Obstetric Hemorrhage

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Learning Objectives

- Describe available research and evidence for anesthetic management of obstetric hemorrhage.
- Explain the role of the CRNA in preventing and managing obstetric hemorrhage in the perioperative setting.
- Review current ACOG and AANA guideline recommendations for obstetric hemorrhage management.

Why does it matter?

- PPH is the leading cause of maternal morbidity and mortality in the US and worldwide
- Accounts for 25% of maternal deaths in the US
- Occurs in up to 10% of deliveries
- 60% of maternal deaths due to obstetric hemorrhage are **PREVENTABLE**
- Rates have continued to rise over the past 15 years
- CRNAs deliver more than 50% of peripartum anesthesia care
  - We play a VITAL role

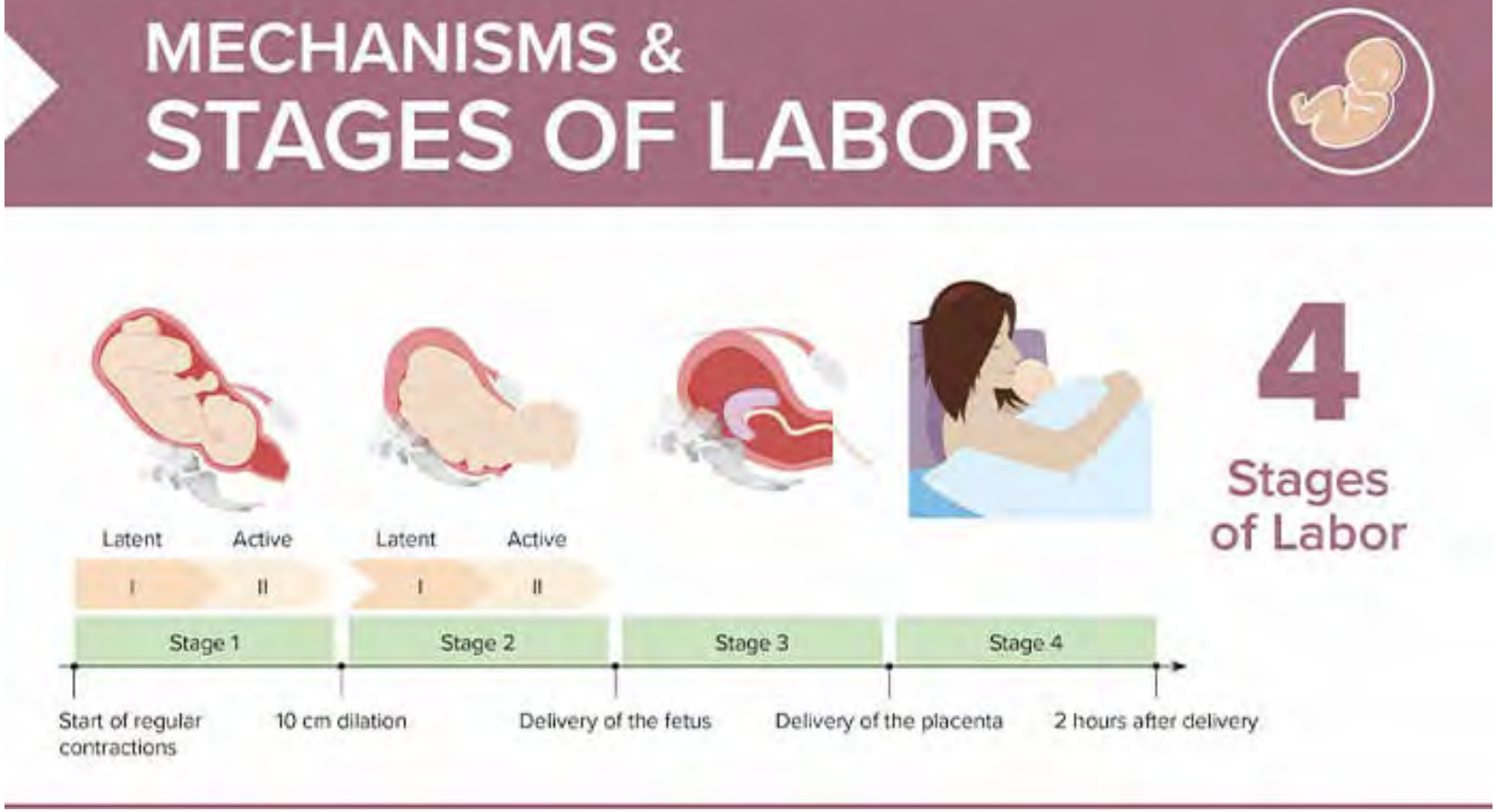
Clinical Fundamentals of OB Hemorrhage

https://www.skedoc.com/health-topics/gynaecologist-&-obstetrician/cesarean-section

Stages of Labor

- Labor is subdivided into 4 stages
- Stage 1: Cervical stage
- Stage 2: Pelvic stage
- Stage 3: Placental stage
- Stage 4: first hour post placental delivery
  - **HIGHEST RISK for PPH**

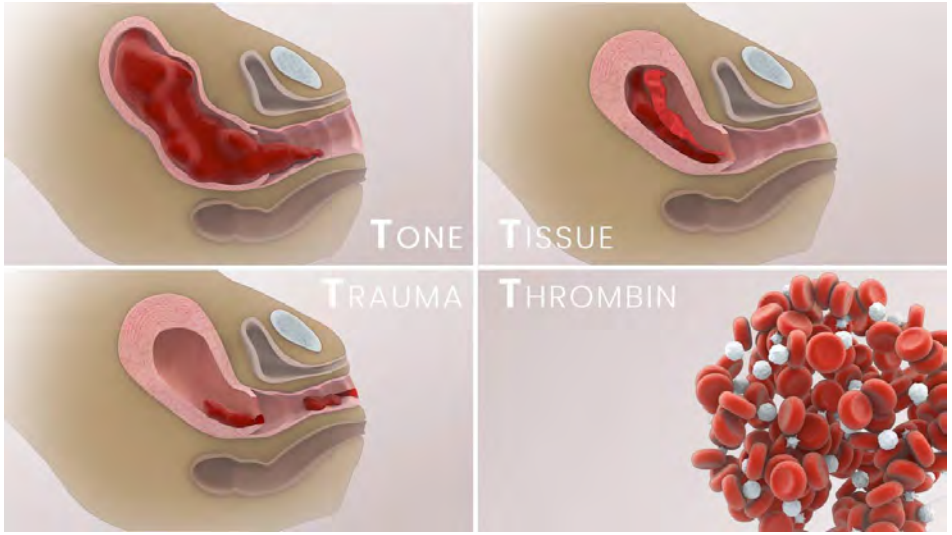
MECHANISMS & STAGES OF LABOR



https://www.lecturio.com/nursing/free-cheat-sheet/stages-of-labor/

Definitions

- Obstetric hemorrhage: severe bleeding during pregnancy, labor or in the postpartum period that may become life threatening
- Postpartum hemorrhage (PPH): EBL >500 mL for vaginal delivery
  >1000mL for c section
  - Typically related to one of the four Ts
    - Tone
    - Tissue
    - Trauma
    - Thrombin



https://pie.med.utoronto.ca/TVASurg/project/managementpph/

Uterine Atony

- At term and throughout labor, uterine blood flow is about 10% of CO
- Most common cause of PPH
- Non contracted uterus unable to compress blood vessels where placenta was attached

Risk Factors for Uterine Atony

- History of PPH
- Advanced maternal age
- Hypertensive disease
- Gestational diabetes
- High parity
- Overdistension of uterus (macrosomia, multiple gestations, polyhydramnios)
- Prolonged labor
- Pitocin use during labor
- Use of volatile anesthetics, magnesium and terbutaline

Best Defense

- Active management of the third stage of labor
- First line of prevention is the administration of uterotonics

Uterotonics

- As a class, these medications stimulate uterine contractions and maintain uterine tone
- Can be used as prophylactic therapy or for the treatment of PPH
- Examples: Pitocin, Methergine, Hemabate, TXA

Pitocin

- Synthetic analog of oxytocin
- First line uterotonic administered in obstetric setting
- Increases prostaglandin production and intracellular calcium in the uterus
- Therefore, stimulating smooth muscle contraction

https://www.fagronsterile.com/products/oxytocin-injection-30u-per-bag-2
https://mms.mckesson.com/product/652825/Par-Sterile-Products-LLC-42023011625

AANA Oxytocin Management

Rule of Threes[4,6,9]

- 1st bolus dose, administered to all maternal patients
  - On cord clamp, administer 3 units IV oxytocin over 30 to 45 seconds. It is suggested to mix the 3 units in a 10 mL syringe for easier administration.
  - 3 minutes following the 1st bolus dose, ask the obstetric provider to assess uterine tone.
    - If uterine tone is adequate, no further interventions are required.
    - If uterine tone is inadequate, administer 2nd dose of oxytocin 3 units IV, or another uterotonic agent per the direction of the obstetric provider.
  - 3 minutes following the 2nd bolus dose, ask the obstetric provider to assess uterine tone.
    - If uterine tone is adequate, no further interventions are required.
    - If uterine tone is inadequate, administer 3rd dose of oxytocin 3 units IV, or another uterotonic agent per the direction of the obstetric provider.
  - If uterine atony continues after three total doses of oxytocin, other uterotonics should be administered.
- Initiate a constant infusion of 3 units per hour for up to five hours.

IV Infusion Regimen[4]

Elective Cesarean Delivery

- Bolus 1 IU oxytocin; start oxytocin infusion at 2.5-7.5 IU/hr (0.04-0.125 IU/min)

Intrapartum Cesarean Delivery

- 3 IU oxytocin over ≥30 sec; start oxytocin infusion at 7.5-15 IU/hr (0.125-0.25 IU/min)

Methergine

- Methylergonovine
- Second line uterotonic
- Ergot alkaloid that directly acts on uterine smooth muscle to increase tone, rate and amplitude of contractions
- Avoid in patients with HTN disorders

https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=c4c48277-eb9e-6150-e053-2a95a90ab21d

Hemabate

- Carboprost tromethamine
- Second line uterotonic
- Prostaglandin that increases intracellular calcium concentration in the uterus
- Avoid in patients with Asthma

https://www.goodrx.com/carboprost/what-is

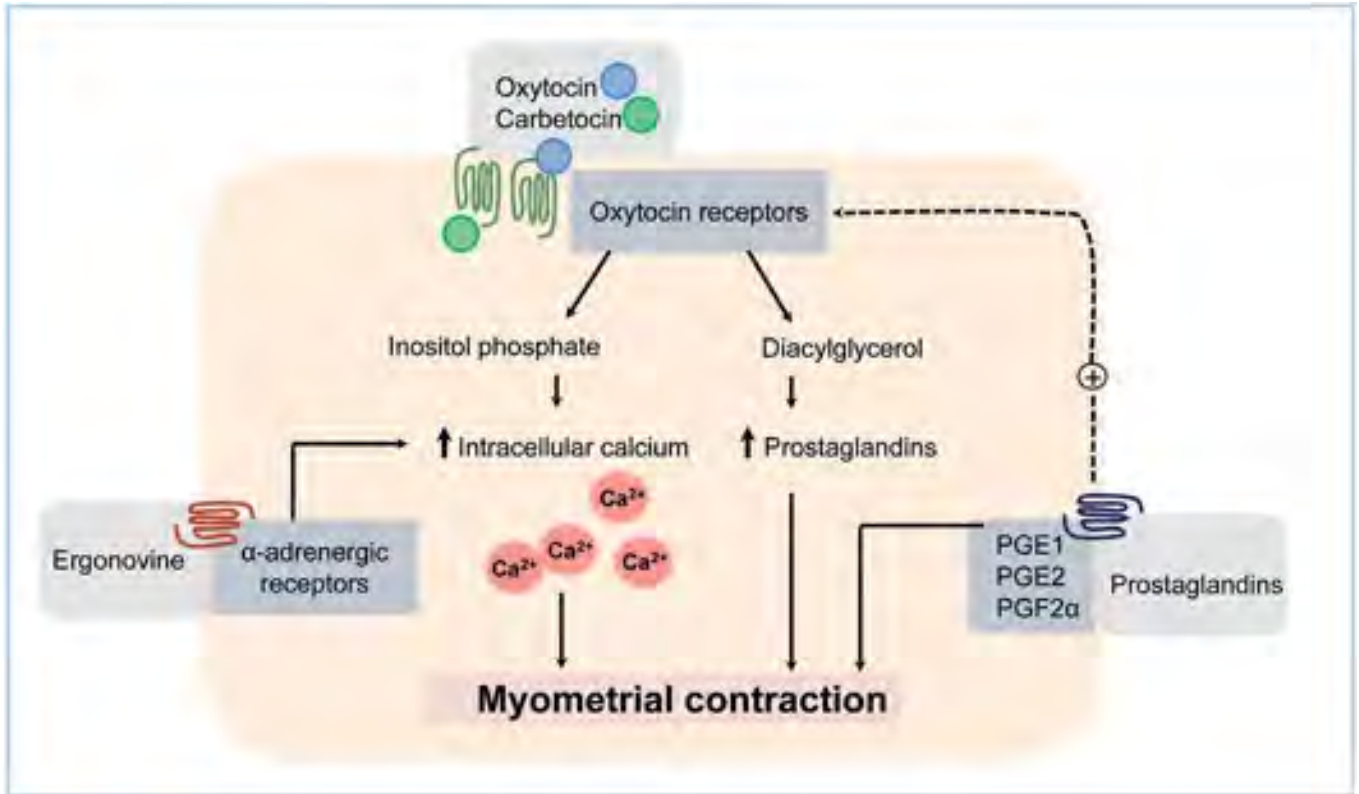
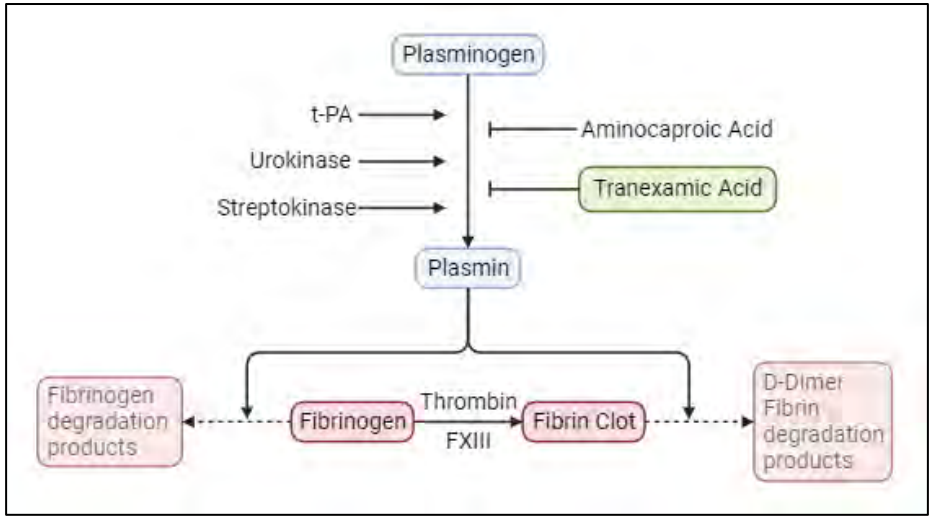


FIGURE 4.2 Mechanism of action of uterotonic drugs. Uterotonic drugs acting via various pathways cause myometrial contraction secondary to an increase in intracellular calcium levels. PGE_1, prostaglandin E_1 (misoprostol); PGE_2, prostaglandin E_2 (dinoprostol); $PGF_{2\alpha}$, prostaglandin $F_{2\alpha}$ (carboprost).

https://aneskey.com/obstetric-medications/

Tranexamic Acid (TXA)

- Not technically classified as a uterotonic
- Lysine analogue
- Another second line agent
- Antifibrinolytic that binds to plasminogen inhibiting the activation of plasmin and the breakdown of fibrin clots



https://www.biorender.com/template/tranexamic-acid-txa-mechanism

Stages of PPH

- Outlined by both AANA and American College of Obstetricians and Gynecologists (ACOG)

Stage 1 -EBL >500 mL for vaginal delivery and >1000 mL for c section -Normal labs and VS	**Stage 2** -EBL up to 1500 mL OR - >2 uterotonics administered with normal VS and labs
Stage 3 -EBL >1500 mL or >2 units of PRBCs given OR -Pt at risk for occult bleeding or coagulopathy OR -Pt with abnormal VS/labs/oliguria	**Stage 4** -CV collapse

Management of Obstetric Hemorrhage

https://www.livescience.com/44726-c-section.html

Challenges

- Inaccurate estimation of blood loss
- Unrecognized hemorrhage risk factors
- Lack of aggressive monitoring
- Inadequate transfusion of blood products
- Poor coordination of team responses

Timely Clinical Interventions

- Additional large bore IV access
- Consider Arterial line
- Administration of crystalloids, colloids, and vasopressors
- Appropriate lab work
- Blood bank preparation of blood products

Recommendations

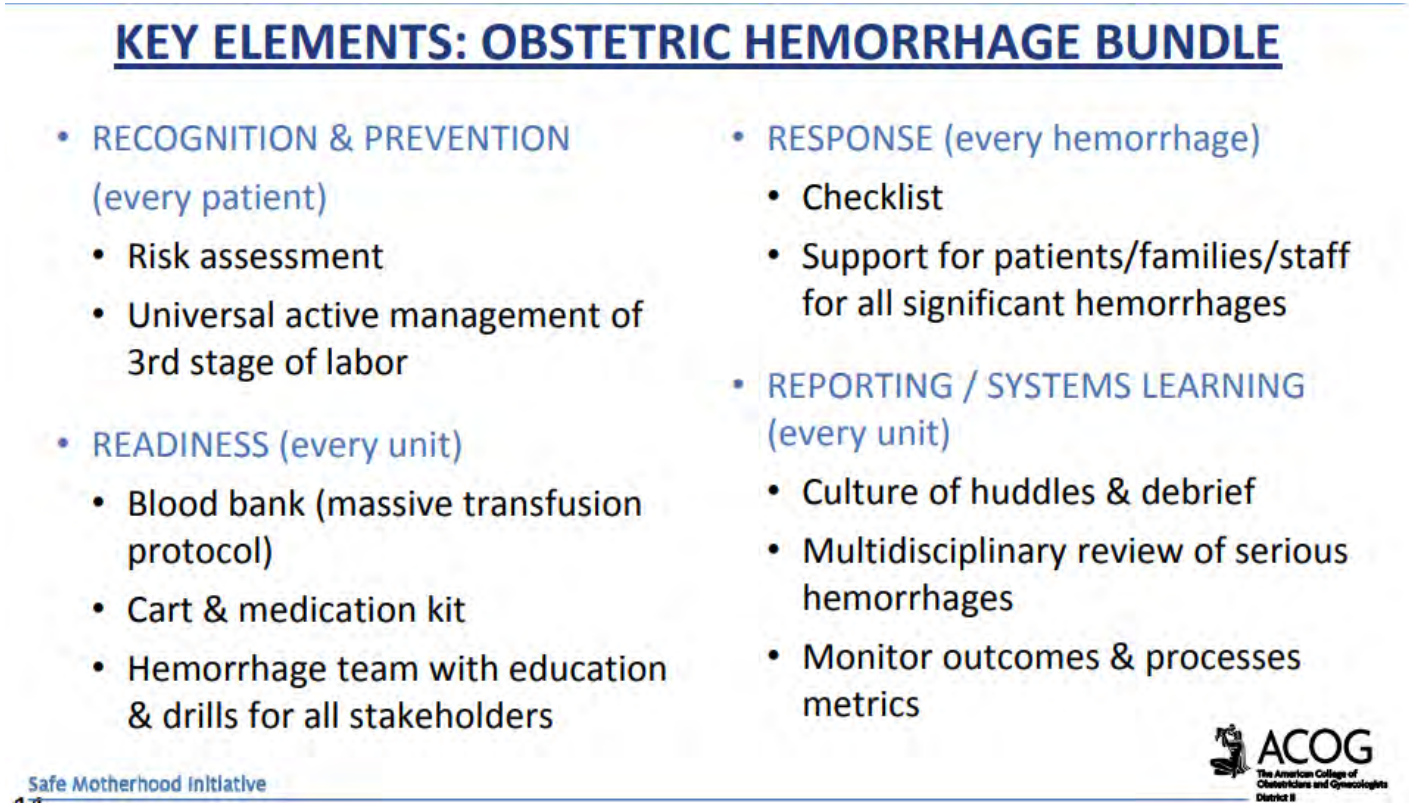
- Joint Commission recommends standardized guideline implementation
- Only 67% of academic obstetric anesthesia units have adopted standardized PPH guidelines
- However, 93% of these units have a massive transfusion protocol (MTP)
- Without guidelines, parturients are managed with significant variability even within a single institution

Standardized PPH Guidelines

AANA Practice Guideline

- Stepwise, systematic approach
  - Decreases need for blood products and transfusion related complications like DIC
- Highlight critical clinical interventions necessary for comprehensive and multidisciplinary care in every maternity unit
- Evidence based recommendations backed by ACOG

Consensus Bundle



Stage 1 PPH Checklist

Checklist: Stage 1	**Initial Steps**	**Medications:**
Blood loss >500 mL vaginal OR Blood loss >1000 mL cesarean with normal vital signs and lab values	☐ Ensure 16G or 18G IV access ☐ Increase IV fluid (crystalloid without oxytocin) ☐ Insert indwelling urinary catheter ☐ Fundal massage **Medications (see right box)** ☐ Increase oxytocin, additional uterotonics **Blood Bank** ☐ Type & crossmatch 2 units RBCs **Action** ☐ Determine etiology & treat	• **Oxytocin (Pitocin)** ○ 10-40 units per 500-1000mL solution • **Methylergonovine (Methergine)** ○ 0.2 milligrams IM (may repeat) • **15-methyl PGF2α (Hemabate, Carboprost)** ○ 250 micrograms IM (may repeat in q15 minutes, maximum 8 doses) • **Misoprostol (Cytotec)** ○ 800-1000 micrograms PR ○ 600 micrograms PO or 800 micrograms SL

Stage 2 PPH Checklist

Checklist: Stage 2 Continued bleeding EBL up to 1500mL **OR** >2 uterotonics with normal vital signs and lab values	**Initial Steps** □ Mobilize additional help □ Place 2nd IV (16-18g) □ Draw STAT labs (CBC, Coags, Fibrinogen) □ Prepare OR **Medications** □ Continue stage 1 medications; consider TXA **(see right box)** **Blood Bank** □ Obtain 2 units red blood cells (do not wait for labs. Transfuse per clinical signs/symptoms) □ Thaw 2 units fresh frozen plasma **Actions** □ For uterine atony → consider uterine balloon or packing, possible surgical interventions □ Consider moving patient to operating room □ Escalate therapy with goal of hemostasis Huddle and move to Stage 3 if continued blood loss and/or abnormal VS	**Transexamic Acid (TXA)** • 1 gram IV over 10 min (add 1 gram vial to 100mL normal saline and give over 10 min; may be repeated once after 30 min) **Possible interventions:** • Bakri balloon • Compression suture/B-Lynch suture • Uterine artery ligation • Hysterectomy

Stage 3 PPH Checklist

Checklist: Stage 3 Continued bleeding with EBL >1500mL OR >2 units RBCs given **OR** Patient at risk for occult bleeding or coagulopathy **OR** Patient with abnormal vital signs/labs/oliguria	**Initial Steps** □ Mobilize additional help □ Move to OR □ Announce clinical status (vital signs, cumulative blood loss, etiology) □ Outline & communicate plan **Medications** □ Continue Stage 1 medications; consider TXA **Blood Bank** □ Initiate massive transfusion protocol □ If clinical coagulopathy: add cryoprecipitate, consult for additional agents **Action** □ Achieve hemostasis, interventions based on etiology □ Escalate interventions

Stage 4 PPH Checklist

Checklist: Stage 4 Cardiovascular Collapse (massive	**Initial Steps** □ Mobilize additional resources **Medications** □ ACLS
hemorrhage, profound hypovolemic shock, or amniotic fluid embolism)	**Blood Bank** □ Simultaneous aggressive massive transfusion **Action** □ Immediate surgical intervention to ensure hemostasis (hysterectomy)
Post-Hemorrhage Management	□ Determine disposition of patient (whether ICU required) □ Debrief with the whole obstetric care team □ Debrief with patient and family □ Document information in patient medical record

Mass Transfusion Protocol

1 Patient currently bleeding & at risk for uncontrollable bleeding

- A Activate MTP — call **(ADD NUMBER)** & say "activate massive transfusion protocol"
- B Nursing/anesthesia draw stat labs
  - type & crossmatch
  - hemoglobin & platelet count, PT (INR)/ PTT, fibrinogen, & ABG (as needed)

2 Immediate need for transfusion (type & crossmatch not yet available)

- A Give 2-4 units O-negative PRBCs
- B **"OB Emergency Release"**

3 Anticipate ongoing massive blood needs

- A Obtain massive transfusion pack
  - Consider using coolers
- B Administer as needed in a 6:4:1 ratio
  - 6 units PRBCs
  - 4 units FFP
  - 1 apheresis pack of platelets

4 Initial lab results

- A Normal › anticipate ongoing bleeding › repeat massive transfusion pack › bleeding controlled › deactivate MTP
- B Abnormal › repeat massive transfusion pack › repeat labs › consider cryoprecipitate and consultation for alternative coagulation agents (Prothrombin Complex Concentrate [PCC], recombinant Factor VIIa, tranexamic acid)

Current Research

Measured Clinical Outcomes

- Blood product administration
- Uterotonic administration
- ICU admission
- Frequency of Hysterectomies
- Maternal Morbidity and Mortality

Blood Product Administration

- California Maternal Quality Care Collaborative
  - 99 facility study finding significant decrease in PPH patients
- Multifacility cohort study demonstrated 15% decrease in PRBC transfusions
- Studies on smaller scale found paradoxical increase in transfusion rates

Other Findings

- Uterotonic Administration
  - 4 year cohort study: uterotonic use increased from 47% to 64.8%
- ICU Admissions
  - Decrease in ICU stay and length of stay > 96 hours post delivery
- Hysterectomy Rates
  - Low volume intervention, difficult to determine guideline effectiveness
  - Some studies have demonstrated rate reduction

Hemorrhage Checklist in Action

https://www.youtube.com/watch?v=8lztjAlkMsM

EXAMPLE

Managing **Maternal Hemorrhage**

VITAL SIGNS

Normal vitals do not always assure patient stability

AIRWAY

- Provide adequate ventilation
- Assess need for intubation

BREATHING

- Supplemental O_2 5-7 L/min by tight face mask

CIRCULATION

- Pallor, delayed capillary refill, and decreased urine output can indicate compromised blood volume without change in BP or HR
- Decreased urine output, decreased BP, and tachycardia may be late signs of compromise

ACTIONS

- Notify team
- Bring cart & medications to patient room
- Activate Massive Transfusion Protocol

INFUSIONS

- Start 2nd large bore IV (16 gauge if possible)
- Ringers Lactate (RL) replaces blood loss at 2:1
- Prepare for transfusion
- Blood coagulation factors
- Warm blood products and infusions to prevent hypothermia, coagulopathy, and arrhythmias

MEDICATION FOR UTERINE ATONY

OXYTOCIN (PITOCIN)

10-40 units per 500-1000mL solution

METHYLERGONOVINE (METHERGINE)

0.2 milligrams IM

Avoid with hypertension

PROSTAGLANDIN F2 ALPHA (HEMABATE)

250 micrograms IM (may repeat in q15 minutes, maximum 8 doses)

Avoid with asthma; use with caution with hypertension

MISOPROSTOL (CYTOTEC)

800-1000 micrograms PR, 600 micrograms PO, or 800 micrograms SL

OTHER CONSIDERATIONS

Intrauterine balloon tamponade

SURGICAL INTERVENTIONS

May be a life-saving measure and should not be delayed pending correction of coagulopathy, the most common reason for the delay

Important Phone Numbers
Rapid Response Team:
Blood Bank:
Anesthesia:
Interventional Radiology:
Senior Surgeon:
ICU:
Director of Service:
Other:

REVISED OCTOBER 2015

ACOG

Apps

ACOG app

Safe Motherhood Initiative

Summary

- Multidisciplinary PPH response team, stage based PPH protocol, and functioning MTP are keys to successful PPH management
- Extent to which CRNAs are utilizing PPH guidelines is still unknown
- Research limitations in determining guideline effectiveness

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Questions?

https://www.thebump.com/a/gentle-c-section