Prehospital Blood Administration

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Disclosures

- W81XWH-12-2-0023
- Department of Defense
- Prehospital Air Medical Plasma Trial (PAMPer)

Why Blood?

“Treatment of haemorrhagic shock involves maintaining blood pressure and tissue perfusion until the bleeding is controlled”

Kwan I et al. The Cochrane Library 2009
Stuff that Didn’t Work

- MAST
- Colloids
- Blood substitutes
- Crystalloid?


Crystalloid

Why is crystalloid dangerous?
- “Popping the Clot” with SBP>90
- Hyper-cholremic Acidosis
- Dilutional Coagulopathy
- Hypothermia
- Leukocyte activity
- Endothelial dysfunction
- Reperfusion Injury


Prehospital Intravenous Fluid Administration Is Associated With Higher Mortality in Trauma Patients: A National Trauma Data Bank Analysis
Haut, Elliott R. MD*; Kalish, Brian T. BA*; Cotton, Bryan A. MD, MPH†; Elliot, David T. MD; Bierer, Adi H. MD, MPH‡; Moravek, Kent A. MD; MPH‡; Kinirons, Alvin N. MD; Cotton, Edward E. III MD; Chang, David C. MBA, MPH, PhD Annals of Surgery 2011

Prehospital Crystalloid

- Survival worsens with larger volume infusions
- Associated with coagulopathy
- Difference in mortality is driven by patients with SBP>90

Brown J et al. J Trauma 2013
Out-of-hospital Hypertonic Resuscitation After Traumatic Hypovolemic Shock: A Randomized, Placebo-Controlled Trial

- Crystalloid solution
- Hypertonic

Other Stuff that Didn’t Work

Guidelines for Prehospital Fluid Resuscitation in the Injured Patient

- Crystalloid

When to Use Blood: Indications

- Associations with RTS (14), ISS (17), BD>3
- AABB Clinical Practice Guidelines 2012
- Transfuse hospitalized patients Hgb<7 (Lvl I)
- Liberalize based on clinical condition (Lvl III)
- Baker JB et al. J Trauma 2001
  - SBP <90
  - HR >120
  - GCS <9
  - High energy mechanism
When to use Blood: Indications


**When to transfuse: Indications**

- Active Uncontrolled Bleeding
- High Energy Mechanism
- Physiologic Parameters
  - BP < 90
  - HR > 120
  - Lactate > 4
  - SI ≥ 1

Guyette et al. *J Trauma* 2014 (in press)
What are the Risks?


What Product?

- Whole Blood
  - The predominant blood product until 1960’s
  - Still used in Military and Auster environments
  - Fractionated products favored for utilization
  - Limited comparing whole blood to fractionated products
  - Evidence Does suggest that the best product ratio is 1:1:1
    RBC : Plasma : Platelet

What Product?

- Packed Red Blood Cells
  - PRO
    - Screened, available
    - Volume resuscitation and carrying capacity
    - Likely improves survival in patients with >20% mortality
  - CON
    - Contributes to coagulopathy
    - Worsens hypothermia
    - Pro-inflammatory
    - Decreases survival in patients with <20% mortality

Whoever makes sense of the above.

Whatever makes sense of the above.
What Product?

- Prospective Observational Multicenter Major Trauma Transfusion (PROMMT) Study
  - Higher plasma and platelet ratios are associated with decreased mortality in patients transfused with >3 u of blood products
  - Patients receiving high ratios within 6 hrs associated with survival
  - Supports the need for an RCT
  - Suggests earlier is better?

What Product?

Where?

- What is the Evidence for Prehospital Transfusion?
  - Military applications
    - Prehospital blood administration as part of DCS is associated with decreased mortality: O’Reilly et al. J Trauma 2014
  - Civilian prehospital transfusion
    - Retrospective review of Israeli trauma patients with prehospital transfusion: Yaniv et al. J Trauma 1999
    - Descriptive studies in air medical systems
      - Burns & Zietlow: AMJ 1999
      - Sumida et al. AMJ 2000
PREHOSPITAL TRANSFUSION OF PLASMA AND RBCS IN TRAUMA PATIENTS
Holcomb et al. *PEC* 2015

- Retrospective review of 137 patients receiving RBCs and Plasma
- Not powered for outcomes
- Improved pH, TEG, and decreased crystalloid
- No difference in survival

Where?

Several Trauma Bay and Prehospital Studies are currently underway:
- Prehospital Air Medical Plasma Trial (PAMPer)
- Prehospital Use of Plasma for Traumatic Hemorrhage (PUPTH)
- Control of Major Bleeding After Trauma (COMBAT)
- Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) Trial

Where?

Prehospital Blood Administration requires:
- Increased training
- Significant expense
- Regulatory Compliance
- Refrigeration
- Judicious protocolized use
- Can you recycle product to limit waste

Who?: Is this right for you?
Future Directions

- RCT of blood products
- Evidence based transfusion criteria
- New Products
  - Liquid plasma
  - Lyophilized plasma
  - Plasma Concentrates
  - Synthetic blood

Take Home Points

Why Blood? - Resuscitation with crystalloid to normotension is bad

When to Transfuse? For shock or uncontrolled hemorrhage

What Product? Whole Blood or 1:1:1 ratios

Where? Prehospital notification or administration.

Who? Is this right for your service?