HEALTHTRUST®

August 20, 2020

Code Crimson: Massive Transfusion Protocol in Obstetrics

A presentation for HealthTrust Members by

Frank R. Kolucki, Jr., M.D., FACOG

Chairman of the Department of Obstetrics/Gynecology, Moses Taylor Hospital

Disclosures

- The presenter has no financial relationships with any commercial interests pertinent to this presentation.

- This program may contain the mention of drugs or brands presented in a case study or comparative format using evidence-based research. Such examples are intended for educational and informational purposes and should not be perceived as an endorsement of any particular supplier, brand or drug.

Code Crimson: Massive Transfusion Protocol in Obstetrics

Learning Objectives

1. Define risk factors which contribute to catastrophic maternal hemorrhage
2. Recall why massive transfusion protocols are physiologic and effective
3. Explain the benefits of utilizing an evidence-based care team approach to aid patients in extremis
4. Review the Joint Commission provision of care, treatment and service standards for Maternal safety regarding hemorrhage

Code Crimson: Massive Transfusion Protocol in Obstetrics

A Quality & Safety Initiative

Maternal Mortality

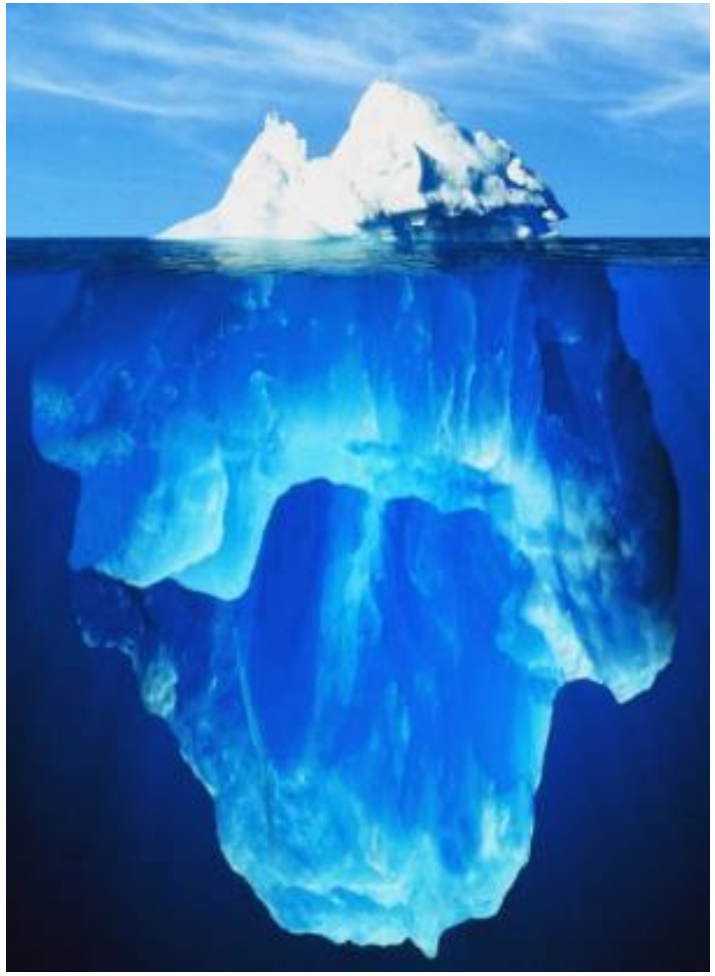
An American Failure

- America is the most dangerous country in the developed world to give birth
- U.S. ranks 65th in the world regarding maternal death rate*
- Increased from 14 to 26.4 / 100,000 Births from 1990–2015
- Occurred during a time of unprecedented medical advancement
- Maternal death classified as “Never Event” by CHS OB Collaborative
- Greatest tragedy in modern medicine

Sources: *ACOG Patient Safety and Quality Improvement.* Berg, Cl et al., Obstet Gynecol 2012.
WHO, UNICEF, UNFPA, The World Bank, and UNDP. Trends in Maternal Mortality 1990-2013 :2014

Maternal Morbidity Is Extreme

- Shock
- Acute Kidney Injury
- Pulmonary Embolism
- Acute Respiratory Distress Syndrome (ARDS)
- Myocardial Infarction
- Sepsis
- Increased by 45% from 2006 – 2015
- Affects 80,000 mothers per year



Sources: Callaghan, Wm, et al.. Obstet, Gynecol, 2012.
K. Fingar, et al., Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006-2015.

Maternal Fetal Medicine

- Antenatal Steroids
- Antibiotics for Preterm Premature Rupture of Membranes (PPROM)
- Magnesium for Neuroprotection
- Fetal Therapy for Twin-Twin Transfusion Syndrome, Neonatal Alloimmune Thrombocytopenia, and Neural Tube Defects
- Head/body cooling for Hypoxic Ischemic Encephalopathy

Clear Need for Action

Where is the “M” in Maternal-Fetal Medicine?

Current Commentary

Where Is the “M” in Maternal–Fetal Medicine?

Mary E. D'Alton, MD

In contrast to the generally encouraging trend regarding global maternal mortality, there has been an apparent increase in the maternal mortality ratio in the United States. Although maternal death remains a relatively rare adverse event in this country, programs to reduce maternal mortality also will result in a reduction in maternal morbidity, which is a far more prevalent problem. Progress in the field of maternal–fetal medicine over the past several decades has been largely attributable to improvements in fetal and neonatal medicine. We need to develop an organized, national approach focused on reducing maternal mortality and morbidity. The goal will be to outline a specific plan for clinical, educational, and research initiatives to put the "M" back in maternal–fetal medicine.

(Obstet Gynecol 2010;116:1401–4)

Twenty-five years ago, in a seminal article published in the *Lancet*, Allen Rosenfield and Deborah Maine alerted the public to the tremendous problem of global maternal mortality.[1] Recognizing that maternal–child health care programs in developing countries were doing little to reduce maternal mortality and improve maternal health, this commentary was a call to action for health professionals, policy makers, and politicians to focus on this critical issue. Soon thereafter, the international movement to reduce maternal mortality was launched at the global Safe Motherhood Conference in Nairobi, Kenya. Finally, the international community acknowledged the importance of maternal health in the broader context of women's rights and equality and committed resources to decreasing maternal mortality. More recently, reduction in maternal mortality became one of the eight Millennium Development Goals of the United Nations.[2]

There has been good news this year in the progress toward the Millennium Development Goals of the United Nations, which targets a reduction in the maternal mortality ratio by 75% from 1990 to 2015. In a comprehensive analysis funded by the Bill and Melinda Gates Foundation, estimates of global maternal deaths have declined from 526,300 in 1980 to 342,900 in 2008.[3] Maternal mortality is difficult to measure, particularly in developing countries; thus, there are wide uncertainty intervals around these numbers. Nevertheless, these new estimates provide hope that interventions to reduce fertility rates, increase income and education, and expand access to skilled birthing attendants, among other efforts, may be producing the desired results. Because only a minority of countries is currently on track to meet the Millennium Development Goals of the United Nations, it is imperative that the global health community remains fully committed to this goal. At this year's Women Deliver conference, Melinda Gates pledged $1.5 billion toward maternal, newborn, and child health in developing countries over the next 5 years, the second largest donation in the foundation's history. This money not only will enormously help countries with the highest rates of maternal mortality but also it may prompt governments and organizations worldwide to invest more toward maternal health.

In contrast to the generally encouraging trend regarding global maternal mortality, there has been an apparent increase in the maternal mortality ratio in several high-income countries, such as the United States, Canada, Denmark, and Norway.[3] This is not the first evidence that maternal mortality is increasing in the United States. The National Center for Health Statistics has reported that the maternal mortality ratio increased by 62% between 1990 and 2006, from 8.2 to 13.3 per 100,000.[4] These increases have been largely attributed to methodological changes in the

From the Departments of Obstetrics and Gynecology, Columbia University Medical Center, and New York Presbyterian Hospital, New York, New York.

Corresponding author: Mary E. D'Alton, MD, Departments of Obstetrics and Gynecology, Columbia University Medical Center, 622 West 168th Street, PH 16-20, New York, NY 10032; email: md571@columbia.edu.

Financial Disclosure
The author did not report any financial conflict of interest.

ISSN: 0029-7844/10

Source: D'Alton ME. Where is the "M" in maternal-fetal medicine?. Obstet Gynecol. 2010;116(6):1401-1404. doi:10.1097/AOG.0b013e3181fd2556

HEALTHTRUST

National Focus

Quick Safety Issue 51 | October 2019

Proactive prevention of maternal death from maternal hemorrhage

Issue:
In the United States, approximately 700 women die annually from pregnancy-related complications — a shocking statistic considering that most pregnancy-related deaths are preventable.[1] The most frequent cause of severe maternal morbidity and preventable maternal mortality is obstetric hemorrhage — excessive blood loss from giving birth.[2] Recent data indicate that rates of maternal hemorrhage are increasing in developed countries, including the U.S. Also, the rate of hemorrhage-associated severe maternal morbidity (defined as the need for blood transfusion of four or more units of packed red blood cells and/or ICU level care during the birth process or immediate postpartum period) has exceeded the morbidities associated with other obstetric or medical conditions that may result in complications requiring higher level of care.

In addition, there are significant racial/ethnic disparities in pregnancy-related mortality; black women have a pregnancy-related mortality ratio approximately three times as high as that of white women.[3-4] Fully addressing these unacceptable mortality rates will require truly understanding the contributing factors that lead to mortality in African American women and other disproportionately affected populations in order to develop focused solutions. Overall, better understanding is needed on the circumstances surrounding pregnancy-related deaths and strategies to prevent future deaths.

As a result of this significant patient safety concern, The Joint Commission introduced two new standards, effective July 1, 2020, to address complications in maternal hemorrhage and severe hypertension/preeclampsia. This Quick Safety provides background information around strategies for the management of maternal hemorrhage that are outlined in new Provision of Care, Treatment, and Services standard PC.06.01.01: ***Reduce the likelihood of harm related to maternal hemorrhage***.

Maternal mortality by the numbers
Maternal hemorrhage is defined by the American College of Obstetricians and Gynecologists (ACOG) as a cumulative blood loss of greater than or equal to 1,000 mL, or blood loss accompanied by signs or symptoms of hypovolemia, within 24 hours after the birth process.[5] Approximately 3-5% of obstetric patients will experience a postpartum hemorrhage.[6] These preventable events are the cause of 27% of maternal deaths worldwide,[7] and 11.2% of U.S. maternal deaths.[8]

A review of the Joint Commission sentinel event database for cases coded as maternal death or severe maternal morbidity for 2010 through August 2019, indicate maternal hemorrhage is a causal factor in 51% of those reported sentinel events.

During 2011-2015, the Centers for Disease Control and Prevention (CDC) reports 3,410 pregnancy-related deaths occurred in the U.S., and the overall pregnancy-related mortality ratio was 17.2% pregnancy-related deaths per 100,000 live births.[8] When combined, cardiovascular conditions were responsible for more than 33% of pregnancy-related deaths; these conditions include cardiomyopathy (10.8%), other cardiovascular conditions (15.1%), and cerebrovascular accidents (7.6%). Other leading causes of pregnancy-related death included other noncardiovascular medical conditions (14.3%), infection (12.5%), and obstetric hemorrhage (11.2%).[8]

According to the CDC, the rate of postpartum hemorrhage with procedures to control hemorrhage per 10,000 delivery hospitalizations increased from 4.3 in 1993 to 21.2 in 2014, with sharper increases in later years. The rate of postpartum hemorrhage with blood transfusions also increased noticeably over time, from 7.9 in 1993 to 39.7 in 2014.[9]

Although common risk factors for postpartum hemorrhage are known (see sidebar), it is important to note that 20% of hemorrhages occur in women with ***no risk factors***. All members of the obstetrical care team must maintain a constant readiness for this often-unpredictable emergency. Maintaining situational

Risk factors for maternal hemorrhage

Uterine atony
Lacerations
Retained placenta
Abnormally adherent placenta (accreta)
Coagulation defects
Uterine inversion

Source: American College of Obstetricians and Gynecologists, 2017

(Cont.)

The Joint Commission.

HEALTHTRUST

National Focus

R³ Report | Requirement, Rationale, Reference

A complimentary publication of The Joint Commission

Issue 24, August 21, 2019

Published for Joint Commission-accredited organizations and interested health care professionals, *R3 Report* provides the rationale and references that The Joint Commission employs in the development of new requirements. While the standards manuals also may provide a rationale, *R3 Report* goes into more depth, providing a rationale statement for each element of performance (EP). The references provide the evidence that supports the requirement. *R3 Report* may be reproduced if credited to The Joint Commission. Sign up for email delivery.

Provision of Care, Treatment, and Services standards for maternal safety

Effective July 1, 2020, 13 new elements of performance (EPs) will be applicable to Joint Commission-accredited hospitals. These new requirements are within the Provision of Care, Treatment, and Services (PC) chapter at PC.06.01.01 and PC.06.01.03 and are designed to improve the quality and safety of care provided to women during all stages of pregnancy and postpartum. The United States ranks 65th among industrialized nations in terms of maternal death.[1] Because of worsening maternal morbidity and mortality, The Joint Commission evaluated expert literature to determine what areas held the most potential impact. The literature review revealed that prevention, early recognition, and timely treatment for maternal hemorrhage and severe hypertension/preeclampsia had the highest impact in states working on decreasing maternal complications. This approach was supported by a technical advisory panel assembled by The Joint Commission, resulting in the development of EPs that focus on these complications.

Engagement with stakeholders, customers, and experts

In addition to an extensive literature review and public field review, The Joint Commission obtained expert guidance from the following groups:

- Technical Advisory Panel (TAP) of subject matter experts from various health care and academic organizations and professional associations from the maternal health field.
- Standards Review Panel (SRP) comprised of clinicians and administrators who provided a "boots on the ground" point of view and insights into the practical application of the proposed standards.

The prepublication version of the maternal safety standards will be available online until June 30, 2020. After July 1, 2020, please access the new requirements in the E-dition or standards manual.

---

1. Centers for Disease Control and Prevention. Reproductive Health, Pregnancy Mortality Surveillance System webpage. Page last reviewed: June 4, 2019. Accessed Aug. 20, 2019.

The Joint Commission

HEALTHTRUST

National Focus

Provision of Care, Treatment, and Services chapter

Standard PC.06.01.01: Reduce the likelihood of harm related to maternal hemorrhage.

Requirement	EP 1: Complete an assessment using an evidence-based tool for determining maternal hemorrhage risk on admission to labor and delivery and on admission to postpartum. (See also PC.01.02.01, EPs 1 and 2; PC.01.02.03, EP 3; RC.02.01.01, EP 2)
Rationale	Assessing and discussing patients' risks for hemorrhage allows the team to identify higher-risk patients and be prepared. The risk of hemorrhage may change during a patient's stay depending on the clinical situation.
Reference	Harvey CJ. "Evidence-Based Strategies for Maternal Stabilization and Rescue in Obstetric Hemorrhage." *Advanced Critical Care*. 2018;3(29):284-94.
Requirement	EP 2: Develop written evidence-based procedures for stage-based management of pregnant and postpartum patients who experience maternal hemorrhage that includes the following: • The use of an evidence-based tool that includes an algorithm for identification and treatment of hemorrhage • The use of an evidence-based set of emergency response medication(s) that are immediately available on the obstetric unit • Required response team members and their roles in the event of severe hemorrhage • How the response team and procedures are activated • Blood bank plan and response for emergency release of blood products and how to initiate the organization's massive transfusion procedures • Guidance on when to consult additional experts and consider transfer to a higher level of care • Guidance on how to communicate with patients and families during and after the event • Criteria for when a team debrief is required immediately after a case of severe hemorrhage *Note: The written procedures should be developed by a multidisciplinary team that includes representation from obstetrics, anesthesiology, nursing, laboratory, and blood bank.*
Rationale	Having defined procedures to manage patients experiencing severe hemorrhage is integral to ensuring that everyone caring for a patient functions well as a team so delays in critical processes are minimized. Communication between team members during an emergency is a key factor for success. It is important for an organization to standardize the language team members will use to identify patients with severe hemorrhage and trigger a predetermined response from staff. Post-emergency debriefs are valuable for summarizing how well the team followed procedures and to determine if there are opportunities for improvement.
Reference	Committee on Practice, Bulletins-Obstetrics. "Practice Bulletin No. 183: Postpartum Hemorrhage." Obstetrics & Gynecology. 2017;130(4):e168-e186. Kogutt BK and Vaught AJ. "Postpartum Hemorrhage: Blood Product Management and Massive Transfusion." Seminars in Perinatology. 2019;43(1):44-50. American College of Obstetricians and Gynecologists. "Preparing for Clinical Emergencies in Obstetrics and Gynecology." ACOG Committee Opinion No. 590. Obstetrics & Gynecology. 2014;123:722-725. World Health Organization. WHO Recommendations for the Prevention and Treatment of Postpartum Hemorrhage. Geneva, Switzerland: World Health Organization. 2012.
Requirement	EP 3: Each obstetric unit has a standardized, secured, dedicated hemorrhage supply kit that must be stocked per the organization's defined process and, at a minimum, contains the following: • Emergency hemorrhage supplies as determined by the organization • The organization's approved procedures for severe hemorrhage response

HEALTHTRUST

National Focus

Rationale	Having all supplies to treat hemorrhage in one place is essential to minimizing delays in treatment. Using defined processes during emergencies has been shown to improve adherence to recommended processes of care. Each organization should complete an assessment to determine the number of kits needed and the location to store them for easy access.
Reference	Agarwala AV, et al. "Bringing Perioperative Emergency Manuals to Your Institution: A "How To" From Concept to Implementation in 10 Steps." *The Joint Commission Journal on Quality and Patient Safety*. 2019;45(3):170-179. Bereknyei MS, et al. "Use of an Emergency Manual During an Intraoperative Cardiac Arrest by an Interprofessional Team: A Positive-Exemplar Case Study of a New Patient Safety Tool." *The Joint Commission Journal on Quality and Patient Safety*. 2018;44(8):477-484. World Health Organization. WHO Recommendations for the Prevention and Treatment of Postpartum Hemorrhage. Geneva, Switzerland: World Health Organization. 2012.
Requirement	EP 4: Provide role-specific education to all staff and providers who treat pregnant and postpartum patients about the organization's hemorrhage procedure. At a minimum, education occurs at orientation, whenever changes to the processes or procedures occur, or every two years.
Rationale	For the care team to function optimally in a true emergency, it is essential that all members know the procedures they should follow in the event of hemorrhage. Although not required, in situ simulations that allow staff to practice organizational procedures in actual clinical settings are encouraged.
Reference	Committee on Practice, Bulletins-Obstetrics. "Practice Bulletin No. 183: Postpartum Hemorrhage." Obstetrics & Gynecology. 2017;130(4):e168-e186. American College of Obstetricians and Gynecologists. "Preparing for Clinical Emergencies in Obstetrics and Gynecology." ACOG Committee Opinion No. 590. Obstetrics & Gynecology. 2014;123:722-725.
Requirement	EP 5: Conduct drills at least annually to determine system issues as part of on-going quality improvement efforts. Drills include representation from each discipline identified in the organization's hemorrhage response procedure and include a team debrief after the drill.
Rationale	Multidisciplinary drills give an organization the opportunity to practice skills and identify system issues (e.g., unwillingness of the blood bank to release blood products despite authorization for this in the procedure) in a controlled environment. It is crucial to have members from as many disciplines identified in the organization's response procedure as possible available during drills to be able to test each level of the emergency and identify areas of improvement. This is crucial for identifying weaknesses in the response system and to identify opportunities for improvement. Organizations should assess their level of proficiency to determine the frequency drills should be performed; organizations that have reached a high level of mastery may need less frequent drills.
Reference	American College of Obstetricians and Gynecologists. "Preparing for Clinical Emergencies in Obstetrics and Gynecology." ACOG Committee Opinion No. 590. Obstetrics & Gynecology. 2014;123:722-725. Kyryabina E, et al. "What is the Value of Health Emergency Preparedness Exercises? A Scoping Review Study." *International Journal of Disaster Risk Reduction*. 2017;21:274-283. Lee A, et al. "Intrapartum Maternal Cardiac Arrest: A Simulation for Multidisciplinary Providers." MedEdPORTAL. 2018;14:1-8.
Requirement	EP 6: Review hemorrhage cases that meet criteria established by the organization to evaluate the effectiveness of the care, treatment, and services provided by the hemorrhage response team during the event.
Rationale	Continuous feedback loops are imperative for organizations to find errors and improve skills to ensure that patients are receiving the highest level of care. Root cause analysis, apparent-cause analysis, or similar tools to review the care in a rigorous, psychologically

The Joint Commission

HEALTHTRUST

National Focus

	safe environment is critical to identify successes and opportunities for improvement in a way that creates a culture of safety and empowers staff to design safe and effective procedures and processes.
Reference	Callaghan WM, et al. "Facility-Based Identification of Women with Severe Maternal Morbidity: It is Time to Start." Obstetrics & Gynecology. 2014;123:978-981. Kilpatrick SJ, et al. "Standardized Severe Maternal Morbidity Review: Rationale and Process." Obstetrics & Gynecology. 2014;124:361-366.
Requirement	EP 7: Provide education to patients (and their families including the designated support person whenever possible). At a minimum, education includes: • Signs and symptoms of postpartum hemorrhage during hospitalization that alert the patient to seek immediate care • Signs and symptoms of postpartum hemorrhage that alert the patient to seek immediate care
Rationale	Women need to know what symptoms are considered dangerous, when to call for help during hospitalization, and when to seek care after discharge. Women should understand a) what amount of bleeding is concerning, and b) possible signs of internal bleeding that should prompt them to call for help or seek care even if no bleeding is seen (e.g., abdominal pain, extreme tiredness, or rapid heartbeat.)
Reference	American College of Obstetricians and Gynecologists. "Optimizing Postpartum Care." ACOG Committee Opinion No. 736. Obstetrics & Gynecology. 2018;131:e140-e150. Suplee PD, et al. "Discharge Education on Maternal Morbidity and Mortality Provided by Nurses to Women in the Postpartum Period. *Journal of Obstetric, Gynecologic and Neonatal Nursing*. 2016;45:8994-904. Suplee PD, et al. "Improving Postpartum Education About Warning Signs of Maternal Morbidity and Mortality. *Journal of Obstetric, Gynecologic and Neonatal Nursing*. 2016;20:552-567.

Not a complete literature review.

The Joint Commission

HEALTHTRUST

CDC Launches Campaign Addressing Pregnancy-Related Deaths

Today's Headlines

A Benefit of ACOG Membership

Produced by BulletinHealthcare

Good morning, Frank Kolucki
August 17, 2020

Visit ACOG's COVID-19 resource page and stay up-to-date with information for you, your practice, and your patients. VISIT NOW

Editor's Note

ACOG Today's Headlines is a digest of women's health news selected from thousands of sources by the editors of BulletinHealthcare. ACOG does not endorse the views of any articles or advertisements that appear in this digest.

Top News Stories

CDC Launches Campaign Addressing Pregnancy-Related Deaths

Fox News (8/14, McGorry) reported the CDC launched the "Hear Her" campaign "to stop pregnancy-related deaths." The campaign "seeks to shed light on warning signs of potentially life-threatening conditions during pregnancy and the year after giving birth by featuring personal stories from women from different backgrounds who experienced severe pregnancy-related complications, according to a press release." Fox News added, "Dr. Maureen G. Phipps, the executive officer of the **American College of Obstetricians and Gynecologists**, told Fox News the Hear Her campaign will not only empower women but it will encourage those supporting them to be more attentive." Dr. Phipps said, "The maternal mortality crisis requires collaboration from everyone – and that means making our patients a valued voice in every conversation: throughout the prenatal period, during labor and delivery, and in the year after birth. As obstetrician-

An American Tragedy

50% of Maternal Deaths Are Preventable

Source: D'Alton, et al. National Partnership for Maternal Safety 2014

Maternal Mortality

Three Significant Etiologies/Three Opportunities/Three High Value Targets

- Hemorrhage
- Hypertension/Preeclampsia Eclampsia
- Thromboembolism

Source: National Partnership Maternal Safety. ACOG 2014

Healthcare Is a Team Sport

Team Members

- Nursing
- Pharmacy
- Laboratory Medicine
- Physicians
- Administrators

Healthcare Is a Team Sport

Maternal mortality and morbidity crisis cannot be fixed by obstetricians alone.

Need your help in your sphere of influence.

Focus on Massive Transfusion Protocol: Code Crimson

- Evidenced based protocol in the treatment of a life-threatening Peripartum Hemorrhage.

There's No Bleeding Like Obstetrical Bleeding

It's Audible

Why Is Obstetrical Bleeding so Bad?

- Uterine Perfusion at Term > 700cc / minute
- Extreme hemorrhage → exsanguination → pulselessness → hypoperfusion of brain/myocardium → cerebral anoxia and fatal arrhythmia in minutes
- Significant predisposition for coagulopathy
- Tissue Factor → thrombin production → consumptive coagulopathy "Disseminated Intravascular Coagulation (DIC)"

Source: *Tisherman, SA.et all J Trauma Acute Care Surgery 2017*

Obstetrical Predisposition to Coagulopathy/DIC

- Consumption of clotting factors during severe hemorrhage
- Abruption
- Hemolysis elevated liver enzymes low platelets (HELLP) Syndrome/Eclampsia/Severe Preeclampsia
- Amniotic Fluid Embolism/Anaphylactoid Syndrome of Pregnancy
- Acute fatty liver
- Iatrogenic i.e., Dilutional Coagulopathy
- Sepsis from retained products of conception

Predisposition to Coagulopathy

Tissue Factor(thromboplastin) → Thrombin production → Coagulopathy/DIC

Tissue Factor Exposure Potentiated By:

- Abruption
- Endothelial damage from shock
- HELLP Syndrome Preeclampsia / Eclampsia
- Fetal demise (rare)

Blood Component Therapy:

What We Have to Work With

Blood components: Indications and dosing in adults

Component (volume)	Contents	Indications and dose
Whole blood (1 unit = 500 mL)	RBCs, platelets, plasma	Rarely required. May be appropriate when massive bleeding requires transfusion of more than 5 to 7 units of RBCs (increasingly used in early trauma management).
RBCs in additive solution (1 unit = 350 mL)	RBCs	Anemia, bleeding. The increase in hemoglobin from 1 unit of RBCs will be approximately 1 g/dL; the increase in hematocrit will be approximately 3 percentage points.
FFP or other plasma product* (1 unit = 200 to 300 mL)	All soluble plasma proteins and clotting factors	Bleeding or expected bleeding (eg, emergency surgery) in individuals with deficiencies of multiple coagulation factors (eg, DIC, liver disease, massive transfusion, anticoagulation with warfarin or warfarin overdose if not corrected by vitamin K and/or PCC, depending on the clinical setting); therapeutic plasma exchange in TTP. FFP may be used to manage bleeding in individuals with isolated factor deficiencies (most often factor V) if a factor concentrate or recombinant factor is not available. In the rare event that FFP is used to replace a clotting factor, the dose is 10 to 20 mg/kg. This dose will raise the level of any factor, including fibrinogen, by close to 30%, which is typically sufficient for hemostasis.
Cryoprecipitate, also called "cryo" (1 unit = 10 to 20 mL)	Fibrinogen; factors VIII and XIII; VWF	Bleeding or expected bleeding with low fibrinogen: The increase in plasma fibrinogen from 1 unit of Cryoprecipitate per 10 kg body weight will be approximately 50 mg/dL. Bleeding or expected bleeding in individuals with deficiencies of factor XIII or factor VIII (hemophilia A) if a recombinant product or factor concentrate is unavailable. Bleeding or expected bleeding in individuals with VWD if DDAVP (desmopressin) is ineffective and recombinant VWF or a VWF concentrate is unavailable. Cryoprecipitate is generally provided in pools containing 5 units, and most patients receive one to two pools.
Platelets (derived from whole blood or apheresis) (1 unit of apheresis platelets or a 5 to 6 unit pool of platelets from whole blood = 200 to 300 mL)	Platelets	The platelet count increase from 5 to 6 units of whole blood-derived platelets or 1 unit of apheresis platelets will be approximately 30,000/microL in an average-sized adult.

Refer to UpToDate topics on these products and on specific conditions for details of use. Frozen blood products (FFP, Cryoprecipitate) take 10 to 30 minutes to thaw. It may take the same amount of time to perform an uncomplicated crossmatch.

RBCs: red blood cells; FFP: Fresh Frozen Plasma; DIC: disseminated intravascular coagulation; PCC: prothrombin complex concentrate; TTP: thrombotic thrombocytopenic purpura; VWF: von Willebrand factor; VWD: von Willebrand disease.
* Other plasma products include Plasma Frozen Within 24 Hours After Phlebotomy (PF24) or Thawed Plasma. PF24 may be used interchangeably with FFP for all of the indications listed above, with the exceptions of factor VIII deficiency or protein C deficiency, which are treated with recombinant products or plasma-derived factor concentrates. In the rare event that specific factor concentrates are unavailable and these deficiencies must be treated with a plasma product, FFP should be used. Thawed Plasma may be used interchangeably with FFP for all of the indications listed above, with the exception of factor VIII deficiency without access to factor VIII concentrates, in which FFP should be used; or factor V deficiency, in which FFP or PF24 should be used.

UpToDate®

Source: The Wolters Kluwer Health division of Wolters Kluwer, UpToDate, Inc. <https://www.uptodate.com/contents/clinical-use-of-plasma-components>. Accessed August 12, 2020

Blood Component Therapy in Obstetrical Hemorrhage

The Old Way:

- 4 units of PRBC +/- 1 unit FFP “Hope for the Best”
- → Leads to the dilutional coagulopathy and severe life-threatening hemorrhage

Medicine Advances Exponentially in Wartime

- Massive Transfusion Protocols have developed as a direct result of the Afghanistan / Iraq war experience
- Validated through the experience of major trauma centers

The New Way / Damage Control Resuscitation

Higher ratios of FFP and Platelets to PRBC

Higher ratios of FFP and Platelets to PRBC

PRBC : FFP : Platelets + cryoprecipitate

1 1 1 10-20 units

(for obstetrical patients)

Apheresis concentrate or six units of whole blood derived platelets

- Blood products are cornerstone of resuscitation not crystalloids or colloids (use lactated ringers when necessary)
- Once activated, blood bank will provide predefined ratio of blood component therapy without waiting for lab results

Sources: Borgman MA, Spinella PC, Perkins JG, et al. J Trauma 2007;63:805
Holcomb JB,Wade CE, Michalek JE, et al. Ann Surg 2008;248:447
Cotton BA, Au BK, Nunez TC, et al. J Trauma 2009; 66:41
Shaz BH, Dente CJ, Nicholas J, et al. Transfusion 2010;50:493
Inaba K, Lustenberger T, Rhee P, et al. J Am Coll Surg 2010;211:573
De Biasi AR, Stansbury LG, Dutton RP, et al. Transfusion 2011;51:1925
Perkins JG, Cap AP, Spinella PC et al. J Trauma 2009; 66:S77
Johansson PI, Stensella J, Rosenburg I, et al. Transfusion2007; 47:593

Why Is This Better?

- More physiologic, mimics whole blood
- Staves off coagulopathy, acquired or induced, via non-judicious use of crystalloids or colloids as volume expanders
- Infusion of cold fluids exacerbates heat loss, dilution of clotting factors and decreases O2 carrying capacity → Oxygen Debt/Acidosis
- Combats part of death quadriad of
  - Consumptive Coagulopathy / DIC
  - Hypothermia
  - Acidemia (potentiates D.I.C)
  - Electrolyte aberration

Why Cryoprecipitate Is **Important** in **Obstetric Hemorrhage**

- Can’t clot without fibrinogen/substrate of all clot
- Fibrinogen is often exceedingly low in Post Partum Hemorrhage

Does It Work?

Evidence

- Retrospective study of 246 combat trauma patients
  - Physiologic Massive Transfusion Protocol (MTP) recipients had increased survival rate 88% vs. 66%
- Implementation of MTP dramatically decreased mortality at a major trauma center
- Proven Survival Benefit
- Preventing Maternal Death: 10 Clinical Diamonds
  - "If your L/D does not have a recently updated MTP based on trauma protocols, get one today!"

Sources: Borgman MA, Spinella PC, Perkins JG et all J Trauma 2007
Trauma 2008 65:527-534 Gunter OL Jr
Cannon J W,Khan MA, Raja et al. Damage control resuscitation in patients with severe trauma
J Trama Acute Care Surgery 2017 ; 82:605-17.
Steven L. Clark MD, Gary Hankins M.D., Obstet Gynecol 2012; 119:360-4

When to Start Massive Transfusion Protocol

- At the outset of severe life-threatening hemorrhage
- DO NOT WAIT FOR LABS
- Delay leads to death quadriad of
  - Consumptive Coagulopathy “DIC”
  - Hypothermia
  - Acidemia
  - Electrolyte aberation (hypocalcemia, hyperkalemia)

Denial → Delay → Death

When to Start Massive Transfusion Protocol, *continued*

- Look at the patient
  - Signs of hemodynamic instability
  - Anxiety – tachypnea – confusion –lightheadedness
  - Weak pulse
  - Skin color pink vs. pale – blue or mottled
  - Cold extremities or diaphoresis
  - Shortness of breath or palpitations
  - Vitals SBP < 100, pulse >110, O2 sat < 95% RA
  - Urine output < 30 cc/hr
  - Lee & White test/wall clot/ “rough test” of coagulopathy
    - If no clot in redtop within 6 minutes or if clot forms and lyses within 30 minutes fibrinogen usually < 150 mg / dl
  - Oozing from surgical site
  - Consistency of blood is watery red (no clot) vs. thick port wine color

Don’t put your head in the sand!

Re: Labs—Evaluation During Massive Hemorrhage

- CBC
- ↑ PT/PTT
- Fibrinogen (minimum of 100mg /dl to form clot)
- < 200 = 100% positive predictive value for severe life-threatening postpartum hemorrhage (PPH)

Don’t Wait!

Obstetrical Coagulopathy is fulminant Coagulopathy

Source: Charbit, et al., J Thromb Haemost (2007)

Point of Care Testing (POCT)

- Point-of-care testing (POCT) of Hgb, HCT and coagulation allows rapid availability of test results to aid clinical decision-making at the bedside/OR table

- Thromboelastography or rotational thromboelastography can be used to identify coagulation abnormalities

Source: Waters, M.D., Perioperative Blood Management 2009

Quantitate Blood Loss Accurately

- Measurement should be a formal process in each obstetrical unit
- Use graduated fluid collection system
- Weigh pads
- Accurately assess clot size

Quantitating Blood Loss

Important Values to Know

EBL NSVD	≤ 500 ml
EBL C/S	≤ 1000 ml
Amniotic Fluid	- 700 ml
Oligohydramnios	- 300 ml
Polyhydramnios	- 1400 ml

Common Item Size Estimates

Golf ball-sized clot = 40-60 ml

Tennis ball-sized clot = 135 ml

Softball-sized clot = 400ml

Can of Soda = 350 ml

Full Kidney Basin = 500 ml

* 1gram = 1 ml

Estimation Chart

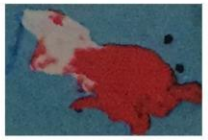
4X4 Gauze pad 100% Saturated = 5-10 ml

4X18 Vaginal delivery pad 50% Saturated = 20-30 ml

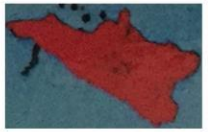
4X18 Vaginal delivery pad 100% Saturated = 60-80 ml

Peripad 50% Saturated = 30-50 ml

Peripad 100% Saturated = 60-90 ml



Laparotomy pad 50% Saturated = 40-60 ml



Laparotomy pad 100% Saturated = 80-100 ml

Blue Chux pad 50% Saturated = 200-400 ml

Blue Chux pad 100% Saturated = 700 ml

Hematologic Goals in Massive Obstetric Hemorrhage

- Hemoglobin > or = 10 g/dl pre-delivery
  - Lower hemoglobin acceptable after delivery when stable
  - PT < 1.5 X Control
  - PTT < 1.5 X Control
  - Fibrinogen > 200 mg / dl
  - Platelets > or = 50,000s /microL

Code Crimson: Massive Transfusion Protocol (MTP)

Goal: To Martial Support of Entire Hospital to Save Patient

- Well-coordinated early and aggressive multidisciplinary team effort including obstetricians, nursing, anesthesia, pharmacy, critical care medicine, OR staff, laboratory medicine, blood bank, imaging, ICU, hematology, administration, etc.

- Chaos → organized chaos → proficiency → EXPERT, HIGHLY RELIABLE, COLLABORATIVE CARE

TXA

Tranexamic Acid

- Obstetrical hemorrhage game changer!
- The WOMAN Trial (World Maternal Antifibrinolytic Trial)
  - Landmark, multinational, randomized, double-blind, placebo-controlled trial
- Decrease in deaths due to PPH by 20–30%!
  - Including both vaginal and cesarean deliveries
  - No increase in adverse events / clotting

Source: Lancet, April 26, 2017

TXA, *continued*

Tranexamic Acid

- Give early! Minutes Matter
- Give often (best within three hours of hemorrhage)
- Dose one gram
  - 10ml of a 100 mg/ml solution over 10-20 min
  - Repeat in 30 minutes if still bleeding
- Should be emergency release medication in all obstetrical units

Source: Lancet, April 26, 2017

TXA, *continued*

CAVEATS

- Do not run in IV blood line
- Do not mix with solutions containing Penicillin
- Possible Group B strep (GBS+) patients
- Contradicted in subarachnoid hemorrhage
- Active intravascular clotting (DIC)
- Personal history of thromboembolic event or thrombophilia
- Reduce dose with Renal Insufficiency
  - Not likely in child bearing population
  - Be mindful of possible acute kidney injury

Covid-19 Update

- Blood component therapy supply significantly limited
- Blood donation has dropped precipitously
- Expert review released 3/2020 suggested prophylactic tranexamic acid and second line uterotonic In all deliveries without contraindications

Source: Rupsa C. Boelig, MD, MS, Gabriele Saccone, MD, Federica Bellussi, MD, Vincenzo Berghella, MD, “MFM Guidance for COVID-19,” American Journal of Obstetrics & Gynecology MFM, DOI: 10.1016/j.ajogmf.2020.100106, 2020.

MTH Code Crimson v19

Code Crimson – Level 1

For patients with potential / actual hemorrhage

FBS Staff- Notify Switchboard of Code Crimson (x5555) for overhead page
Switchboard will alert Laboratory, Anesthesia, Ultrasound, Interventional Radiology, Nursing Supervisor, and Pharmacy to await further instructions
Draw the following STAT Labs and tube specimens to Laboratory for:
Code Crimson- CBC; PT / PTT; Fibrinogen; CMBP;
Type and Screen; and Type and Cross **Three (3) Units Packed Red Blood Cells, Three (3)Units Fresh Frozen Plasma, and One (1) Unit Aphoresed Platelets**
Notify Lab (x6300) of inbound STAT Blood Work
Repeat Labwork every 60 minutes or after every completed MTP.
Ensure IV access & Patency
Confirm treatment with Tranexamic Acid 1 gm IV repeat in 30 minutes if bleeding continues
Obtain Uterine Tamponade Balloon
Prepare OR Hysterectomy pan
Notify CRNA to prepare Rapid Infuser/ Blood Warmer

Code Crimson – Level 2

For patients with a **life threatening** potential/actual hemorrhage

Notify Switchboard of Code Crimson (X5555) for overhead page and alerts
Confirm treatment with Tranexamic Acid 1 gm IV repeat in 30 minutes if bleeding continues
FBS Staff – Draw the following **STAT** Labs and tube specimens to Laboratory for:
CBC; PT / PTT; Fibrinogen; Type and Screen; CMBP, and Type and Cross
Six (6) Units Packed Red Blood Cells, Six (6) Units Fresh Frozen Plasma, One (1) Unit Aphoresed Platelets, and Ten (10) Unit Cryoprecipitate (only 1 unit plts in hospital; additional units will be procured by lab)
Notify Lab (x6300) and Blood Bank (x6361) of inbound STAT Blood Work
T/L will designate one person to be in contact with lab for blood products and to obtain when ready (blood runner).
Repeat Labwork work every 60 minutes or after every completed MTP.
- **Ensure two (2) large bore (#18) IV access**
- **Prepare OR Hyster pan/Prepare Uterine Tamponade Balloon**

Ready Second MTP2 PACKAGE
- **6 Units RBCs**
- **6 Units FFP**
- **1 Unit Aphoresed Platelets**
- **10 Units Cryoprecipitate**
- **Administer 10 mg Vitamin K IV for 1 dose**
- **Calcium Gluconate 2 gm (4.65meq/ 1gm) IV**

(lab will procure any additional blood products as needed)

Laboratory may contact the **FBS-Charge Nurse/ TL @ x6908**

Nursing Supervisor (x6867/6768)
Anesthesiologist
Anesthesia CRNA (x6925)
* **Prepare Rapid Infuser/ Blood Warmer**
If necessary, Anesthesia will notify Cell Saver perfusionist - James Yi (H) 570-587-2510 (C) 570-815-6577

If AB plasma for AB patient is not available A plasma may be used

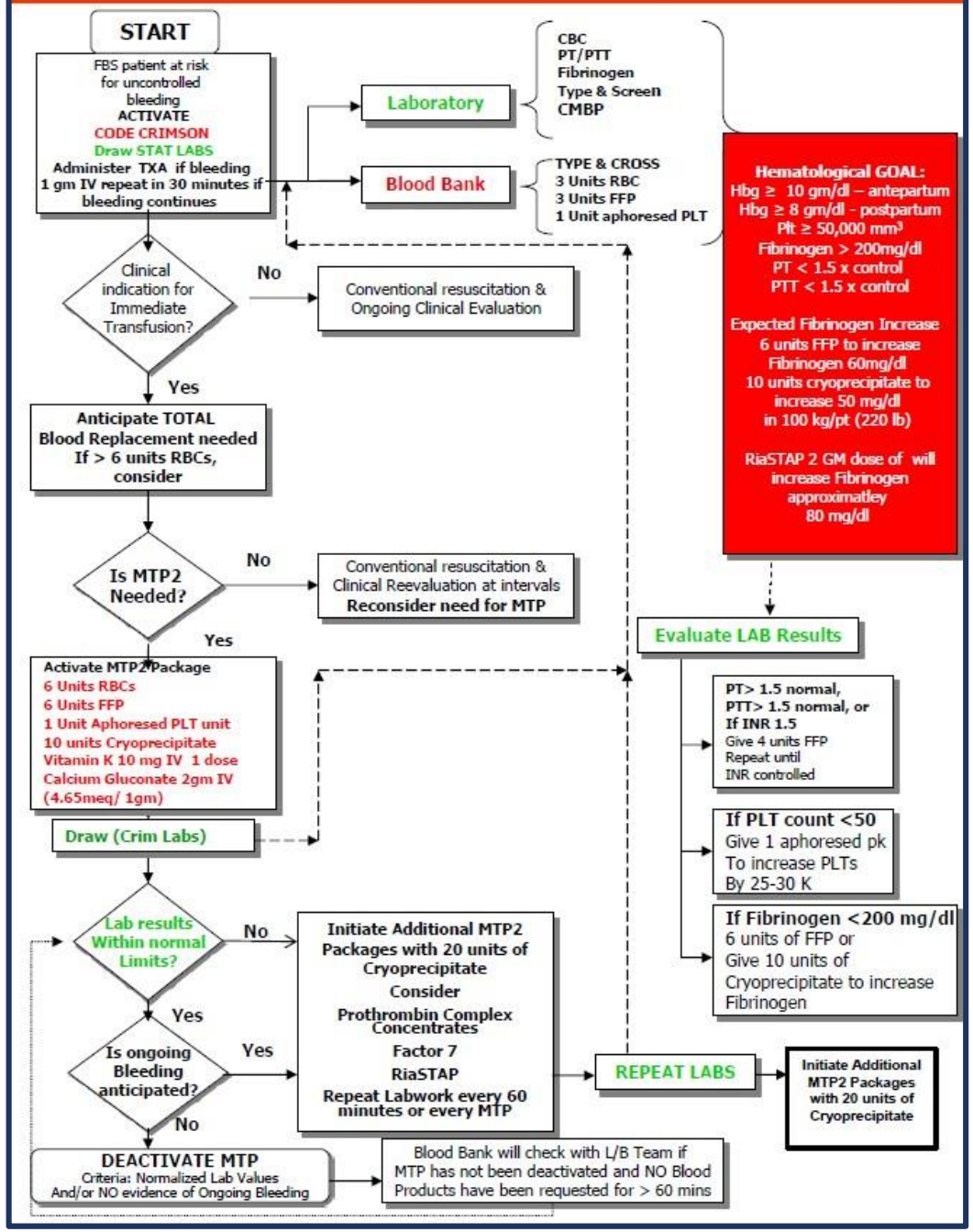
Operating Room (x6400)
Interventional Radiology (x7306) (OB/GYN Physician or designee must speak directly with Radiologist)
If necessary, **Notify Rapid Response Team (RRT)**
Dial #5555, provide Switchboard Operator with Room Number / location for RRT response
Notify ICU of possible transfer (x5480)
Notify second in-house OB physician of situation
IF ANTICIPATING ONGOING BLEEDING:
- **Repeat STAT LABS- CBC; PT / PTT; Fibrinogen;**
- **CMBP**
- **INITIATE ADDITIONAL MTP2 PACKAGES with 20 Units of Cryoprecipitate**
- **Consider For Continued Life Threating Hemorrhage**
  - **Prothrombin Complex Concentrate (Kcentra)**
  - **Factor 7 (NovoSeven)**
  - **RiaSTAP** ***for consumptive coagulopathy/DIC; severe hypofibrinogenemia or volume overload***

Calculating Corrected Calcium Equation
4- [(0.8 X Albumin] + serum Ca = corrected Ca

Developed 2/06 FBS_ rev10_09072010ds, 1/10/2011me, 2/14/11ej, 5/9/11me, 4/9/2014dg, 6/24/2014dg, 12/18/2017 dg, 01/04/2018 dg

MASSIVE TRANSFUSION PROTOCOL [MTP]

Updated 01./2018



Massive Transfusion Protocol: Code Crimson

- Electrolytes including potassium and calcium can fluctuate wildly
- Part of Death Quadriad

MASSIVE TRANSFUSION PROTOCOL
CODE CRIMSON (OB)

Generic = Chemical = Therapeutic Automatic Interchange and Protocols for specific drugs as approved by the Medical Staff are permitted for implementation for all applicable orders below

Diagnosis: Post Partum HEMORRHAGE; ACTIVATE CODE CRIMSON

☐ LEVEL 1:
LABS: Draw STAT Code Crimson Lab and Massive Transfusion Package 1 [MTP1] .Notify LAB @ 6300 of inbound blood work
- CBC
- PT/INR
- PTT
- Fibrinogen
- CMBP
- D-dimer
- Type and Screen
- Type & Cross 3 Units Packed Red Blood Cells, 3 Units Fresh Frozen Plasma, 1 Unit Aphoresed Platelets

☐ If ongoing bleeding, order and Prepare Massive Transfusion Package [MTP2] and 10 Units Cryoprecipitate
- 6 Units Packed Red Blood Cells (RBC)
- 6 Units Fresh Frozen Plasma (FFP)
- 1 Unit Aphoresed Platelets (PLT)
- 10Units Cryoprecipitate (CR10)

☐ LEVEL 2:
LABS: Draw STAT Code Crimson Lab and Massive Transfusion Package 2 [MTP2]. Notify LAB @ 6300 of inbound blood work
- CBC
- PT/INR
- PTT
- Fibrinogen
- D-dimer
- CMBP
- Type & Cross 6 Units Packed Red Blood Cells, 6 Units Fresh Frozen Plasma, 1 Unit Aphoresed Platelets, and 10 Units Cryoprecipitate

■ Insure two (2) large bore (#18) IV access

☐ If ongoing bleeding, order additional MTP2
(6 Units Packed Red Blood Cells, 6 Units Fresh Frozen Plasma, 1 Units Aphoresed Platelets)and 20 units Cryoprecipitate CR10, CR10. Further MTP2 packs will be dictated by clinical presentation and lab work.

Medication:
☐ Tranexamic Acid 1 gram/ 100 ml in 0.9% NaCl; Infuse, Infuse 100 ml bag over 20 minutes (ie. 300 ml/hr) for 2 doses
☐ Vitamin K 10mg in 50 mL of NSS IV once over 30 minutes
☐ Calcium Gluconate 2 grams STAT after every MTP2 ; Administer IV Push over 10 minutes (max rate: 200mg/min)

Factors (SELECT ONE ONLY)
- RiaSTAP (fibrinogen concentrate) 2 grams for 1 dose STAT for fibrinogen level <200mg/dl. IV infusion over 20 minutes in separate line. Rate not to exceed 5ml/min. Pharmacy to Round dose to the nearest vial size. Document lot # in Electronic Health Record (Cerner)

☐ KCentra 50 units/kg based upon total body weight for 1 dose STAT, when the bleeding has not abated after administration of tranexamic acid , or Immediately in a Factor Deficiency Patient or a low Fibrinogen result with cryopercipate or FFP administered.
- Maximum Dose to be administered is 5000 units Factor IX
- Doses will be rounded to the nearest 500 units Factor IX
- Infuse at a rate of 0.12 mL/kg/minute (~3 units/kg/minute) in a separate line and do not mix with any other medications or blood products. Do not allow blood to enter syringe (to reduce risk of fibrin clot formation).
- Do not exceed a rate of 8.4mL/minute (~210 units/minute)
- Administered within 4 hours of reconstitution.
- Document lot # in Electronic Health Record (Cerner)

☐ (NovoSeven® RT) Coagulation Factor VIIa Room Temperature Stable IV Bolus over 2-5 minutes (stored in pharmacy in refrigerator or room temperature). Dose Coagulation Factor VIIa (NovoSeven® RT) based on weight below. (Dosing equals 60 mcg/kg rounded up to the nearest 1000 mcg, 2000 mcg, or 5000 mcg vial)

For patient's weight of:
- ☐ 50 kilograms or less, administer 3000 mcg
- ☐ 67-83 kilograms, administer 5000 mcg
- ☐ 101-116 kilograms, administer 7000 mcg
- ☐ 134-150 kilograms, administer 9000 mcg
- ☐ 166-180 kilograms, administer 11,000 mc
- ☐ 51-66 kilograms, administer 4000 mcg
- ☐ 84-100 kilograms, administer 6000 mcg
- ☐ 117-133 kilograms, administer 8000 mcg
- ☐ 151-165 kilograms, administer 10,000 mcg

Physicians signature:	Date:	Time:
Nurse Noting signature:	Date:	Time:

Rev 1/11, 5/11, 3/12, 2/13, 4/14, 0614, 0714, 1216, 0117,11/17, 0118 0318

Source: Luis D. Pacheco M.D., George R. Saade, M.D., Maged M. Costantine, M.D., Steven L., Clark, M.D., & Gary D.V. Hankins, M.D. An update on the use of massive transfusion protocols in obstetrics. *American Journal of Obstetrics and Gynecology*, 2016-03-01, Volume 214, Issue 3.

Massive Transfusion Protocol: Code Crimson

- Kcentra
- Prothrombin complex concentrate should be used as a last resort in refractory cases of hemorrhage
- More favorable safety profile than Factor 7

MASSIVE TRANSFUSION PROTOCOL
CODE CRIMSON (OB)

Generic – Chemical – Therapeutic Automatic Interchange and Protocols for specific drugs as approved by the Medical Staff are permitted for implementation for all applicable orders below

Diagnosis: Post Partum HEMORRHAGE; ACTIVATE CODE CRIMSON

☐ **LEVEL 1:**
LABS: Draw STAT Code Crimson Lab and Massive Transfusion Package 1 [MTP1] .Notify LAB @ 6300 of inbound blood work
- CBC
- PT/INR
- PTT
- Fibrinogen
- CMBP
- D-dimer
- Type and Screen
- Type & Cross 3 Units Packed Red Blood Cells, 3 Units Fresh Frozen Plasma, 1 Unit Aphoresed Platelets

☐ If ongoing bleeding, order and Prepare Massive Transfusion Package [MTP2] and 10 Units Cryoprecipitate
- 6 Units Packed Red Blood Cells (RBC)
- 6 Units Fresh Frozen Plasma (FFP)
- 1 Unit Aphoresed Platelets (PLT)
- 10Units Cryoprecipitate (CR10)

☐ **LEVEL 2:**
LABS: Draw STAT Code Crimson Lab and Massive Transfusion Package 2 [MTP2]. Notify LAB @ 6300 of inbound blood work
- CBC
- PT/INR
- PTT
- Fibrinogen
- D-dimer
- CMBP
- Type & Cross 6 Units Packed Red Blood Cells, 6 Units Fresh Frozen Plasma, 1 Unit Aphoresed Platelets, and 10 Units Cryoprecipitate

■ Insure two (2) large bore (#18) IV access

☐ If ongoing bleeding, order additional MTP2
(6 Units Packed Red Blood Cells, 6 Units Fresh Frozen Plasma, 1 Units Aphoresed Platelets)and 20 units Cryoprecipitate CR10, CR10. Further MTP2 packs will be dictated by clinical presentation and lab work.

Medication:
☐ Tranexamic Acid 1 gram/ 100 ml in 0.9% NaCl; Infuse, Infuse 100 ml bag over 20 minutes (ie. 300 ml/hr) for 2 doses
☐ Vitamin K 10mg in 50 mL of NSS IV once over 30 minutes
☐ Calcium Gluconate 2 grams STAT after every MTP2 ; Administer IV Push over 10 minutes (max rate: 200mg/min)

Factors (SELECT ONE ONLY)
- RiaSTAP (fibrinogen concentrate) 2 grams for 1 dose STAT for fibrinogen level <200mg/dl. IV infusion over 20 minutes in separate line. Rate not to exceed 5ml/min. Pharmacy to Round dose to the nearest vial size. Document lot # in Electronic Health Record (Cerner)

☐ KCentra 50 units/kg based upon total body weight for 1 dose STAT, when the bleeding has not abated after administration of tranexamic acid , or Immediately in a Factor Deficiency Patient or a low Fibrinogen result with cryoprecipate or FFP administered.
- Maximum Dose to be administered is 5000 units Factor IX
- Doses will be rounded to the nearest 500 units Factor IX
- Infuse at a rate of 0.12 mL/kg/minute (~3 units/kg/minute) in a separate line and do not mix with any other medications or blood products. Do not allow blood to enter syringe (to reduce risk of fibrin clot formation).
- Do not exceed a rate of 8.4mL/minute (~210 units/minute)
- Administered within 4 hours of reconstitution.
- Document lot # in Electronic Health Record (Cerner)

☐ (NovoSeven® RT) Coagulation Factor VIIa Room Temperature Stable IV Bolus over 2-5 minutes (stored in pharmacy in refrigerator or room temperature). Dose Coagulation Factor VIIa (NovoSeven® RT) based on weight below. (Dosing equals 60 mcg/kg rounded up to the nearest 1000 mcg, 2000 mcg, or 5000 mcg vial)

For patient's weight of:
- ☐ 50 kilograms or less, administer 3000 mcg
- ☐ 67-83 kilograms, administer 5000 mcg
- ☐ 101-116 kilograms, administer 7000 mcg
- ☐ 134-150 kilograms, administer 9000 mcg
- ☐ 166-180 kilograms, administer 11,000 mc
- ☐ 51-66 kilograms, administer 4000 mcg
- ☐ 84-100 kilograms, administer 6000 mcg
- ☐ 117-133 kilograms, administer 8000 mcg
- ☐ 151-165 kilograms, administer 10,000 mcg

Physicians signature:	Date:	Time:
Nurse Noting signature:	Date:	Time:

Rev 1/11, 5/11, 3/12, 2/13, 4/14, 0614, 0714, 1216, 0117,11/17, 0118 0318

Source: Luis D. Pacheco M.D., George R. Saade, M.D., Maged M. Costantine, M.D., Steven L. Clark, M.D., & Gary D.V. Hankins, M.D. An update on the use of massive transfusion protocols in obstetrics. *American Journal of Obstetrics and Gynecology*, 2016-03-01, Volume 214, Issue 3.

Critical Event Checklists

Postpartum Hemorrhage – Critical Event Checklist

Stage 1 Bleed

- ☐ Call for help and have someone bring the Uterine Tamponade Balloon Kit (Hemorrhage kit) to room
  - Notify Anesthesia, Charge Nurse, OB
- ☐ Establish IV access if not present (at least 18-gauge)
  - Establish 2nd large bore IV or Saline lock
  - Increase Oxytocin rate (to at least 500 mL/hr)
  - Draw STAT labs (CBC, PT/PTT, Fibrinogen/D Dimer, T & S) (notify lab of draw)
  - Type and Cross;
  - 3 units RBCs
  - 3 units FFP
  - 1 unit Aphoresed Platelets
- ☐ Continue vigorous fundal massage
- ☐ Get ready uterine tamponade balloon
- ☐ Administer Uterotonic medication ordered by Provider
  - No response to first dose – move on to alternate agent
  - Good response to first dose – give additional doses as ordered
- ☐ Tranexamic Acid (TXA)
- ☐ Empty bladder – consider indwelling catheter
- ☐ Weigh peri-pads and chux to estimate blood loss
  - Record blood loss volume every 15 minutes
- ☐ Physician or Midwife
  - Rule out retained Products of Conception, laceration, hematoma
- ☐ Surgeon if Cesarean Section
  - Inspect for uncontrolled bleeding at all levels, especially broad ligament, posterior uterus and retained placenta consider uterine tamponade
- ☐ Administer O_2 to keep sats greater than 95%
- ☐ Keep patient warm

Stage 2 Bleed

- ☐ All items from Stage 1 AND:
- ☐ Tranexamic Acid (TXA)
- ☐ Ensure labs are drawn and 'super STAT'
- ☐ Activate response team
  - Notify second OB
  - Anesthesia to bedside
  - Nursing Supervisor
  - Notify Blood Bank of Massive Transfusion Protocol and Designate a 'blood runner'
  - Get Rapid Infuser
  - Get ready uterine tamponade balloon
  - Interventional radiology if ability to do embolization
- ☐ Type and Cross total of: (MTP)
  - 6 units packed RBCs
  - 6 units FFPs
  - 1 unit Aphoresed Platelets
  - 10 units Cryoprecipitate
- ☐ Calcium Gluconate 2 grams (4.65mEq/1gm) IV
- ☐ Assess and announce vital signs every 5 minutes including pad/chux volume and O_2 sats
- ☐ Bimanual massage
- ☐ Record hourly urine output with urimeter
- ☐ Move to OR
  - Prepare Hysterectomy tray
  - Prepare for Embolization if available in house

* *If bleeding ongoing – repeat CBC/PLTs, Coagulation panel II STAT and Chem 12 panel every 60 minutes or status post each massive transfusion protocol (MTP)

- ☐ Apply SCDs
- ☐ Use fluid warmer or rapid infuser

After 8-10 units of PRBCs and coagulation factor replacement may consider risk/benefit of rFactor VIIa

Medication doses

Oxytocin:
- Infusion 100 mL bolus (30 units/500 mL) over 20 minutes
- Premixed (30 units/500 mL) IVF – increased rate after delivery of placenta (at least 500 mL/hr)
- 10 units IM times 1 dose

Methylergonovine maleate (not with hypertension)
- 0.2 mg IM (NOT IV) every 2-4 hrs

Carboprost tromethamine (Hemabate) (not with Asthma)
- 250 mcg IM or intramyometrial (NOT IV) every 15-90 minutes - do not exceed 8 doses/24 hr

Misoprostol (Cytotec)
- 600 mcg - 1000 mcg PR time 1 dose
- 400 mcg - 800 mcg SL times 1 dose

Tranexamic Acid (TXA)
- 1 gram (10 mL of a 100 mg/mL Solution over 10-20 minutes) Repeat in 30 minutes if still bleeding

PRBCs (approximately 35-40 minutes for crossmatch once sample is in the lab and assuming no antibodies present)
FFP (approximately 35-45 minutes to thaw for release)
PLTs Local variation in time to release (may need to come from regional blood bank)
CRYO (approximately 35-45 minutes to thaw for release)

OB-1601 10/13 (Rev. 03/14, 05/14, 12/16, 08/18)

Massive Transfusion/Code Crimson Worksheet
Level 1

PPID Label

Notify Switchboard ext.5555

Time: _____

(Switchboard will alert Laboratory, Anesthesia, Ultrasound, IR, Nursing Supervisor and Pharmacy to await further instructions)

Second In-House OB Physician

Type and Cross Total of three units packed RBCs, three units FFP, one unit of platelets

Lab Results

(Repeat after each MTP or Q 1 hour until stable)

Draw STAT Labs _____

(CBC, PT/PTT, INR, Fibrinogen, Type and Cross, CMBP)

Result Time_____

Draw STAT Labs _____

(CBC, PT/PTT, INR, Fibrinogen, Type and Cross, CMBP)

Result Time_____

Notes:

Ensure IV Access

Site 1_____

Site 2_____

Foley Catheter Insertion_____

Administer O2 to keep sats greater than 95%

Keep Patient warm

Apply SCDs

Continuous vigorous fundal massage

Prepare

Uterine Tamponade Balloon Cart _____

OR Hysterectomy Pan_____

Prepare Rapid Infuser/Blood Warmer_____

Blood Products Intake *(Indicate in mLs)*

RBCs: Unit 1_____ Unit 2_____ Unit 3_____

FFP: Unit 1_____ Unit 2_____ Unit 3_____

Platelets:_____ **Cryoprecipitate:**_____

Total Blood Product Intake: _____

Medications

Oxytocin 30 units/500mL at 500 mL/hr _____

Methergine 0.2 mg IM Q 2-4hrs_____

Hemabate 250mcg IM or intramyometrial (can be given every 15-90 minutes; do not exceed 8 doses in 24 hrs)

Dose 1_____ Dose 2_____

Dose 3_____ Dose 4_____

Misoprostol 600mcg- 1000mcg PR time 1 does_____

Or 600mcg- 800mcg SL or po X1 _____

Tranexamic Acid 1 gm/100ml NSS IV over 20 min

Repeat in 30 min if bleeding not controlled.

Dose 1_____ Dose 2_____

Additional IV Intake

IV Fluids: _____

_____

Output/ EBL *(Record blood loss volume Q 15min)*

(Weigh EBL 1gm= 1cc)

Delivery EBL: _____ Delivery Urine Output:_____

Additional blood loss: _____

Additional Hourly Output: _____

Vital Signs Q 5 Min including O2 sat _____ _____

_____ _____

Signature:

_____

HEALTHTRUST™

Massive Transfusion/Code Crimson Worksheet
Level 2

PPID Label

Type and Cross Total of six units packed RBCs, six units FFP, one unit of platelets, ten units' cryoprecipitate, and additional MTP2 packages with 20 units of cryoprecipitate

Lab Results

(Repeat after each MTP or Q1 hour until stable)

Draw STAT Labs _____
(CBC, PT/PTT, INR, Fibrinogen, Type and Cross, CMBP)
Result Time_____

Draw STAT Labs _____
(CBC, PT/PTT, INR, Fibrinogen, Type and Cross, CMBP)
Result Time_____

Notes:

Output/ EBL *(Record blood loss volume Q 15min)*
(Weigh EBL 1gm= 1cc)

Delivery EBL: _____ Delivery Urine Output:_____

Additional blood loss: _____

_____

Additional Hourly Output: _____

Blood Products Intake *(Indicate in mLs)*

RBCs: Unit 1_____ Unit 2_____ Unit 3_____ Unit 4_____ Unit 5_____ Unit 6_____

FFP: Unit 1_____ Unit 2_____ Unit 3_____ Unit 4_____ Unit 5_____ Unit 6_____

Platelets: _____ **Cryoprecipitate:** _____

Total Blood Product Intake: _____ **Calcium Gluconate:**_____

Blood Products Intake *(Indicate in mLs)*

RBCs: Unit 1_____ Unit 2_____ Unit 3_____ Unit 4_____ Unit 5_____ Unit 6_____

FFP: Unit 1_____ Unit 2_____ Unit 3_____ Unit 4_____ Unit 5_____ Unit 6_____

Platelets: _____ **Cryoprecipitate:** _____

Total Blood Product Intake: _____ **Calcium Gluconate:**_____

Medications *(Refer to page 1)*

Vitamin K 10 mg IV 1 dose_____
Prothrombin Complex Concentrates_____
Factor 7 _____
RiaSTAP _____

Additional IV Intake

IV Fluids: _____

_____

Notes:

Signature:
_____

HEALTHTRUST™

Battling Coagulopathy

"Dire complication of severe hemorrhage"

Reversal can be extremely complex

Fibrinogen is Key

Substrate of all clot

↓

No / Low Fibrinogen

↓

No Clot

↓

Exsanguination

(Can occur in 10 to 12 minutes in extreme cases)

Battling Coagulopathy, *continued*

- Fibrinogen < 200 mg/dl
- 100% positive, predictive value for life-threatening obstetrical hemorrhage

Critically Low Fibrinogen Renders All Other Measures Poorly Effective

Adverse Case Review Results Show:

- Prothrombin complex concentrates (Kcentra or FEIBA) *Poorly effective*
- Factor 7 *Poorly effective*
- TXA *sub-optimally effective* (will help stabilize any residual clot)
- Life-saving hysterectomy (not always so)

Increase Fibrinogen While Concomitantly Engaging in Other Lifesaving Measures

- Repeat TXA
- Hysterectomy
- Pelvic Packing
- Interventional Radiology
- Hypogastric artery ligation if surgeon is proficient
- Aortocaval hand compression while catching up with blood component therapy
- Prothrombin Complex Concentrate*
- Factor VII

Source: Luis D. Pacheco, M.D., George R. Saade, M.D., Maged M. Costantine, M.D., Steven L. Clark, M.D., and Gary D.V. Hankins M.D. An update on the use of massive transfusion protocols in obstetrics. American Journal of Obstetrics and Gynecology, 2016-03-01, Volume 214, Issue 3.

Treatment of Consumptive Coagulation / DIC

Part of the Death Quadriad

- Acidemia
  - Prevented by increasing O2 Delivery via PRBCs (Prevent or Repay Oxygen Debt) Sodium Bicarbonate Therapy
- Hypothermia
  - Prevented with Bair Hugger / High Capacity Blood / IV Fluid Warmer
- Consumptive Coagulation /DIC
  - Correction is sometimes extremely complex
- Electrolyte Aberration
  - Hypocalcemia empiric or lab directed calcium carbonate
  - Hyperkalemia: Serial potassium levels.
    - Glucose / Insulin drip if necessary
    - Calcium gluconate to decrease likelihood of malignant cardiac arrhythmia
    - Bicarbonate therapy if acidotic

Three Broad Examples—Case Example 1

Patient Profile 1

- Hemoglobin 7
- PT /PTT is Normal
- Fibrinogen is 250

(Normal Pregnancy Value for Fibrinogen is 301 to 696, less than 300=Red Flag)

Hematological GOAL:
Hbg ≥ 10 gm/dl – antepartum
Hbg ≥ 8 gm/dl - postpartum
Plt ≥ 50,000 mm^3
Fibrinogen > 200mg/dl
PT < 1.5 x control
PTT < 1.5 x control

Expected Fibrinogen Increase
6 units FFP to increase
Fibrinogen 60mg/dl
10 units cryoprecipitate to
increase 50 mg/dl
in 100 kg/pt (220 lb)

RiaSTAP 2 GM dose of will
increase Fibrinogen
approximately
80 mg/dl

Coagulation Goals

- Use Standard MTP
- 6 PRBCs, 6 FFP, 1 Platelet and 10-20 units cryoprecipitate

Three Broad Examples—Case Example 2

Patient Profile 2

- Hemoglobin is 9
- PT / PTT is twice the normal value
- Fibrinogen 175

(Normal Pregnancy Value for Fibrinogen is 301 to 696, less than 300 Red Flag)

Hematological GOAL:
Hbg ≥ 10 gm/dl – antepartum
Hbg ≥ 8 gm/dl - postpartum
Plt ≥ 50,000 mm^3
Fibrinogen > 200mg/dl
PT < 1.5 x control
PTT < 1.5 x control

Expected Fibrinogen Increase
6 units FFP to increase
Fibrinogen 60mg/dl
10 units cryoprecipitate to
increase 50 mg/dl
in 100 kg/pt (220 lb)

RiaSTAP 2 GM dose of will
increase Fibrinogen
approximately
80 mg/dl

Coagulation Goals

- FFP 4 Units
  - Clotting factors should normalize PT /PTT
- Administration of clotting factors should increase the Fibrinogen by approximately 40 mg/dl
- Total Fibrinogen at goal/ Approximately 215 mg/dl

Three Broad Examples—Case Example 3

Patient Profile 3

- Hemoglobin is 8
- PT/PTT is 1.5 times normal
- Fibrinogen 100

(Normal Pregnancy Value for Fibrinogen is 301 to 696, less than 300 Red Flag)

Hematological GOAL:
Hbg ≥ 10 gm/dl – antepartum
Hbg ≥ 8 gm/dl - postpartum
Plt ≥ 50,000 mm^3
Fibrinogen > 200mg/dl
PT < 1.5 x control
PTT < 1.5 x control

Expected Fibrinogen Increase
6 units FFP to increase
Fibrinogen 60mg/dl
10 units cryoprecipitate to
increase 50 mg/dl
in 100 kg/pt (220 lb)

RiaSTAP 2 GM dose of will
increase Fibrinogen
approximately
80 mg/dl

Coagulation Goals

- PRBC 2 Units
- 4 Units FFP should increase fibrinogen by 40 mg/dl
- 20 units cryoprecipitate should increase fibrinogen by 100 mg /dl
- Total Fibrinogen should achieve goal of approximately 240 mg/dl

Fibrinogen Is Key

- Normal Pregnancy Value 301 to 696 mg/dl
  - Red Flag < 300
  - 100% PPV PPH < 200 *
  - No Clot Formation < 100
- Critically low fibrinogen levels (≤ 100-150) cannot be returned to normal using only FFP w/o cryoprecipitate
  - In some cases, established coagulopathy needs fibrinogen concentrate (Ria-STAP) for correction
- Use all blood component therapy as needed

Source: Charbit, et al., J Thromb Haemost (2007)

Riastap: Fibrinogen Concentrate

- Heat treated lyophilized powder from pooled source
- Available at some institutions
- 1 vial=600-1300mg fibrinogen
- Obstetrical dosing: 2grams → in fibrinogen of approximately 80 mg/dl
- Pharmacologic armament for severe hemorrhage

Source: Ahmed S., *Transfusion Medicine.* 2012

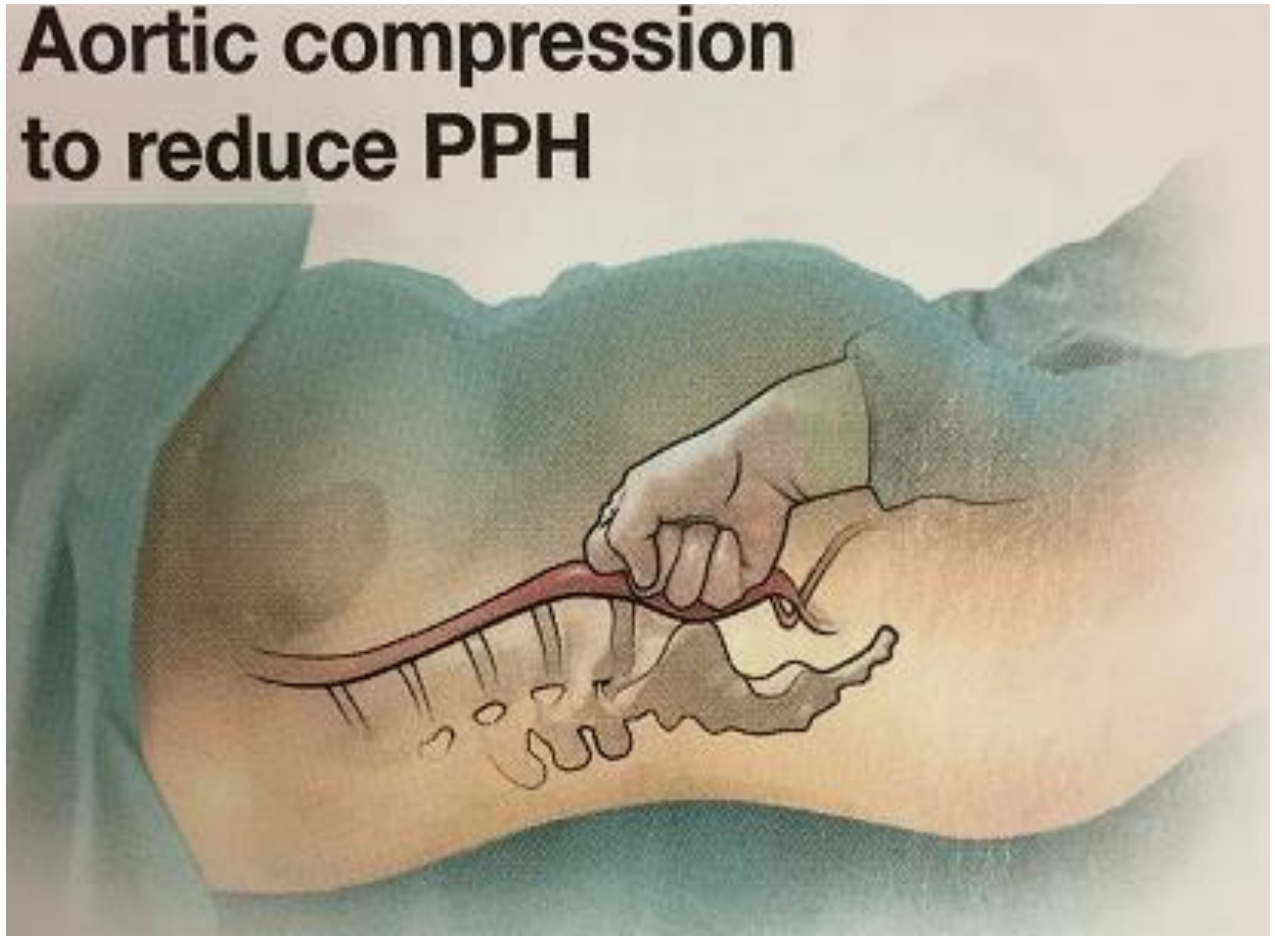
Mentor's Pearl

- **PUT IT ON!!!**
- You can always take it off later (Diuretics)
- Risk of exsanguination and death from resultant coagulopathy and academia is greater than fluid overload and pulmonary edema
- Pregnant woman generally have a healthy cardiac status and the risk of fluid overload and result pulmonary edema is rare.

De-escalate Blood Component Therapy When Stable

Surgical Caveat

Utilize aortic compression while “catching up” with blood component therapy



HEALTHTRUST

Surgical Caveat, *continued*

- Re-explore if necessary to remove blood clot, blood breakdown products and re-inspect pedicles
- Retained clot may activate fibrinolytic system and potentiate consumptive coagulopathy

Low Obstetrical Volume Centers

- Know your limits
  - *But prepare for the worst*
- Planning is everything
- Liberal transfer policy
  - *Preferably before labor*

Low Obstetrical Volume Centers, *continued*

Postpartum Hemorrhage Risk Assessment

- History of PPH
- Large Fibroid
- Grand Multiparty
- Uterine Overdistension
- Macrosomia
- Polyhydramnios
- Multiple gestations
- Placenta Previa
- Inherited bleeding diathesis
- Chorioamnionitis
- Retained placenta tissue/Membranes
- Use of uterine relaxing agents (Tocolytics halogenated anesthetics nitroglycerin)
- Prolonged labor/Oxytocin use

Low Obstetrical Volume Centers, *continued*

- Screen all patients for Morbidly Adherent Placenta
- Where is the placenta?!
- Confirm location relative to scar

Transfer any patient at risk to an accredited center of excellence

Wise obstetrician left placenta in, closed uterus and transferred!

Code Crimson / Massive Transfusion Protocol (MTP)

- Facilities with limited Blood Banking capability have the capacity to administer PRBCs and FFP with limited platelet resources(high demand, short shelf life)
  - FFP and cryoprecipitate have long shelf life/low cost
- U.S. military looking at usage of FFP as primary resuscitative volume expander
- FDA cleared freeze-dried plasma for military use
- Judicious resuscitation with crystalloids/colloids
- Permissive hypotension so as not to disrupt clot or exacerbate blood loss
- Target systolic blood pressure @ 90

Source: UpToDate MTP 2014, Shock volume 40 no.6 2013

Code Crimson / Massive Transfusion Protocol (MTP), *continued*

Use of Hemostatic Tools

- Fibrin sealants (Vistaseal) “Clot in a bottle” Fibrinogen & Thrombin
- Topical Thrombin (Thrombogen, Costasis)
- Hemostatic matrices (Floseal, Surgiflo) Thrombin plus matrix gelatin
- Gelatin Sponges (Gelfoam)
- Oxidized regenerated cellulose (Surgicel)
- Microfibrillar Collagen (Avitene)
- Cellulose Hemostatic matrix products (fibrillar, Surgicel SNOW)
- Use singly or together to control bleeding surfaces
- Helpful with diffuse low volume bleeding of coagulopathy

Code Crimson / Massive Transfusion Protocol (MTP), *continued*

Use of Hemostatic Tools

- Uterine Tamponade Balloon / Packing
- Uterine Compression Sutures
- Pelvic Pressure Pack
- Interventional Radiology
- Penrose or Foley Around Uterus
- Expeditious Transfer Plan vs. Timely Definitive Procedure LIFE-SAVING HYTERECTOMY

Miscellaneous Pearls

- Keep patient warm—Utilize high capacity rapid infuser / fluid warmer for PRBC, FFP, Platelets, Cryoprecipitate and IV fluids
- Hypothermia is part of “Death Quadriad”
- Utilize high capacity blood product warmer/ 8 bays (*Total Cost:$6,560.31*)
- Last in, First out blood bank policy for PRBCs
- PRBCs are actively metabolizing
- Decrease risk of storage lesion which can lead to hemolysis and hyperkalemia

Massive Transfusion Protocol Equipment

High Capacity Blood Component Therapy Warmer

- Eight Warming bays accommodate 1 MTP
- Six units of FFP
- Two 5 packs of cryoprecipitate

HEALTHTRUST

Massive Transfusion Protocol Equipment

High Volume Rapid IV Blood Component Therapy Infuser

- Ranger Rapid Infuser
- Level 1 Rapid Infuser
- Important to have an 18-gauge IV or central line
- Infuses within one minute

Massive Transfusion Protocol Equipment

Utilize Advanced Tissue Sealant Technology for Lifesaving Hysterectomy

HEALTHTRUST

Complications of Massive Transfusion

Adverse events	Comments and potential treatments
Transfusion reactions	
Allergic	Range from simple urticarial to anaphylaxis. Steroid and diphenhydramine might be given to patients with allergic transfusion
Haemolytic transfusion reaction (acute and delayed)	Might be reduced by giving group O RBCs and AB plasma for emergency release of blood products
Febrile non-haemolytic transfusion reaction	Diagnosis of exclusion
Immunological reactions	
Transfusion-related acute lung injury (TRALI)	Incidence can be reduced by transfusing male-only plasma
Transfusion-related immunomodulation (TRIM)	Might be responsible for increased risk of bacterial infection
Transfusion-associated graft *vs* host disease (Ta-GVHD)	Irradiation of cellular blood products in patients at risk (such as neonates and immunosuppressed patients) to prevent Ta-GVHD
Post-transfusion purpura (PTP)	Can be treated with IVIg infusion, steroid, or plasma exchange
Metabolic complications	
Hypocalcaemia*	Because of citrate overload from rapid transfusion of blood products. Neonates and patients with pre-existing liver disease are at risk for hypocalcemia. Monitor ionized calcium level and correct if necessary
Hypomagnesaemia*	Because of large volume of magnesium-poor fluid and citrate overload. Monitor ionized magnesium level and correct if necessary
Hyperkalaemia*	Because of haemolysis of RBC from storage, irradiation, or both. Neonates and patients with pre-exisiting cardiac and renal diseases are at risk for hyperkalaemia. Monitor potassium level and correct if necessary. Fresh RBCs (<5–10 days old), irradiated <24 h before transfusion or washing may decrease risk
Hypokalaemia*	Because of re-entry into transfused RBCs, release of stress hormones, or metabolic alkalosis. Monitor potassium level and correct if necessary
Metabolic alkalosis*	Because of citrate overload. Monitor acid–base status
Acidosis*	Because of hypoperfusion, liver dysfunction, and citrate overload. Monitor acid–base status
Hypothermia*	Because of infusion of cold fluid and blood products, opening of body cavities, decrease heat production, and impaired thermal control. Neonates and infants are at increased risk. Blood warmer should be used
Other adverse events	
Haemostatic defects*	Result from complex mechanism (discuss in the pathophysiology section)
Infection	Can result from blood products or other resuscitated procedures, such as surgeries
Transfusion-associated circulatory overload (TACO)*	Should be differentiated from TRALI. Infants and patients with pre-existing cardiac disease are at increased risk. Oxygen and diuresis can be used
Air embolism	A rare fatal complication. Instructions and/or protocols on how to use rapid infuser must be followed

Source: H.P. Pham & B.H. Shaz BJA (2013)

Alliance for Innovation on Maternal Health Program

COUNCIL ON PATIENT SAFETY IN WOMEN'S HEALTH CARE

safe health care for every woman

PATIENT SAFETY BUNDLE

Obstetric Hemorrhage

READINESS

Every unit

- Hemorrhage cart with supplies, checklist, and instruction cards for intrauterine balloons and compressions stitches
- Immediate access to hemorrhage medications (kit or equivalent)
- Establish a response team - who to call when help is needed (blood bank, advanced gynecologic surgery, other support and tertiary services)
- Establish massive and emergency release transfusion protocols (type-O negative/uncrossmatched)
- Unit education on protocols, unit-based drills (with post-drill debriefs)

RECOGNITION & PREVENTION

Every patient

- Assessment of hemorrhage risk (prenatal, on admission, and at other appropriate times)
- Measurement of cumulative blood loss (formal, as quantitative as possible)
- Active management of the 3rd stage of labor (department-wide protocol)

RESPONSE

Every hemorrhage

- Unit-standard, stage-based, obstetric hemorrhage emergency management plan with checklists
- Support program for patients, families, and staff for all significant hemorrhages

REPORTING/SYSTEMS LEARNING

Every unit

- Establish a culture of huddles for high risk patients and post-event debriefs to identify successes and opportunities
- Multidisciplinary review of serious hemorrhages for systems issues
- Monitor outcomes and process metrics in perinatal quality improvement (QI) committee

Standardization of health care processes and reduced variation has been shown to improve outcomes and quality of care. The Council on Patient Safety in Women's Health Care disseminates patient safety bundles to help facilitate the standardization process. This bundle reflects emerging clinical, scientific, and patient safety advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed. Although the components of a particular bundle may be adapted to local resources, standardization within an institution is strongly encouraged.

The Council on Patient Safety in Women's Health Care is a broad consortium of organizations across the spectrum of women's health for the promotion of safe health care for every woman.

May 2015

For more information visit the Council's website at www.safehealthcareforeverywoman.org

Source: Council on Patient Safety in Healthcare. Accessed August 19, 2020. https://safehealthcareforeverywoman.org/

Case Report 2016

41 years old Gravida 5 Para 4

- Status post C-Section for fetal Intolerance of labor
- Diagnosed with intraoperative expanding retroperitoneal hematoma
- Transferred to Interventional Radiology for uterine artery embolism
- Bleeding stopped / patient stable

18 hours post-op

Patient has mental status change, acute abdominal distension hypotension and maternal cardiac arrest

Case Report 2016, *continued*

Emergently returned to OR for exploratory laparotomy

- 5 liters of blood in abdomen. Femoral artery ruptured and retracted into the abdomen
- Black Hawk Down Junctional Injury

MTP/Code Crimson Called

- OB team evacuated clot and held pressure
- 2 vascular surgeons called to repair femoral artery and place vascular graft

Expert Highly Reliable Collaborative Care

- Post Partum Patient in Extremis
- 10 Liter Blood Loss
- 6 Hours of Cumulative Surgery
- 78 Units of Blood Component Therapy
- 65 Hospital Staff & Employees
- 11 Specialties and Sub-specialties
- 40 Day Hospital Stay
- 21 Day Rehabilitation

Mother of 5 home to children & husband!

HEALTHTRUST

Assessment Question 1

Which of the following risk factors contribute to catastrophic maternal hemorrhage?

a. Placental abruption

b. Amniotic fluid embolism

c. Sepsis from retained products of conception

d. All of the above

Assessment Question 1: Correct Response

Which of the following risk factors contribute to catastrophic maternal hemorrhage?

a. Placental abruption

b. Amniotic fluid embolism

c. Sepsis from retained products of conception

d. All of the above

Assessment Question 2

Why are massive transfusion protocols considered more physiologic

a. Causes dilutional coagulopathyAmniotic fluid embolism

b. Mimics whole blood

c. Exacerbates acidemia

d. Increases heat loss

Assessment Question 2: Correct Response

Why are massive transfusion protocols considered more physiologic

a. Causes dilutional coagulopathyAmniotic fluid embolism

b. Mimics whole blood

c. Exacerbates acidemia

d. Increases heat loss

Assessment Question 3

How does an evidence-based care team approach improve patient outcomes in maternal hemorrhage?

a. Decrease time to treatment for maternal hemorrhage

b. Minimize delays in critical processes

c. Enhance communication between team members

d. All of the Above

Assessment Question 3: Correct Response

How does an evidence-based care team approach improve patient outcomes in maternal hemorrhage?

a. Decrease time to treatment for maternal hemorrhage

b. Minimize delays in critical processes

c. Enhance communication between team members

d. All of the Above

Assessment Question 4

What is the intention of the Joint Commission provision of care, treatment and service standards for maternal safety regarding hemorrhage?

a. Reduce the likelihood of harm related to maternal hemorrhage

b. Remove the requirement of annual hemorrhage response drills

c. Outline documentation requirements for hemorrhage

d. Provide a policy template for hemorrhage

Assessment Question 4: Correct Response

What is the intention of the Joint Commission provision of care, treatment and service standards for maternal safety regarding hemorrhage?

a. **Reduce the likelihood of harm related to maternal hemorrhage**

b. Remove the requirement of annual hemorrhage response drills

c. Outline documentation requirements for hemorrhage

d. Provide a policy template for hemorrhage

Take Home Message

- Patients in extremis do not allow “do overs”
- Study Code Crimson / MTP
- Implement Code Crimson / MTP
- Drill Code Crimson / MTP
- Practice doesn’t make perfect
- **Perfect practice makes perfect**

References

- Rupsa C. Boelig, M.D., MS, Gabriele Saccone, M.D., Federica Bellussi, M.D., Vincenzo Berghella, M.D., “MFM Guidance for COVID-19,” American Journal of Obstetrics & Gynecology MFM, DOI: 10.1016/j.ajogmf.2020.100106, 2020.
- ACOG Patient Safety and Quality Improvement. Berg, Cl et al., Obstet Gynecol 2012.
- WHO, UNICEF, UNFPA, The World Bank, and UNDP. Trends in Maternal Mortality 1990-2013 :2014.
- Callaghan, Wm, et al., Obstet, Gynecol, 2012.
- National Partnership Maternal Safety, ACOG 2014.
- K Fingar, MM, Hambrick, et al., Trends and Disparities in Delivery Hospitalizations Involving Severe Maternal Morbidity, 2006-2015.
- Tisherman, SA., et al., J Trauma Acute Care Surgery 2017.
- D'Alton ME. Where is the "M" in maternal-fetal medicine? *Obstet Gynecol*. 2010;116(6):1401-1404. doi:10.1097/AOG.0b013e3181fd2556.
- Council on Patient Safety in Healthcare. Accessed August 12, 2020. https://safehealthcareforeverywoman.org/.
- Borgman MA, Spinella PC, Perkins JG, et al. J Trauma 2007;63:805.
- Holcomb JB,Wade CE, Michalek JE, et al., Ann Surg 2008;248:447.
- Cotton BA, Au BK, Nunez TC, et al. J Trauma 2009; 66:41.
- Shaz BH, Dente CJ, Nicholas J, et al. Transfusion 2010;50:493.
- Inaba K, Lustenberger T, Rhee P, et al. J Am Coll Surg 2010;211:573.

References, *continued*

- De Biasi AR, Stansbury LG, Dutton RP, et al. Transfusion 2011;51:1925.
- Perkins JG, Cap AP, Spinella PC et al. J Trauma 2009; 66:S77.
- Johansson PI, Stensella J, Rosenburg I, et al. Transfusion2007; 47:593.
- Trauma, 2008 65:527-534 Gunter OL, Jr.
- Cannon, JW, Khan MA, Raja et al., Damage control resuscitation in patients with severe trauma.
- J Trauma Acute Care Surgery 2017; 82:605-17.
- Steven L. Clark M.D., Gary Hankins, M.D., Obstet Gynecol 2012; 119:360-4.
- Charbit, et al., J Thromb Haemost (2007).
- Waters, M.D., Perioperative Blood Management, 2009.
- Source: Lancet, April 26, 2017.
- Luis D. Pacheco M.D., George R. Saade, M.D., Maged M. Costantine, M.D., Steven L. Clark, M.D., & Gary D.V. Hankins, M.D. An update on the use of massive transfusion protocols in obstetrics. American Journal of Obstetrics and Gynecology, 2016-03-01, Volume 214, Issue 3.
- Charbit, et al., J Thromb Haemost (2007).
- Ahmed S., Transfusion Medicine, (2012).
- UpToDate MTP 2014, Shock volume 40 no.6 2013.
- H.P. Pham & B.H. Shaz BJA, (2013).

Thank you

Frank R. Kolucki, Jr. M.D., FACOG
FKolucki@mth.org

HEALTHTRUST