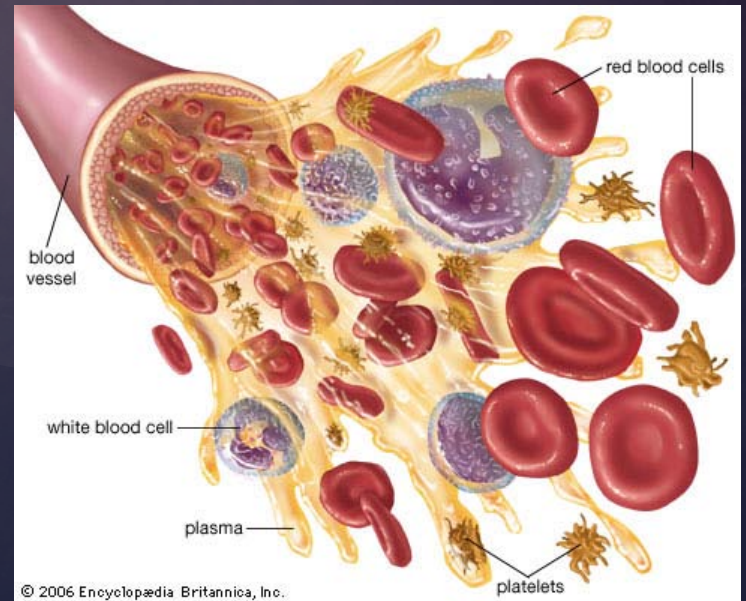


Hemostatic Resuscitation in Trauma

{ Joanna Davidson, MD
6/6/2012



Case of HM

- 28 yo M arrives CCH trauma bay 5/27/12 at 241 AM
- Restrained driver in low speed MVC after getting shot in the chest
- Arrived boarded and collared with a GCS of 9
- Primary survey significant for slow shallow labored breathing, blood pressure 70/30, HR 110
- Secondary survey significant for 2 GSW
 - 1 to the back just to the right of midline at T12 level
 - 1 to R anterior axilla

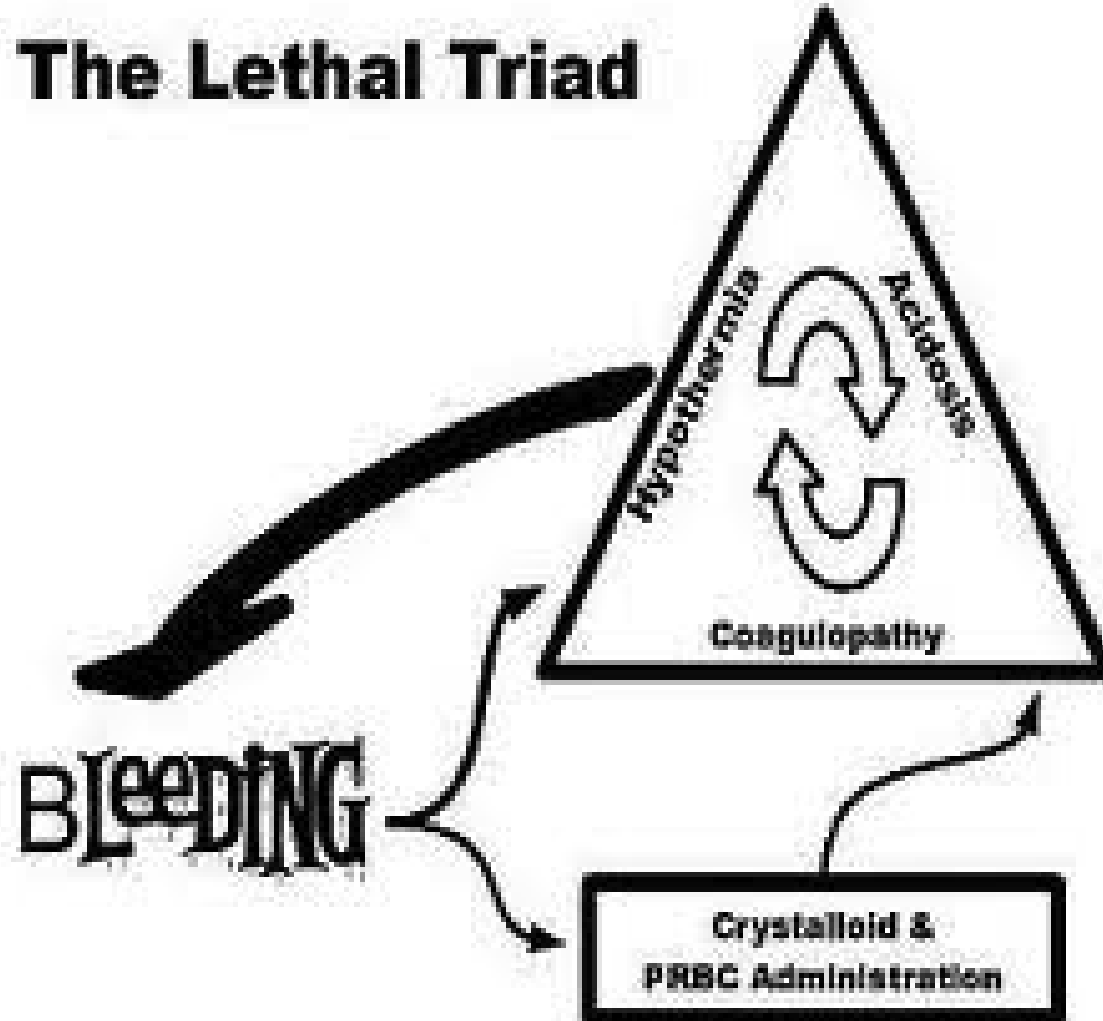
HM in the shock room

- Intubated for airway protection/failure to oxygenate
- Labs on arrival:
 - 7.14/22.3/72/7/BE -22
 - 6.7\ 13/ 193 INR 1.22 fibrinogen 242
 - 141 | 100 | 15
 -
 - 3.3 | 8 | 1.6
 - AG33
- CXR- layering pleural effusion on R → CT placed
- MTP initiated
 - 6U pRBC
 - 6U FFP
- TXA given

Hemorrhage after trauma is the second most frequent cause of death, exceeded only by TBI, and remains the leading cause of potentially preventable and early in-hospital deaths



The Lethal Triad

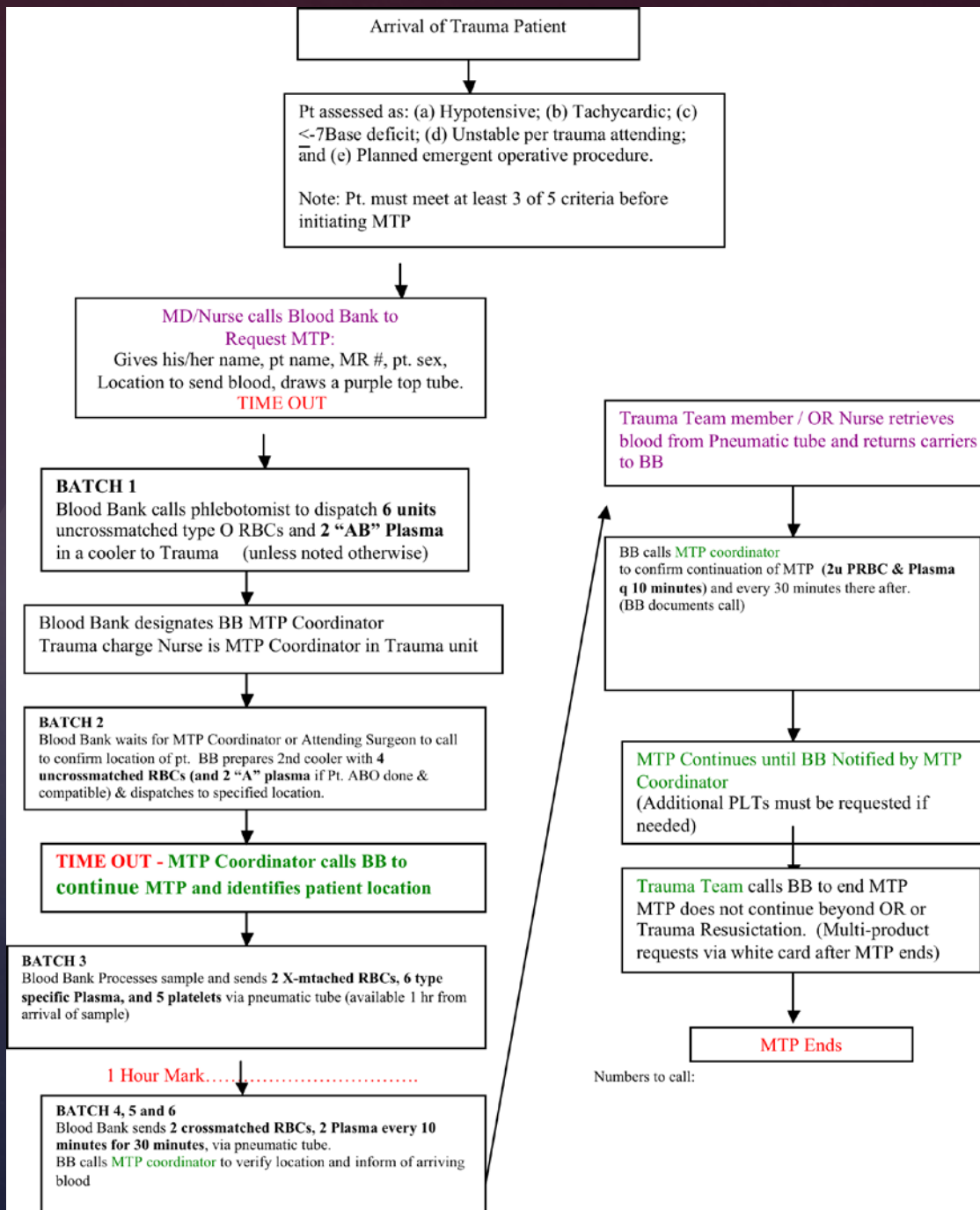


Massive Transfusion

- Defined as greater than 10 units of packed red blood cells (PRBCs) in a 24 hour period
- Replacement of total blood volume in 24 hours
- Replacement of 50% of total blood volume in less than 3 hours

When to initiate MTP

- Assessment of Blood Consumption Score (ABC Score)
 - ED SBP <90
 - Penetrating trauma
 - HR >120 bpm
 - +FAST exam
 - 3= 45% need for MTP, 4= 100% need
- Mclaughlin Score- independent predictors of requiring MTP in battlefield
 - HR>105
 - SBP<110
 - pH<7.25
 - Hct<32%
- **Senior clinician's discretion**
- Thromboelastography/ROTEM



1:1:1

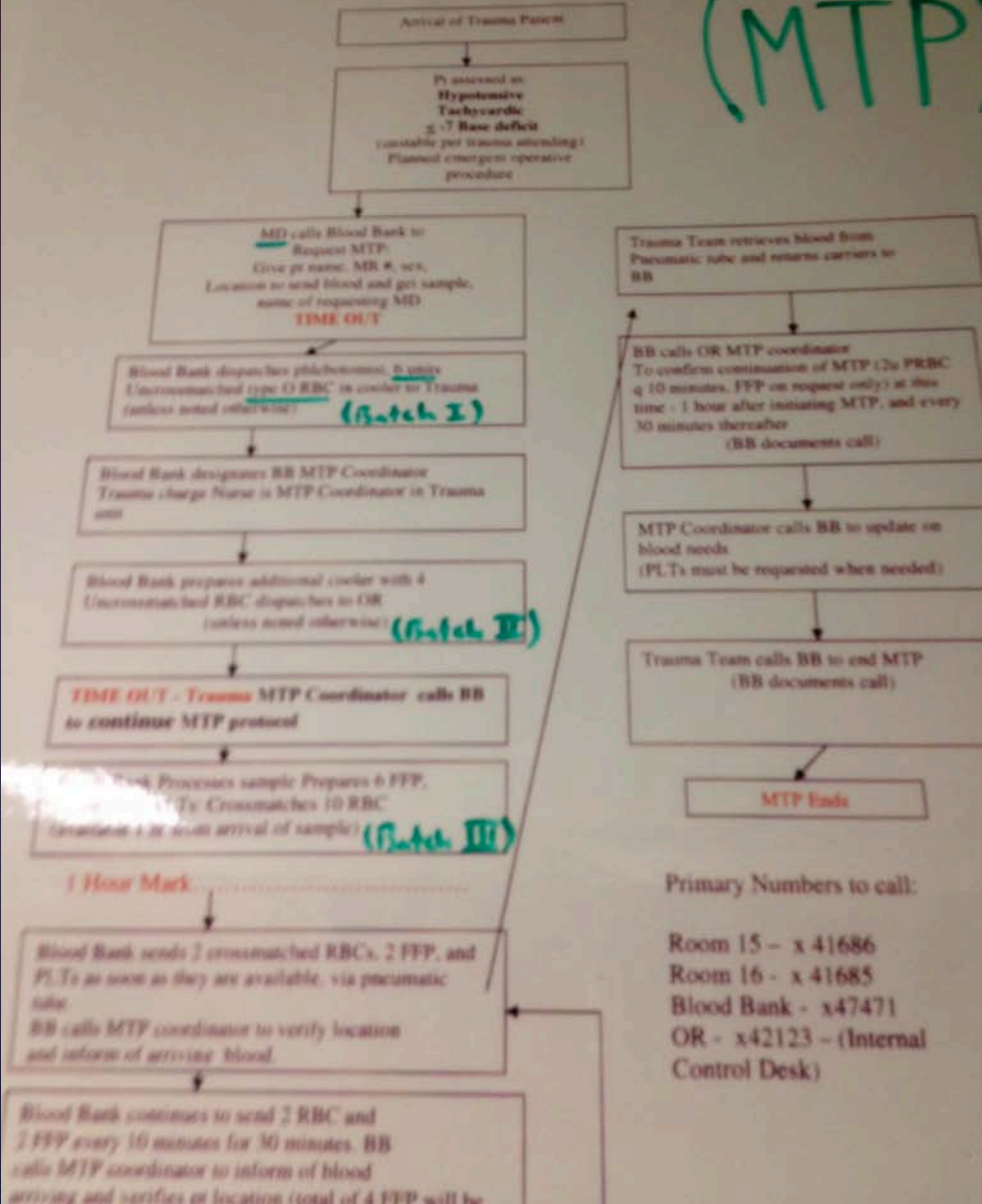
- Large military studies demonstrate that patients who receive higher FFP:RBC ratio have improved survival (Borgman et al)
- Demonstrated in civilian studies as well (Zink et al)
- Flaws exist in these studies
 - Survival bias
 - Retrospective
- Still most centers support 1:1
- FFP administration may have worse outcomes if MTP not required

Platelets (1:1:1)

- Age of platelets is important
- Room temperature
- ASA/plavix use



Trauma Massive Transfusion Protocol (MTP)



Level 1 How To with Sue



TXA

- Inhibits fibrinolysis, possible anti-inflammatory effect
- MATTERS trial demonstrated benefits in military situations
- CRASH 2- massive RCT in civilian population
- Safe
- Cheap (\$100/gram)



Other concepts in damage control

- Permissive hypotension
- PCCs
- Recombinant FVII

Back to case of HM

- After 6 RBC and 6 FFP patient stable for CT scan
 - 4:18 AM ABG: 7.17/59/23/21/BE -7
- CT chest/abdomen: large right hepatic lobe laceration with active extravasation of contrast, large hemoperitoneum, large renal laceration with surrounding perinephric fluid collection

HM continued

- IR called in for embolization however when HM gets back from CT he is not so stable anymore
 - BP dropped precipitously to SBP 60s
 - 6AM ABG: 7.014/51/98/13/-18
- Additional 2U pRBC infused and patient taken to OR emergently

HM in the OR

- Operative report: “large amounts of arterial bleeding from right lobe of liver...vessel loop placed around hepatic artery occluding it. The patient was in extremis at this point and would not tolerate a trip to angiography suite for a more selective embolization of the artery due to patients temperature, coagulopathy, and worsening base deficit.”
- OR input: 2000 cc crystalloid, 10 pRBC, 2 plts, 5 FFP
- 24 hour total blood products:
 - 22 RBCs
 - 19 FFP
 - 5 Platelets
 - TXA
 - Factor 7

HM ICU Day #9 (6/5/12)

- Patient continues to be intubated/sedated
- ARDS/TRALI
- Abdominal washout and TAWT performed
- Febrile/bacteremic

Resources

- McLaughlin DF, Niles SE, Salinas J, Perkins JG, Cox ED, Wade CE, Holcomb JB. A predictive model for massive transfusion in combat casualty patients. J Trauma. 2008 Feb;64(2 Suppl):S57-63; discussion S63. PubMed PMID: [18376173](#).
- Nunez TC, Voskresensky IV, Dossett LA, Shinall R, Dutton WD, Cotton BA. Early prediction of massive transfusion in trauma: simple as ABC (assessment of blood consumption)? J Trauma. 2009 Feb;66(2):346-52. PubMed PMID: [19204506](#).
- <http://emcrit.org/wp-content/uploads/resus-of-crit-ill-trauma-patients.pdf>
- <http://emcrit.org/podcasts/massive-transfusion-kenji/>
- Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. CRASH-2 trial collaborators. Lancet 2010; 376: 23–32

Resources

- The importance of early treatment with tranexamic acid in bleeding trauma patients: an exploratory analysis of the CRASH-2 randomised controlled trial. CRASH-2 trial collaborators. *Lancet* 2011; 377:1096-101.
- Curry N, Davis PW. “Whats new in resuscitation strategies for the patient with multiple trauma?” *Injury*, 2012. article in press.
- Morrison JJ, Dubose JJ, Ramusen TE, Midwinter MJ. “Military Application of Tranexamic Acid in Trauma Emergency Resuscitation (MATTERs) Study. *J Trauma* 2011; 71(1) Supplement S9
- <http://emcrit.org/podcasts/tranexamic-acid-trauma/>
- <http://lifeinthefastlane.com/2012/04/rr-in-the-fastlane-015/>

Thank you

- Dr. Nagy, Dr. Dennis, trauma staff
- All of the countless medical students, residents, attendings who never let me push patients so that this baby can continue to cook

