Signs of Hypovolemia

**CMQCC OB Hemorrhage Emergency Management**

**Cumulative blood loss of 500 - 999 mL**
- Should trigger increased supervision and intervention

<table>
<thead>
<tr>
<th>Amount of Blood Loss</th>
<th>Clinical Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 mL</td>
<td>- Slight BP $\Delta$, HR, RR UO normal</td>
</tr>
<tr>
<td>1500 mL</td>
<td>- Narrow PP, HR $&gt;$100, diaphoretic</td>
</tr>
<tr>
<td>2000 mL</td>
<td>- $\downarrow$ BP, Narrow PP, HR $&gt;$ 120, pale cool, restlessness</td>
</tr>
<tr>
<td>$\geq$ 2500 mL</td>
<td>- Profound Hypotension, HR $&gt;$140, RR $&gt;$ 40, $\downarrow$ UO, anuria</td>
</tr>
</tbody>
</table>
## Laboratory Diagnosis of DIC

- All of the routine screening tests of coagulation yield grossly abnormal results

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelets</td>
<td>Decreased</td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>Less than 200</td>
</tr>
<tr>
<td>Fibrin Split Products</td>
<td>Increased</td>
</tr>
<tr>
<td>PT &amp; aPTT</td>
<td>Initially increased</td>
</tr>
</tbody>
</table>
1st and 2nd Line Uterotonics

- **Pitocin (oxytocin)** 10 U/mL
  - 10-40u in 500 -1L NS or LR IV or 10 units IM if no IV access
  - Onset of action - 5 minutes
  - Side Effects: N&V, ↓ Na++, water intoxication (prolonged use)
  - Contraindications: allergy
  - Avoid rapid IV infusion - hypotension, ↑ HR

- **Methergine (methylergonovine)** .2 mg/mL
  - 0.2mg IM every 2-4hr
  - Onset of action IM 2-5 minutes / PO 5-10 minutes
  - Side Effects: HTN, N&V, chest pain, myocardial infarction
  - Contraindications: HTN, Preeclampsia
  - Relative contraindications: recent use of ephedrine or macrolide antibiotics, or azole antifungal medications
**Prostaglandins**

- **Cytotec (misoprostol) PGE\(_1\) analogue**
  - 600-800 mcg sublingual or oral  100 or 200 mcg tablets (1 time!)
  - Onset of action varies when given PR
  - Side effects: fever, chills/rigors/shivering, headache, N&V, diarrhea
  - Contraindications: allergy,
    - caution use with history of asthma
    - does not exacerbate bronchospasm associated with Hemabate.

- **Hemabate (carboprost) PGF\(_\alpha\) 250 mcg/mL**
  - 250mcg IM every 15-90 min (max 8 doses = 2 mg)
  - Refrigerate
  - Side effects: N&V, diarrhea, fever, chills, bronchospasm, hypertension
  - Contraindications: allergy,
    - Caution in women with asthma, active cardiac, pulmonary, hepatic disease
Other techniques when meds don’t work!

The B-Lynch

Uterine compression suture technique
Intrauterine Balloon

Doumouchtsis SK et al., 2007
Uterine Balloon Hysterotomy Insertion

- Use Ultrasound guidance to determine cc’s needed
- Sterile Normal Saline
- Never use air to inflate the balloon
- Average filling volume 250-300cc (500cc’s max)
- Document the amount of Normal Saline used
- Vaginal Packing (arm band) / Secure tubing
- Connect to closed system / Foley bag
“Intrauterine Balloon Should be First Step after Failure of Medical Therapy”

- High success rate not different than other approaches
- Low-tech, fast, inexpensive, easy to utilize on any L&D Unit
- Least morbidity of any “next step”
- Can be used as “Tamponade Test” to temporize, determine needs and mobilize other resources
Additional Hemorrhage Management

- Intervention Radiology
- Uterine artery embolization
- Collateral circulation
- Ongoing assessment
Signs and Symptoms of Shock

- Anxiety, restlessness
- Nausea
- A rapid, weak, thready pulse
- Cool, clammy, mottled skin
- Rapid shallow respirations
- Hypothermia
- Thirst and dry mouth
- Fatigue
- Distracted look in the eyes
- Tachycardia
- Narrow Pulse Pressure
- Hypotension
Blood Products and Equipment
California Maternal Quality Care Transfusion Guidelines

- For massive ongoing hemorrhage
- Resuscitation transfusion not based on labs but clinical condition
- AVOID coagulopathy
- Transfuse with uncrossed PRBCs until crossed blood available
- Goal minimum ratio of PRBC:FFP of 6:4
- One unit platelets (single platelet pheresis pack) given for every 4-6 units of PRBCs : FFP
- Guidelines consistent with practice guidelines of the American Society of Anesthesiologists
Blood Components

Whole Blood

- Red Blood Cells
  - Filtered Red Blood Cells
  - Frozen Red Blood Cells
  - Washed Red Blood Cells

- Platelet Rich Plasma
  - Plasma
  - Platelet Concentrates
  - Fresh Frozen Plasma
  - Frozen Plasma

Fractionation

- Plasma Protein Fraction
- Albumin
- Gamma Globulin
- IVIG
- Special Gamma Globulin Products
- Lyophilized Factor VIII
- Other Clotting Factor Derivatives

Cryoprecipitate (Factor VIII)
# Blood Component Therapy

<table>
<thead>
<tr>
<th>Product</th>
<th>Volume (mL)</th>
<th>Contents</th>
<th>Effect (per unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed Red Blood Cells</td>
<td>240</td>
<td>RBC, WBC, plasma</td>
<td>↑ hematocrit 3% &amp; Hgb 1 g/dl</td>
</tr>
<tr>
<td>Platelets</td>
<td>50</td>
<td>Platelets, RBC,WBC, plasma</td>
<td>↑ platelet count 5,000-10,000 mm$^3$ per unit</td>
</tr>
<tr>
<td>Fresh Frozen Plasma</td>
<td>250</td>
<td>Fibrinogen, antithrombin III, factors V &amp; VIII*</td>
<td>↑ fibrinogen by 10mg/dl</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>40</td>
<td>Fibrinogen, factors VIII &amp; XIII and Von Willebrand</td>
<td>↑ fibrinogen by 10mg/dl</td>
</tr>
</tbody>
</table>

* slightly decreased amounts of factor V and factor VIII [ACOG 2006]
Packed Red Blood Cells (PRBCs)

- Single unit of PRBCs will increase Hct by 3-4%
- Uncrossed O neg blood can be used as a substitute while waiting for crossmatching if needed
Fresh Frozen Plasma (FFP)

- Contains nearly all the coagulation factors with smaller amounts of factor V and factor VIII

- Can be used up to 24 hours after thawing and for up to 5 days if relabeled “thawed plasma”

- PRBCs and FFP recommended together for massive hemorrhage

- Ratio of 1.5/1 or 1/1 FFP/PRBCs is recommended
Platelets

- Recommended when platelet count is 50,000 - 100,000 u/L
- Single Donor Apheresis
- Equivalent of 6 units of platelet concentrates
- Should increase the platelet count by 40-50,000 u/L (transient)
How are Platelets administered?
Cryoprecipitate

- Priority for women with Fibrinogen levels < 80
- 10 unit pack (or 1 adult dose) raises Fibrinogen 80-100 mg/dl
- Best for DIC with low fibrinogen and don’t need volume replacement
- Caution: 10 units come from 10 different donors, so infection risk is proportionate
- 35 - 45 minute thaw time
Other products used in hemorrhage

- **Desmopressin (DDAVP)**
  - FDA approved for patients with von Willebrand disease and some types of hemophilia

- **Off label use of recombinant rFVIIa group**
  - Only as a “rescue” agent
  - 90 mcg/kg IV over 3-5 minutes
  - **Correct for:**
    - Acid-base imbalance
    - Hypothermia
    - Hypocalcemia
    - Hyperkalemia
    - Transfuse needed blood products
Severe Hemorrhage

+ Rapid crystalloid infusion

+ Cool operating room temperature

= Hypothermia
The Lethal Triad  
Coagulopathy: Why?

- **Dilutional**
  - Transfusion of crystalloid and packed cells devoid of clotting factors
  - A problem once 1 – ½ total blood volume replaced

- **Hypothermia**
  - Significantly decreases platelet function: even if counts are adequate

- **Acidemia**
  - Occurs with massive hemorrhage due to hypovolemia, peripheral tissue hypoxia: as hydrogen ion concentration increases, enzyme functions involved in coagulation pathway stop functioning

  - VERY DIFFICULT TO REVERSE!
Rapid Infuser / Blood Warmer

NEW! IN-LINE MICROWAVE FLUID WARMING TECHNOLOGY

T900™ SYSTEM FEATURES
- FDA LEVEL II S10 BK APPROVAL, UL 544 APPROVAL
- DELIVER FLUID AT 40°C IN 5 SECONDS WITH FLOW RATES FROM 16 - 570 ML/MIN
- PRECISE OUTLET FLUID TEMPERATURE AT ALL FLOW RATES
- MEASURE BLOOD OR FLUID TEMPERATURE NONINVASIVELY
- INTUITIVE – TRAIN CLINICIANS IN LESS THAN ONE MINUTE
- FAST SET UP AND OPERATION
- ON-BOARD AIR COMPRESSOR FOR PRESSURE INFUSERS
- SAFE, DRY HEAT – NO RISK OF WATERBORNE INFECTION

T900™ DISPLAY FEATURES
- DISPLAY PANEL
  - Actual outlet temperature
  - Air embolism detection alarm
  - LED step-by-step prompts
- FLOW RATE INDICATOR
  - Complements drip chamber
  - Empty cartridge alert (2sec)
  - Bright LED display

T900™ DISPOSABLE FEATURES
- DISPOSABLE CARTRIDGE
  - Easy to use snap-in design
  - Requires only 3cc to prime
- PATENTED FILTER VENT
  - Gently spins fluid off inner wall
  - Prevents turbulence
  - Hydrophobic filter at top allows air to escape

PALADIN BIOMEDICAL CORPORATION
45 Howe Road
Wilmot, NH 03287
888-927-4069
www.paladinbiomedical.com

Caution: U.S. Federal law limits this device to sale by or on order of a physician.
Refer to operator's manual for warnings, precautions and instructions of use.
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Photography by Michael Kusmanoff (KUSMANOFFPHOTO.COM)
Design by Robin Ahnott

“Hot Line”

“Bair Hugger”
Four Major Recommendations for California Birth Facilities:

- Improve *readiness* to hemorrhage by implementing standardized protocols (general and massive).
- Improve *recognition* of OB hemorrhage by performing on-going objective quantification of actual blood loss during and after all births.
- Improve *response* to hemorrhage by performing regular on-site multi-professional hemorrhage drills.
- Improve *reporting* of OB hemorrhage by standardizing definitions and consistency in coding and reporting.
Improve recognition...

Perform on-going objective quantification of actual blood loss during and after all births *(record output on a flow sheet)*

- **Training and quantification of how blood loss is estimated** – put up posters

- **Measurement of actual blood**
  - Fluid in canisters, under buttocks drapes
  - Weigh saturated items
  - and subtract dry weight
Escalation

- An abnormal parameter requires:
  - Prompt reporting to a physician or other qualified clinician
  - Prompt bedside evaluation by a physician or other qualified clinical provider with the ability to activate resources in order to initiate emergency diagnostic and therapeutic interventions as needed
The population we serve
Estimation of Blood Loss Before and After Training

Small vol. often over estimated
Large vol. often under estimated
Both improve markedly with training!
Informational Webinar AWHONN’s
— Postpartum Hemorrhage (PPH) Project January 2014

Quantification of Blood Loss
Every Birth

© Benioff Children’s Hospitals
OB Hemorrhage Cart: 2014

- Quick access to emergency supplies
- Refrigerator for meds
- Establish necessary items and par levels
- Label drawers/compartments
- Include checklists
- Develop process for checking and restocking
- Educate nursing and physician staff

McNulty, 2014
Obstetric Hemorrhage Cart: Labor and Delivery

- **IV start**
  - 16 gauge angiocaths
  - Baseline blood tubes
    - Red top, blue top, tiger top
- **IV pressure bags**
- **Foley with attached urometer**

- **Bakri balloon with syringe**
  - 500 cc fluid for filling
  - Foley bag for drainage collection
- **Kerlex roll**
- **Vaginal pack**
- **Right angle retractors**
- **Eastman vaginal retractors**
- **Ring forceps x 4**

McNulty, 2014
Obstetric Hemorrhage Cart: OR

- IV start
  - 16 gauge angioc aths
  - Blood draw tubes
    - Red top, blue top, tiger top
- IV pressure bags
- Foley with urometer
- Sutures for B-lynch and modified B-lynch techniques
  - #1 Vicryl, standard x 2
  - #1 Monocryl, 36” long on curved 90 mm blunt needle
- Laminated 8 x 11” diagram
  - B-Lynch technique
  - Modified B-Lynch technique
- Hunter’s curette
- Right angle retractors
- Eastman vaginal retractors
- Ring forceps x 4
- Short Allis tissue forceps x 2
- Bakri balloon
  - 500 cc fluid for filling
  - Bag for drainage collection
- Kerlex roll
- Vaginal pack

McNulty, 2014
# The Importance of IV Gauge!

Get 2\textsuperscript{nd} Line In Before Vasoconstriction Develops!

<table>
<thead>
<tr>
<th>Gauge</th>
<th>Gravity Flow</th>
<th>Flow with Rapid Infuser</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>65 ml/min</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>140 ml/min</td>
<td>250 ml/min</td>
</tr>
<tr>
<td>16</td>
<td>190 ml/min</td>
<td>350 ml/min</td>
</tr>
<tr>
<td>14</td>
<td>300 ml/min</td>
<td>500 ml/min</td>
</tr>
</tbody>
</table>
National Partnership for Maternal Safety: Consensus Bundle on Obstetric Hemorrhage

Elliott K. Main, D. and D. Bingham,
Goffman, B. Scavone, L. Kane Low,
P. Fontaine, J. Gorlin, D. Lagrew,
and B. Levy 2015

Safety Bundle organized into 4 domains:

1. Readiness
2. Recognition and prevention
3. Response
4. Reporting and Systems Learning
This bundle was developed by the Council On Patient Safety in Women’s Health Care, National Partnership for Maternal Safety 2014
The Maternal Safety Bundle for Obstetric Hemorrhage

- Proactive approach
- Includes 13 elements
- Establishes resources
- Manage OB Hemorrhage
OB Hemorrhage Checklist

**Prenatal Assessment & Planning**

- Identify and prepare for patients with special considerations: Placenta Previa/Accreta, Bleeding Disorder, or those who Decline Blood Products
- Screen and aggressively treat severe anemia: if oral iron fails, initiate IV Iron Sucrose Protocol to reach desired Hgb/Hct, especially for at risk mothers.

**Admission Assessment & Planning**

- Verify Type & Antibody Screen from prenatal record
  - If not available,
    - Order Type & Screen (lab will notify if 2nd clot needed for confirmation)
  - If prenatal or current antibody screen positive (if not low level anti-D from Rho-GAM),
    - Type & Crossmatch 2 units PRBCs
  - All other patients,
    - Send Clot to blood bank

- Evaluate for Risk Factors (see below)
  - If medium risk:
    - Order Type & Screen
    - Review Hemorrhage Protocol
  - If high risk:
    - Order Type & Crossmatch 2 units PRBCs
    - Review Hemorrhage Protocol
    - Notify OB Anesthesia

- Identify women who may decline transfusion
  - Notify OB provider for plan of care
  - Early consult with OB anesthesiologist
  - Review Consent Form

**Ongoing Risk Assessment**

- Evaluate for development of additional risk factors in labor:
  - Prolonged 2nd Stage labor
  - Prolonged oxytocin use
  - Active bleeding
  - Chorioamnionitis
  - Magnesium sulfate treatment
- Increase Risk level (see below) and convert to Type & Screen or Type & Crossmatch
- Treat multiple risk factors as High Risk

**Admission Hemorrhage Risk Factor Evaluation**

<table>
<thead>
<tr>
<th>Low (Clot only)</th>
<th>Medium (Type and Screen)</th>
<th>High (Type and Crossmatch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No previous uterine incision</td>
<td>Prior cesarean birth(s) or uterine surgery</td>
<td>Placenta previa, low lying placenta</td>
</tr>
<tr>
<td>Singleton pregnancy</td>
<td>Multiple gestation</td>
<td>Suspected Placenta accreta or percreta</td>
</tr>
<tr>
<td>≤4 previous vaginal births</td>
<td>&gt;4 previous vaginal births</td>
<td>Hematocrit &lt;30 AND other risk factors</td>
</tr>
<tr>
<td>No known bleeding disorder</td>
<td>Chorioamnionitis</td>
<td>Platelets &lt;100,000</td>
</tr>
<tr>
<td>No history of PPH</td>
<td>History of previous PPH</td>
<td>Active bleeding (greater than show) on admit</td>
</tr>
<tr>
<td></td>
<td>Large uterine fibroids</td>
<td>Known coagulopathy</td>
</tr>
</tbody>
</table>

**STAGE 0: All Births: Prevention & Recognition of OB Hemorrhage**

- **Active Management of Third Stage**
  - Oxytocin infusion: 10-20 units oxytocin/1000ml solution titrate infusion rate to uterine tone; or 10 units IM; do not give oxytocin as IV push
  - Vigorous fundal massage for at least 15 seconds

- **Ongoing Quantitative Evaluation of Blood Loss**
  - Using formal methods, such as graduated containers, visual comparisons and weight of blood soaked materials (1gm = 1ml)

- **Ongoing Evaluation of Vital Signs**
  - If: Cumulative Blood Loss >500ml vaginal birth or >1000ml C/S - OR - Vital signs >15% change or HR ≥110, BP ≤85/45, O2 sat <95% - OR - Increased bleeding during recovery or postpartum, proceed to STAGE 1
# STAGE 1: OB Hemorrhage

**Cumulative Blood Loss >500ml vaginal birth or >1000ml C/S -OR-**

**Vital signs >15% change or HR ≥110, BP ≤85/45, O2 sat <95% -OR-**

**Increased bleeding during recovery or postpartum**

**MOBILIZE**
- Primary nurse, Physician or Midwife to:
  - Activate OB Hemorrhage Protocol and Checklist
- Primary nurse to:
  - Notify obstetrician (in-house and attending)
  - Notify charge nurse
  - Notify anesthesiologist

**ACT**
- Primary nurse:
  - Establish IV access if not present, at least 18 gauge
  - Increase IV Oxytocin rate, 500 mL/hour of 10-40 units/1000mL solution;
  - Titrate infusion rate to uterine tone
  - Continue vigorous fundal massage
  - Administer Methergine 0.2 mg IM per protocol (if not hypertensive); give once, if no response, move to alternate agent; if good response, may give additional doses q 2 hr
  - Vital Signs, including O2 sat & level of consciousness (LOC) q 5 minutes
  - Weigh materials, calculate and record cumulative blood loss q 5-15 minutes
  - Administer oxygen to maintain O2 sats ≥95%
  - Empty bladder: straight cath or place Foley with urimeter
  - Type and Crossmatch for 2 units Red Blood Cells STAT (if not already done)
  - Keep patient warm

**Physician or midwife:**
- Rule out retained Products of Conception, laceration, hematoma

**Think (if cesarean birth and still open):**
- Inspect for uncontrolled bleeding at all levels, esp. broad ligament, posterior uterus, and retained placenta

**THINK**
- Consider potential etiology:
  - Uterine atony
  - Trauma/Laceration
  - Retained placenta
  - Amniotic Fluid Embolism
  - Uterine Inversion
  - Coagulopathy
  - Placenta Accreta

If: Continued bleeding or Continued Vital Sign instability, and <1500 mL cumulative blood loss

Proceed to STAGE 2

### UTEROTONIC AGENTS for POSTPARTUM HEMORRHAGE

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Side Effects</th>
<th>Contraindications</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitocin® (Oxytocin)</td>
<td>10 units/ml (1000 mL rate)</td>
<td>IV infusion</td>
<td>Continuous</td>
<td>Usually none; Nausea, vomiting, hypotension ('water intoxication') with prolonged IV admin, BP and 1 HR with high doses, esp IV push</td>
<td>Hypersensitivity to drug; Hypersensitivity to drug</td>
<td>Room temp</td>
</tr>
</tbody>
</table>
| Methergine® (Methylergonovine) | 0.2 mg (not given IV) | IM or intra-myometrial (not given IV) | -Q 2-4 hours
- If no response after first dose, it is unlikely that additional doses will be of benefit | Nausea, vomiting, Severe hypertension, esp. with rapid administration or in patients with HTN or PIH | Hypertension, PIH, Heart disease; Hypersensitivity to drug; Hypersensitivity to drug | Refrigerate, Protect from light |
| Hemabate® (15-methyl PG F2a) | 250 mcg | IM or intra-myometrial (not given IV) | -Q 15-90 min
- Not to exceed 8 doses/24 hrs
- If no response after several doses, it is unlikely that additional doses will be of benefit | Nausea, vomiting, Diarrhea
Fever (transient), Headache
Chills, shivering
Hypertension
Bronchospasm | Caution in women with hepatic disease, asthma, hypertension, active cardiac or pulmonary disease; Hypersensitivity to drug | Refrigerate |
| Cytotec® (Misoprostol) | 800-1000mcg | Per rectum (PR)   | One time                   | Nausea, vomiting, diarrhea
Shivering, Fever (transient)
Headache | Rare
Known allergy to prostaglandin; Hypersensitivity to drug | Room temp |
## STAGE 2: OB Hemorrhage
**Continued bleeding or Vital Sign instability, and <1500 mL cumulative blood loss**

<table>
<thead>
<tr>
<th>MOBILIZE</th>
<th>ACT</th>
<th>THINK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary nurse (or charge nurse):</strong></td>
<td></td>
<td>Sequentially advance through procedures and other interventions based on pathology:</td>
</tr>
<tr>
<td>- Call obstetrician to bedside</td>
<td><strong>Do not delay other interventions</strong> (see right column) while waiting for response to medications</td>
<td>Vaginal birth</td>
</tr>
<tr>
<td>- Call Anesthesiologist</td>
<td>- Additional uterotonic medication: Hemabate 250 mcg IM [if not contraindicated] OR Misoprostol 800-1000 mg PR</td>
<td>If trauma (vaginal, cervical or uterine):</td>
</tr>
<tr>
<td>- Activate Response Team: PHONE #:</td>
<td>- Can repeat Hemabate up to 3 times every 20 min; (note-75% respond to first dose)</td>
<td>- Visualize and repair</td>
</tr>
<tr>
<td></td>
<td><strong>Primary nurse:</strong></td>
<td>If retained placenta:</td>
</tr>
<tr>
<td></td>
<td>- Notify Blood bank of hemorrhage; order products as directed</td>
<td>- D&amp;C</td>
</tr>
<tr>
<td></td>
<td><strong>Charge nurse:</strong></td>
<td>If <strong>uterine atony</strong> or lower uterine segment bleeding:</td>
</tr>
<tr>
<td></td>
<td>- Notify Perinatologist or 2nd OB</td>
<td>- Intrauterine Balloon</td>
</tr>
<tr>
<td></td>
<td>- Initiate OB Hemorrhage Record</td>
<td>If <strong>above measures unproductive:</strong></td>
</tr>
<tr>
<td></td>
<td>- If selective embolization, call Interventional Radiology Team and second anesthesiologist</td>
<td>- Selective embolization (Interventional Radiology if available &amp; adequate experience)</td>
</tr>
<tr>
<td></td>
<td>- Notify nursing supervisor</td>
<td>C-section:</td>
</tr>
<tr>
<td></td>
<td>- Assign single person to communicate with blood bank</td>
<td>- B-Lynch Suture</td>
</tr>
<tr>
<td></td>
<td>- Call medical social worker or assign other family support person</td>
<td>- Intrauterine Balloon</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>If Uterine Inversion:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Anesthesia and uterine relaxation drugs for manual reduction</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>If Amniotic Fluid Embolism:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Maximally aggressive respiratory, vasopressor and blood product support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If vital signs are worse than estimated or measured blood loss: possible uterine rupture or broad ligament tear with internal bleeding, move to laparotomy</td>
</tr>
<tr>
<td></td>
<td>Blood Bank:</td>
<td>Once stabilized: Modified Postpartum management with increased surveillance</td>
</tr>
<tr>
<td></td>
<td>- Determine availability of thawed plasma, fresh frozen plasma, and platelets; initiate delivery of platelets if not present on-site</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Consider thawing 2 FFP (takes 30 min), use if transfusing &gt;2 units PRBCs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Prepare for possibility of massive hemorrhage</td>
<td></td>
</tr>
</tbody>
</table>

**Re-Evaluate Bleeding and Vital Signs**
If cumulative blood loss >1500mL, >2 units PRBCs given, VS unstable or suspicion for DIC, proceed to STAGE 3
# STAGE 2: OB Hemorrhage
Continued bleeding or Vital Sign instability, and <1500 mL cumulative blood loss

<table>
<thead>
<tr>
<th>MOBILIZE</th>
<th>ACT</th>
<th>THINK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary nurse (or charge nurse):</strong></td>
<td>Team leader (OB physician):</td>
<td>Sequentially advance through procedures and other interventions based on etiology:</td>
</tr>
<tr>
<td>☐ Call obstetrician to bedside</td>
<td>☐ Additional uterotonic medication: Hemabate 250 mcg IM [if not contraindicated] OR Misoprostol 800-1000 mg PR</td>
<td>Vaginal birth</td>
</tr>
<tr>
<td>☐ Call Anesthesiologist</td>
<td>○ Can repeat Hemabate up to 3 times every 20 min; (note-75% respond to first dose)</td>
<td>If trauma (vaginal, cervical or uterine):</td>
</tr>
<tr>
<td>☐ Activate Response Team:</td>
<td><strong>Do not delay other interventions</strong> (see right column) while waiting for response to medications</td>
<td>• Visualize and repair</td>
</tr>
<tr>
<td>PHONE #:</td>
<td>☐ Bimanual uterine massage</td>
<td>If retained placenta:</td>
</tr>
<tr>
<td>☐ Notify Blood bank of hemorrhage; order products as directed</td>
<td>☐ Move to OR (if on postpartum unit, move to L&amp;D or OR)</td>
<td>• D&amp;C</td>
</tr>
<tr>
<td><strong>Charge nurse:</strong></td>
<td>☐ Order 2 units PRBCs and bring to the bedside</td>
<td>If uterine atony or lower uterine segment bleeding:</td>
</tr>
<tr>
<td>☐ Notify Perinatologist or 2nd OB</td>
<td>☐ Order labs STAT (CBC/Plts, Chem 12 panel, Coag Panel II, ABG)</td>
<td>• Intrauterine Balloon</td>
</tr>
<tr>
<td>☐ Initiate OB Hemorrhage Record</td>
<td>☐ Transfuse PRBCs based on clinical signs and response, do not wait for lab results</td>
<td>If above measures unproductive:</td>
</tr>
<tr>
<td>☐ If selective embolization, call-</td>
<td></td>
<td>• Selective embolization (Interventional Radiology if available &amp; adequate experience)</td>
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**Blood Bank:**
- Determine availability of thawed plasma, fresh frozen plasma, and platelets; initiate delivery of platelets if not present on-site
- Consider thawing 2 FFP (takes 30 min), use if transfusing >2 units PRBCs
- Prepare for possibility of massive hemorrhage

---

**Re-Evaluate Bleeding and Vital Signs**
If cumulative blood loss >1500mL, >2 units PRBCs given, VS unstable or suspicion for DIC, proceed to STAGE 3
Laurence E. Shields, Suzanne Wiesner, Janet Fulton, Barbara Pelletreau

American Journal of Obstetrics and Gynecology, 2014
http://dx.doi.org/10.1016/j.ajog.2014.07.012
A

Stage 2
Vaginal Delivery

Notify shift Leader of EBL

- Continued Assessment:
  - EBL
  - VS Q 5 minutes
  - \( O_2 \) & pulse ox
  - Fluid and Pitocin Infusion

- Start 2nd IV line
- Hemorrhage Panel
- Insert foley/urometer

Shift Leader / House Supervisor

OB & Anesthesiology to Bedside

- Hemorrhage cart to patient room
- Uterine Massage
- Consider moving to OR
- Retained POC: D&C
- Lower segment / Implantation: Uterine packing / Bakri balloon
- Atony: uterotonics*/ Bakri
- Laceration / Hematoma: Repair.
- Interventional Radiology.

Bleeding Controlled:
Modified PP Care

Hemorrhage Continues or EBL \( \geq \) 1,500 ml
Move to Stage 3
Patient to OR if not there
**Stage 2**

- **C-Section**
  - Notify Shift Leader of EBL
  - **Continued Assessment:**
    - EBL
    - VS Q 5 minutes
    - O2 & pulse oximeter
    - Fluid and Pitocin Infusion
  - Shift Leader / House Supervisor
  - Notify Blood Bank/Lab
    - Hemorrhage Cart & Rapid Infuser to patient room
  - **Interventions**
    - Uterine Massage
    - Atony: Uterotonic, B-lynch, Bakri balloon.
    - Uterine Artery Ligation
    - Laceration / Hematoma: Repair.
    - Consider Interventional Radiology.
  - OB / Anesthesia
  - **Hemorrhage Continues or EBL > 1,500 ml**
    - Move to Stage 3
    - Patient to OR if not there

---

*a* Hemorrhage panel: CBC with platelet count, PT, PTT, Fibrinogen, electrolytes and creatinine.
**Stage 3**
EBL > 1500 ml, Coagulopathy, or Abnormal Vital Signs

- **Circulating RN**
  - Transport to:
    - Operating room
    - Interventional Radiology
  - **Draw Labs**
  - Assist initiating Transfusion

- **Shift Leader**
  - Unit Secretary
  - Reassign Staff

- **Notify:**
  - Blood Bank & Lab
  - OR/IR
  - Pediatric/Nursery
  - Support MDs

- **Assign Runner**
  - Order OB Hemorrhage Pack(s)
  - Facilitate Communication

- **Assign Record Keeper**
  - Tracks Events / Timeline

- **Support, RN**
  - Assist:
    - Circulator
    - OB
    - Anesthesia
    - Prep for OR
    - Hemorrhage Cart
    - Rapid fluid infuser

- **OB and Anesthesia**
  - Conservative Surgery
    - B-Lynch
    - Uterine Art. Ligation
    - Interventional Radiology
  - Hysterectomy
  - Modified Postpartum Care in ICU or L&D

- **Initiated by**
  - OB, Anesthesia, or Nursing

Laurence E. Shields, Suzanne Wiesner, Janet Fulton, Barbara Pelletreau
American Journal of Obstetrics and Gynecology, 2014
CMQCC - California Partnership for Maternal Safety
OBSTETRIC HEMORRHAGE DEBRIEF FORM

The debrief form provides an opportunity for obstetric service teams to review the sequence of events, successes and barriers to a swift and coordinated response to obstetric hemorrhage.

Goal: Debrief all obstetric hemorrhages (up to five) per month that include the following triggers:
- 1000 (1500) ml blood loss – Stage 2 (3) hemorrhage (will depend on the frequency of events at your hospital to be determined by your own institution)
- Administration of second dose of any uterotonic medication (methergine, hemabate, misoprostol)
- Use of uterine tamponade balloon or B-lynch suture
- Administration of blood products

Instructions: Complete debrief form as soon as possible after event as described above. During debrief, obtain input from as many participants as possible.

Date: Time: Submitted by:

<table>
<thead>
<tr>
<th>RECOGNITION</th>
<th>Volume of Blood Lost</th>
<th>Method:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was patient assigned a hemorrhage risk?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Low □ Medium □ High □ Not done</td>
<td>□ Formal quantification □ Visual estimation □ Both</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RESPONSE</th>
<th>Blood products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplies/cart: Identify opportunities for improvement:</td>
<td></td>
</tr>
<tr>
<td>□ Appropriate supplies available</td>
<td></td>
</tr>
<tr>
<td>□ Equipment</td>
<td></td>
</tr>
<tr>
<td>□ Medications</td>
<td></td>
</tr>
<tr>
<td>□ Blood products</td>
<td></td>
</tr>
<tr>
<td>□ Procedure</td>
<td></td>
</tr>
<tr>
<td>□ Device(s) working properly? □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>□ Other issues?:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEAMWORK</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Timely Team response? □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>All roles filled?</td>
<td></td>
</tr>
<tr>
<td>□ Primary Physician □ Primary Nurse □ Charge Nurse □ Secondary Nurse □ Documentation □ Runner □ Anesthesia</td>
<td></td>
</tr>
<tr>
<td>Role clarity? □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Was there a clear leader? □ Yes □ No</td>
<td></td>
</tr>
<tr>
<td>Was there clear communication? □ Yes □ No</td>
<td></td>
</tr>
</tbody>
</table>

Participants (Name, Role):

<p>| |</p>
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</table>

Issue(s) or Recommendation(s):

<p>| |</p>
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</table>
Severe Maternal Morbidity

2015 TJC issues new statement

- Definition of sentinel event reporting
  - A patient safety event (not related to the natural course of the patient’s illness or underlying condition) that reaches a patient and results in any of the following:
    - Death
    - Permanent harm
    - Severe temporary harm
  - For OB:
    - 4 or more units of blood
    - Admission to ICU
Severe Maternal Morbidity

Adverse Outcome Review

- Why do it?
  - Finger point, blame, punish
  - Learn, improve future outcomes

- ACOG, AWHONN, SMFA –

- Recommend all severe morbidity whether sentinel or not:
  - Undergo review process:
    - thorough, credible, multidisciplinary, comprehensive
Case Examples

- **Example #1**
  - A G4P3 woman with known placenta accreta underwent cesarean birth during which expected, but profound, bleeding occurs, requiring 4 units of packed red blood cells. She was monitored in the ICU overnight with a subsequent unremarkable postpartum stay and was discharged.

- **Comment**
  - Meets Criteria for Hospital Review (4 units of PRBC’s and ICU admit)
    - IR, GYN/Onc Surgeon
  - Does not meet criteria for TJC sentinel event reporting
    - Placenta accreta underlying condition results in expected blood loss
"Conduct team training in perinatal areas to teach staff to work together and communicate more effectively. For high risk events, conduct clinical drills and conduct debriefings to evaluate team performance and identify areas for improvement."

JCAHO Sentinel Event Alert, Issue 30 - July 21, 2004
Distribute Work Load Optimally

- Avoid the “one woman band”
- Delegate tasks
  - “Mary: please get the hemorrhage cart”
  - “Sandy, call Dr. Wilcox and ask her to come for a bedside evaluation now”
- Utilize staff in the area of expertise
  - Respiratory Therapists - airway
  - Nursing Supervisor - recorder
Where do we go from here

- **Immediate post-op plan**
  - Treat anemia
  - Care of newborn

- **Long term patient follow-up**
  - Negative impact on patient
    - Hemorrhage during childbirth
    - Unexpected hysterectomy
    - Near death experience
Postpartum Care / Patient Satisfaction
Hemorrhage

- Thompson, et al. (2011). Women's experiences of care and their concerns and needs following a significant primary postpartum hemorrhage. *Birth*
- Australia 206 Women Primary PPH >1500 mL
- Written questionnaire 1\textsuperscript{st} week and 2 and 4 months
- 4 Themes:
  1. Adequacy of care
  2. Emotional response
  3. Future Implications
  4. Concern for the baby

- Findings suggest pay particular attention to informational and emotional need of women who experience significant PPH
Traumatic Childbirth

“process that involves actual or threatened serious injury or death to the mother or her infant. The birthing woman experiences intense fear, helplessness, loss of control and horror”.

- Dehumanizing experience
  - High level of medical interventions, extreme pain
  - Stripped of their dignity
  - Powerless
  - Lack of caring and support from perinatal staff
  - Fear of dying

Traumatic Childbirth

• Unexpected Project Survivors Forum San Jose
• 4/30/14
• 8AM - 5PM
WHAT CAN WE LEARN FROM WOMEN’S ACCOUNTS?

- How they experienced their symptoms
- How they experienced the health care system & the care they received
- What information they were given & what they sought
- How they understand their experience in the context of their lives & relationships
- What maternity clinicians & hospitals can do better for women & their families

Melissa Price
CMQCC OB Hemorrhage Task Force Volunteer
Summary

- Abnormal placentation bears a serious risk of maternal hemorrhage.

- Quantification of blood loss is essential for accurate assessment during hemorrhage.

- Nurses play an essential role during maternal hemorrhage to risk assess, recognize, and correctly respond during an emergency.

- Attention to risk, rapid recognition, escalation and mobilizing a multidisciplinary team during a postpartum crisis will optimize women’s survival during childbirth.

- Implementing hemorrhage drills to enhance reliability in your system will promote safety.
Maternal Mortality Rate
California Residents and United States: 1991-2006

Maternal Mortality Rate, California and United States; 1999-2013

Nurses are a valuable source of information and support for women and their families.

Thank You!

valerie.huwe@ucsf.edu