Obstetric Hemorrhage

Presented by

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GammaAI used for slide layout from original content

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Who are We?

For more information on obstetric hemorrhage response and related resources, please visit our website:

www.sonar-ob.org

Suzie Newell, DNP, CRNA, FAANA

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Maternal Hemorrhage: A Global Crisis with Stark Disparities

Maternal hemorrhage remains a critical challenge, with devastating impacts globally and significant inequities in the United States.

55th	2.5x	2 min
US Ranking	Disparate Risk	Global Tragedy
The United States ranks 55th globally in maternal mortality rates, a concerning position for a developed nation.	Black, Hispanic, Indigenous, and Asian birthing individuals are 2.5 times more likely to experience hemorrhage.	A woman dies in childbirth every two minutes worldwide, with hemorrhage being the leading cause.

The Most Preventable Cause

Despite its prevalence, maternal hemorrhage is also the most preventable cause of maternal mortality, underscoring the urgency for improved intervention and care.

Burgess, 2020; Say, 2014; Trends, 2023; https://onehealthtrust.org/publications/infographics/worldwide-maternal-mortality-rates/

3

We Have to do Better

Decade of Delivery Data: Key Findings

An extensive 10-year analysis of over 76 million deliveries revealed a critical paradox:

Despite rising postpartum hemorrhage (PPH) rates, blood transfusions have surprisingly decreased.

(Corbetta-Rastelli, 2023)

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A Century of Massive Transfusion

World War I (Early 20th Century) — 1
Whole blood was the standard for transfusion, a simple yet effective approach for immediate blood loss.

Vietnam War Era (Mid-20th Century) — 2
Advances in blood storage and fractionation led to component therapy: plasma, platelets, and red cells given separately.

1980s–1990s Resuscitation — 3
Heavy reliance on crystalloids and component therapy often resulted in poor outcomes, complicated by the "lethal triad" (hypothermia, acidosis, coagulopathy).

Afghanistan & Iraq Wars (Early 2000s) — 4
Research highlighted survival benefits of balanced resuscitation (e.g., 1:1 plasma:RBC ratios), leading to the development of Massive Transfusion Protocols (MTPs).

Modern Practice & Whole Blood — 5
Whole blood use has re-emerged in military and some civilian trauma, though widespread adoption faces storage and logistical hurdles.

Massive transfusion practices have dramatically evolved over the last century, shaped by wartime experience and scientific advancements.

Riskin, 2009; Thompson, 2019

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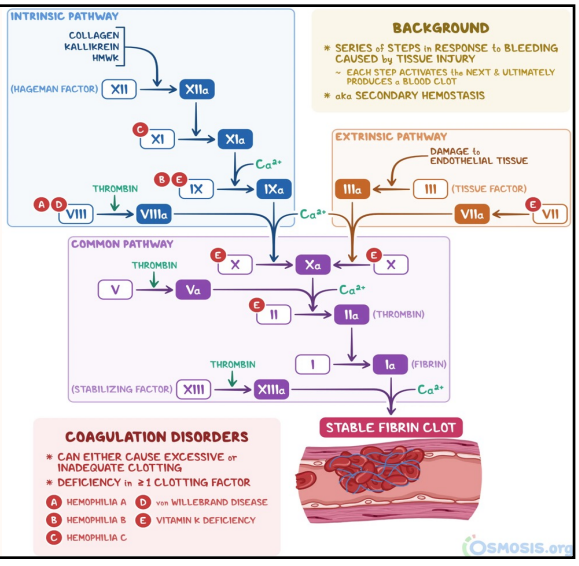
The Coagulation Cascade: A Closer Look

The **Extrinsic Pathway** is activated rapidly in response to external tissue injury, while the **Intrinsic Pathway** begins with internal vessel wall damage. These two pathways merge into the **Common Pathway**, initiated by Factor X, culminating in the conversion of fibrinogen to **Fibrin (Factor I)**, which forms the meshwork of a stable clot.

(Tarantino, 2022)



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DIC in Obstetric Hemorrhage

In obstetric hemorrhage, the finely tuned balance of the coagulation cascade can unravel, leading to Disseminated Intravascular Coagulation (DIC). This is a severe complication where both clotting factors are consumed and existing clots are aggressively broken down, ultimately hindering effective hemostasis.

Severe Hemorrhage
Traumatic bleeding in obstetrics triggers an abnormal clotting response.

Clotting Factor Consumption
Rapid, widespread activation of coagulation depletes essential clotting proteins.

Excessive Fibrinolysis
Massive release of t-PA generates excessive plasmin, aggressively breaking down vital fibrin clots.

Fibrinogen Degradation
The cascade degrades fibrinogen and fibrin, producing Fibrinogen Degradation Products (FDPs).

In essence, in DIC associated with obstetric hemorrhage, the body's mechanisms are collectively working to **break down fibrinogen**, preventing effective clot formation and exacerbating bleeding.

Popescu, 2022

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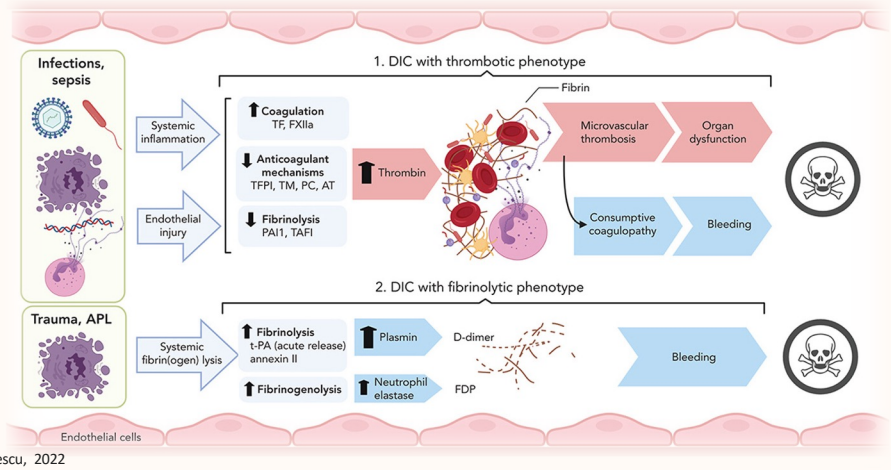
DIC in Obstetric Hemorrhage



Popescu, 2022

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Obstetric Hemorrhage Definition

reVITALize Initiative 2014

Standardized definition established by American College of Obstetrics and Gynecology

Current Standards

500 mL vaginal delivery
1,000 mL cesarean delivery

Cumulative blood loss ≥1,000 mL OR blood loss with signs/symptoms of hypovolemia within 24 hours after birth process, regardless of delivery route

Menard, et al., 2014

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Assessing Bleeding: The Four T's of PPH

When a postpartum hemorrhage occurs, a systematic approach helps identify the root cause. This framework, known as the "4 T's," guides clinicians through the most common etiologies.

Tone

Uterine atony is the most common cause, accounting for about 70% of cases, when the uterus fails to contract effectively after birth.

Tissue

Retained placental tissue or clots prevent uterine contraction and perpetuate bleeding.

Trauma

Genital tract lacerations, uterine rupture, or inversion can all contribute to hemorrhage.

Thrombin

Coagulation abnormalities (inherited or acquired, including DIC) interfere with clot formation and worsen blood loss.

Evensen; 2017

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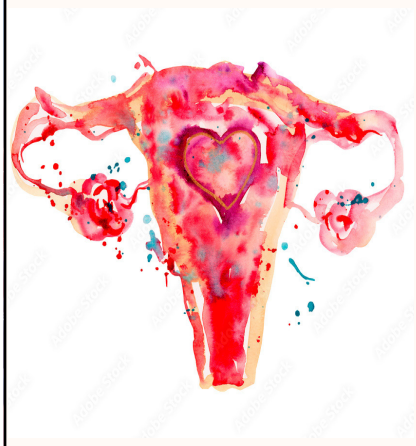

Uterine Atony: The Primary Culprit

Uterine atony is the failure of the myometrium (uterine muscle) to contract effectively after delivery.

This failure leaves the placental bed vessels wide open, preventing crucial hemostasis and leading to excessive blood loss.

Why it matters:

Atony accounts for approximately 70% of all postpartum hemorrhage cases, making its early recognition and management critical.

Bienstock, Eke, & Hueppchen, 2021; Ende et al., 2021

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Risk Factors for Uterine Atony

What exactly makes the uterus boggy? Everything.

1

Uterine Overdistension

- Multiple gestation
- Polyhydramnios
- Macrosomia

2

Labor Anomalies

- Prolonged or rapid labor
- Oxytocin induction/augmentation

3

Maternal Factors

- High parity
- High BMI/obesity
- Prior cesarean or uterine surgery
- Chorioamnionitis

4

Pharmacological Agents

- Magnesium sulfate
- Halogenated anesthetics
- Nifedipine

Bienstock, Eke, & Hueppchen, 2021; Ende et al., 2021

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Other Critical Causes of PPH

While uterine atony is the most common cause, other serious conditions involving the placenta or the uterus itself can lead to severe postpartum hemorrhage.

Placenta Abnormalities

Conditions such as placenta previa, accreta spectrum, or abruption significantly increase hemorrhage risk due to impaired placental separation or abnormal attachment to the uterine wall.

Uterine Rupture

A rare but catastrophic tear in the uterine wall, often along a prior C-section scar, results in acute and massive bleeding, demanding immediate surgical intervention.

Oyelese, 2006

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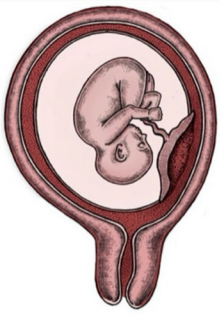

NORMAL PREGNANCY

The placenta attaches to a temporary layer in the uterus that's shed at delivery

PLACENTA ACCRETA

When the placenta attaches too deeply into the uterine wall

PLACENTA INCRETA

When the placenta attaches into the uterine muscle

PLACENTA PERCRETA

When the placenta goes completely through the uterine wall, sometimes invading nearby organs like the bladder

Accreta

https://my.clevelandclinic.org/health/diseases/17846-placenta-accrete
https://www.preventaccreta.org/accreta

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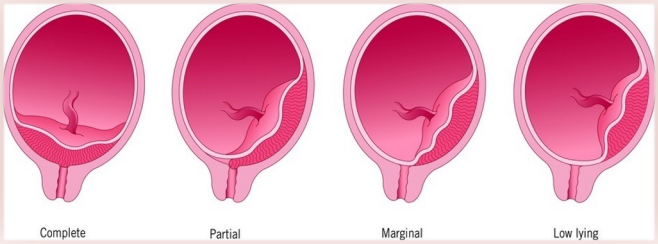

(Figure from Oylese & Smulian, 2006)
Baird, 2017; Oyelese, 2006

Placenta Previa: Categories of Placental Location

1. **Complete Previa**
   The internal cervical os is entirely covered by the placenta, requiring a C-section for delivery.
2. **Partial Previa**
   The placenta partially covers the internal cervical os. This may or may not require a C-section.
3. **Marginal Previa**
   The edge of the placenta reaches the margin of the internal cervical os, but does not cover it.
4. **Low-Lying Placenta**
   The placenta is located in the lower uterine segment, typically within 2 cm of the internal os, but not reaching it.

(Baird, 2017; Oyelese, 2006)

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Uterine Blood Flow: The Why

- Non-pregnant UBF is 60 ml/min
- Pregnant UBF 600-700ml/min

Women can lose 1 liter/minute and can die within ten minutes.

Bienstock, 2021

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Critical Recognition Challenge

Physiological Compensation

Young, healthy obstetric patients have compensated for increased blood volume over 9 months of pregnancy

Pediatric-Like Response

Similar to pediatric patients in hemorrhagic shock - vital signs remain stable until severe decompensation occurs

Critical Point: Use definitions, not vital signs or appearance, as your first line of defense

You will not see signs of decompensation until the patient is in serious trouble

ACOG Practice Bulletin 183, 2017

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The Power of Protocols: Elevating Patient Care

Since the IOM's seminal "To Err is Human" report over 25 years ago, standardized care bundles and clinical guidelines have proven invaluable.

Evidence-Based

Significantly decreases morbidity and mortality.

Equity & Standardization

Ensures consistent, equitable care for all patients.

Enhanced Safety

Despite naysayers, literature consistently shows improved outcomes.

IOM, 2000; Lemming-Lee; 2019; Main, 2020

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Transition to Quantitative Blood Loss (QBL)

Visual estimation (EBL) is inaccurate. We're shifting to Quantitative Blood Loss (QBL) for precision, involving two key components:

Direct Measurement

Objective methods for accurate blood loss assessment.

Cumulative Record Keeping

Continuous collection and reporting of all blood loss.

QBL in Obstetric Hemorrage, 2019

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ACOG Recommendations: PPH Stage 1

For Estimated Blood Loss of 500-999 mL

Immediate interventions focus on pharmacological management to prevent progression to more severe hemorrhage.

1

Pitocin

- Standard first-line uterotonic.
- Follow "Rule of 3's" for administration

2

Methylergonovine (Methergine)

- Administer intramuscularly (IM) only.
- **Contraindicated in patients with hypertension.**

3

Carboprost (Hemabate)

- Administer intramuscularly (IM) only.
- **Contraindicated in patients with asthma.**
- May cause transient diarrhea.

4

Misoprostol (Cytotec)

- Administer per rectum (PR) or sublingually (SL).
- An alternative when IM agents are contraindicated.

Fleisher, 2016; Kovacheva, 2015; Safe Motherhoood Initiative, 2020

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Rule of 3s

Pitocin Protocol for Cesarean Delivery

Initial Dose
3 units IV bolus immediately after delivery of baby

Infusion Rate
333 cc/hour continuous infusion following bolus

Wait 3 minutes after Bolus
Repeat 3 units IV bolus if tone is not improved and wait another 3 minutes. If tone is not improved move to another uterotonic

Reduced hypotension risk

Decreased fluid retention

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ACOG Recommendations: PPH Stage 2

For estimated blood loss (EBL) > 1000 mL or after two uterotonic agents

Administer TXA
Tranexamic Acid should be given to prevent clot degradation and stabilize hemorrhage, improving patient outcomes.

Stat Lab Orders
Obtain urgent lab tests including CBC, coagulation panel, and fibrinogen levels.

Activate MTP
Initiate Massive Transfusion Protocol for rapid administration of blood products. Anesthesia should be prepared to escalate quickly.

Intrauterine Balloon
Consider placement of an intrauterine balloon tamponade (e.g., Bakri balloon) to apply direct pressure to the bleeding site.

Interventional Radiology
Consult Interventional Radiology for potential uterine artery embolization, a targeted approach to stop intractable bleeding.

Emergency Hysterectomy
Prepare for a potential emergency hysterectomy as a last-resort, life-saving measure when other interventions fail.

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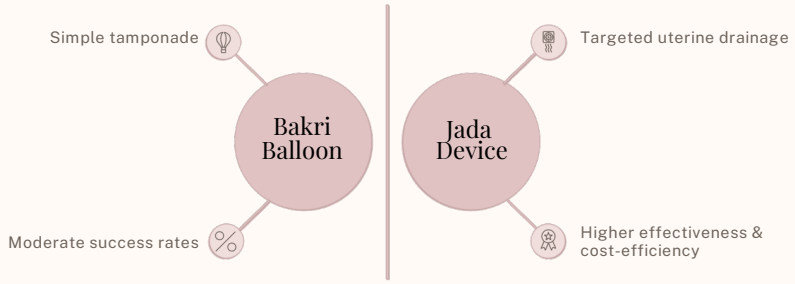
Intrauterine Tamponade: Bakri vs. Jada



Research indicates that the Jada device may offer advantages over the traditional Bakri balloon. A cost-effectiveness analysis by Bridges, Doshi, & Caughey (2023) highlights Jada's superior efficacy and economic benefit in managing PPH.

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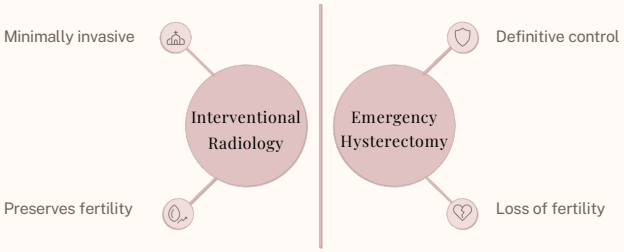
Interventional Radiology vs. Emergency Hysterectomy



The choice between IR and hysterectomy depends on the patient's condition, the availability of interventional radiology services, and the patient's desire for future fertility.

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Directed MTP: Putting it Together As the Anesthesia Provider

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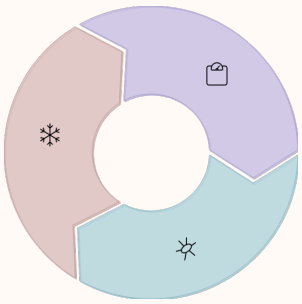
The "Lethal Triad" in Obstetric Hemorrhage

Hypothermia

Reduced body temperature from cold products and the operating room temperature drastically slows enzymatic clotting reactions and platelet function.



Acidosis

Poor tissue perfusion due to blood loss drives anaerobic metabolism and lactic acid buildup, creating a hostile environment for coagulation.

Coagulopathy

Clotting factors and platelets are consumed, diluted, or rendered ineffective by the acidic and cold biochemical environment, exacerbating bleeding.

Kolucki, 2020

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Obstetric Hemorrhage: Massive Transfusion Protocol

Phase 1: Initial Response (QBL > 1000 mL & Bleeding Ongoing)

- *Administer uterotonics (e.g., oxytocin, methylergonovine, carboprost).*
- *Give 1st dose Tranexamic Acid (TXA) 1g IV.*
- *Activate MTP: Order initial units of Packed Red Blood Cells (RBCs), Fresh Frozen Plasma (FFP), and platelets.*
- *Check baseline labs (CBC, Coags, Fibrinogen, Calcium).*

Phase 2: Escalation (QBL > 1500 mL & Bleeding Ongoing/Unstable)

- *Continue MTP: Administer additional RBCs, FFP, and platelets*
- *Administer Cryoprecipitate (for fibrinogen replacement) based on lab results*
- *Correct hypocalcemia with IV Calcium, especially after multiple blood product transfusions.*
- *Call for more staff: Obstetrics, Anesthesia, Blood Bank, Critical Care.*
- *Re-evaluate source of bleeding and consider interventional radiology or surgical options.*

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Phase 1 & Hematological Goals

Key Labs to Draw Stat:

- CBC
- PT/PTT
- Fibrinogen Level
- Type & Screen / Crossmatch
- CMBP
- D-Dimer
- Lactic Acid

Hematological Goals:

- **Hgb ≥ 10** gm/dl (antepartum)
- **Hgb ≥ 8** gm/dl *(postpartum)*
- **Plt ≥ 75,000** mm3
- **Fibrinogen > 250** mg/dl
- **PT < 1.5 x control**
- **PTT < 1.5 x control**

Phase 1: Uterotonics, TXA, Call for the OB MTP Pack, Draw labs

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The Role of Fibrinogen in Obstetric Hemorrhage

Fibrinogen is a cornerstone of effective hemostasis. Its timely correction is paramount in reducing mortality associated with massive obstetric hemorrhage.

Predictive Marker

Hypofibrinogenemia is a critical early predictor for the activation of a Massive Transfusion Protocol (MTP), signaling high-risk cases.

Timely Intervention

Prompt administration of cryoprecipitate to correct fibrinogen levels significantly improves patient outcomes within MTP frameworks.

Continuous Monitoring

Regular assessment of fibrinogen levels is essential for guiding ongoing management and optimizing care in patients with massive hemorrhage.

Prioritizing fibrinogen assessment and correction empowers clinicians to mitigate severe bleeding and improve maternal survival rates.

Meizoso, 2022

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MTP Pack from blood bank

6 Units RBCs

Primary oxygen-carrying capacity restoration

6 Units FFP

Clotting factor replacement and coagulopathy correction

1 Unit Apheresed PLT

Platelet function and hemostatic plug formation

Additional Components

- **10 units Cryoprecipitate** - Fibrinogen and Factor VIII replacement
- **Calcium Gluconate 10% 2gm IV** - Counteracts citrate toxicity with each MTP round

Phase 1 bleeds seamlessly into Phase 2 which is the MTP

Kolucki, 2020

30

ROUND 1

3 Units PRBC
Initial restoration of oxygen-carrying capacity.

1 Pack Platelets
Support platelet function for clot formation.

Cryoprecipitate 20 units
Replenish fibrinogen and Factor VIII.

3 Units FFP
Maintain coagulation profile.

Consider Vitamin K
Assess for severe coagulopathy or warfarin use.

3 Units FFP
Provide essential clotting factors.

Calcium Gluconate* 2g
ASSESS FOR ONGOING BLEEDING.

3 Units PRBC
Continue oxygen support.

Calcium Gluconate 2g
ASSESS FOR ONGOING BLEEDING.

*Calcium Chloride 1 gm is preferred through a central line

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Still Bleeding?

01
Begin The 2nd Round
Continue MTP protocol with same ratios. Monitor patient response closely.

02
Respond to Labs
Address DIC, acidosis, electrolyte abnormalities. Target platelets >75,000.

03
Additional Interventions
20 units Cryoprecipitate.
Redose TXA.

Monitoring Protocol
- Repeat lab work every 30-60 minutes
- Obtain arterial blood gases
- Consider A-line placement for continuous monitoring
- Reassess MTP continuation criteria

Reference: Kolucki, 2020

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Deactivate MTP?

Primary Criteria

Normalized Laboratory Values

- PT/INR within acceptable range
- Platelet count >75,000
- **Fibrinogen >250 mg/dL**

Clinical Assessment

No Evidence of Ongoing Bleeding

- Hemodynamic stability achieved
- Surgical hemostasis confirmed
- Stable hemoglobin levels

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The CRNA's Vital Role in PPH Management

The Role and Goal of the CRNA

Constant Vigilance

Maintain acute awareness of maternal status, vital signs, and blood loss to anticipate and respond rapidly to changes.

Clear Communication

Facilitate precise, concise communication within the care team, updating on patient status and intervention needs.

Call for Extra Help

Proactively mobilize additional resources and personnel as needed to manage escalating hemorrhage effectively.

Activate MTP

Timely initiation and management of the Massive Transfusion Protocol (MTP) for rapid blood product administration.

Stabilize Patient

Focus on maintaining hemodynamic stability through fluid resuscitation, blood product support, and airway management.

Prevent Complications

Guard against severe complications like DIC/TIC, hypothermia, acidemia, and electrolyte imbalances through vigilant monitoring and intervention.

Spinella, 2017

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Critical Access

In small or supply-limited hospitals, **time and logistics are the enemy**. TXA, calcium, heat, and fibrinogen concentrate are low-infrastructure moves that preserve clotting while blood products catch up.

TXA Administration

Immediate antifibrinolytic effect - requires only IV access and standard medication preparation

Warming Measures

Prevent hypothermia using available warming devices and environmental controls

Calcium & Fibrinogen

Restore essential cofactors for coagulation without waiting for blood bank

Resource optimization: Focus on what you can control immediately rather than what you're waiting for. These basic interventions often provide the critical time needed for definitive management.

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Blood Products At A Glance

PRBC

Packed Red Blood Cells

Primary Use: Improve oxygen transport capacity

Expected Action: Increases hemoglobin by 1g/dL and hematocrit by 3%

Storage Life: 35 days refrigerated

Critical Notes: Must use inline filter, compatible only with normal saline. Sodium citrate binds calcium, potentially affecting coagulation.

FFP

Fresh Frozen Plasma

Primary Use: Contains essential clotting factors

Expected Action: Improves PT/INR by 2.5–5%

Storage Life: Stored frozen up to 1 year

Critical Notes: HEMOSTASIS PRIORITY. Units require thawing time before administration.

Reference: American Red Cross, n.d.; Trojiano, 2019; Wong, 2016

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Blood Products At A Glance

Platelets

Platelet Concentrate

Primary Use: Improve oxygen transport capacity

Expected Action: Increases platelet count by 50,000/μL

Storage Life: 5 days at room temperature with agitation

Critical Notes: Essential for hemostasis and platelet function correction. Shortest shelf life of all blood products.

Cryoprecipitate

Clotting Factor Concentrate

Primary Use: Rich source of fibrinogen, Factor VIII, von Willebrand factor, Factor XIII, and fibronectin

Expected Action: 10 units increase fibrinogen by 50–100 mg/dL

Storage Life: Stored frozen up to 1 year

Critical Notes: Concentrated fibrinogen for HEMOSTASIS. Specifically indicated for von Willebrand disease and hemophilia management.

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A comprehensive bibliography of sources supporting evidence-based obstetric care and postpartum hemorrhage management.

All slides were Arranged by Gamma AI from Original content. All illustrations were AI-generated Through Adobe

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- https://my.clevelandclinic.org/health/diseases/17846-placenta-accrete
- https://onehealthtrust.org/publications/infographics/worldwide-maternal-mortality-rates/
- https://www.preventaccreta.org/accreta

Special Thanks

To Matthew Villiaume, PhD, MD from Vanderbilt University, for checking the accuracy of my explanation on the DIC slide

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Slide-by-Slide Image Source Map

- Title / Intro Slides
  Background illustrations are AI-generated via Adobe.
- Historical Development
  Stylized visuals (whole blood, Vietnam War era) are AI-generated via Adobe.
- Coagulation Cascade / DIC
  Diagrams of pathways and fibrin breakdown are AI-generated via Adobe, content citing Tarantino (2022) and Popescu (2022).
- Four T's of PPH
  Infographic icons for Tone, Tissue, Trauma, Thrombin are AI-generated via Adobe.
- Uterine Atony
  Uterus illustration with highlighted risk factors is AI-generated via Adobe, content from Bienstock & Ende references.
- Placenta Abnormalities
  Accreta images from preventaccreta.org and Cleveland Clinic; Placenta previa diagram from Oyelese & Smulian (2006) and Baird (2017); Supporting visuals are AI-generated via Adobe.
- Uterine Blood Flow
  Flow graphic is AI-generated via Adobe, content attributed to Bienstock (2021).
- Recognition Challenge / Protocols
  Illustrations of physiologic compensation and pediatric-like response are AI-generated via Adobe.
- QBL / Stage 1 / Stage 2
  Uterotonic drug icons and Rule of 3's visual are AI-generated via Adobe, with citations Kovacheva (2015) and Fleischer (2016).

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Slide-by-Slide Image Source Map (Continued)

- Intrauterine Tamponade
  Illustration of intrauterine balloon tamponade procedure and relevant equipment are AI-generated via Adobe, with content citing clinical guidelines.
- Interventional Radiology vs. Hysterectomy
  Visual decision tree comparing interventional radiology and hysterectomy options for hemorrhage management are AI-generated via Adobe, citing relevant studies and practice bulletins.
- CRNA Role
  Illustration of a CRNA providing anesthesia care and managing resuscitation during obstetric hemorrhage is AI-generated via Adobe, reflecting professional guidelines.
- Directed MTP / Blood Products
  Visual representation of massive transfusion protocol components, specific blood products, and administration ratios are AI-generated via Adobe, citing Kolucki (2020) and Riskin (2009).
- Still Bleeding? / Fibrinogen
  Diagram illustrating the role of fibrinogen in coagulation and management of persistent bleeding is AI-generated via Adobe, content citing Meizoso (2022) and Popescu (2022).

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Slide-by-Slide Image Source Map (Final)

Deactivate MTP

Visuals depicting criteria for massive transfusion protocol deactivation and algorithms are AI-generated via Adobe, content citing clinical guidelines.

Blood Products At a Glance

Infographics summarizing various blood products, their components, and indications are AI-generated via Adobe, based on current transfusion medicine guidelines.

Critical Access / Limited Resource Add-Ons

Illustrations and text explaining adaptations for managing hemorrhage in critical access or limited resource settings are AI-generated via Adobe, drawing from global health best practices.

References / Closing

Final slide elements including presentation acknowledgments and concluding remarks are AI-generated via Adobe, with abstract background imagery.

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Thank You!

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