

2014 GHEST Symposium: **Massive Hemorrhage Control Protocols**

Menaka Pai, BSc MSc MD FRCPC

Assistant Professor - Department of Medicine, McMaster University

Associate Member - Department of Pathology and Molecular Medicine, McMaster University

Consultant Laboratory Hematologist – Hamilton Regional Laboratory Medicine Program



Objectives

- Define massive hemorrhage
- Discuss evidence-based strategies for managing patients with massive hemorrhage
- Share the Hamilton General Hospital's experience with a massive hemorrhage control protocol (MHCP)
- Suggest general strategies for MHCP design and implementation



WHAT IS MASSIVE HEMORRHAGE?

What is Massive Hemorrhage?

- Replacement of one blood mass, or ≥ 10 units of PRBCs within a 24 hour period
- Dynamic and expectant definitions may be more useful...
 - **Witness or anticipated blood loss exceeding 10 units of PRBC in 6 hours**

Where do we see massive hemorrhage?



Reynolds MW et al. *Patient Safety in Surgery* 2008
Brace V, Kernaghan D, Penney G. *BJOG* 2007
Speiss B et al. *Kaplan's Cardiac Anesthesia* (Chap. 29). 2006.
Annals of Thoracic Surgery 2007;83: S27-86

Hemorrhage is a serious problem in the trauma world

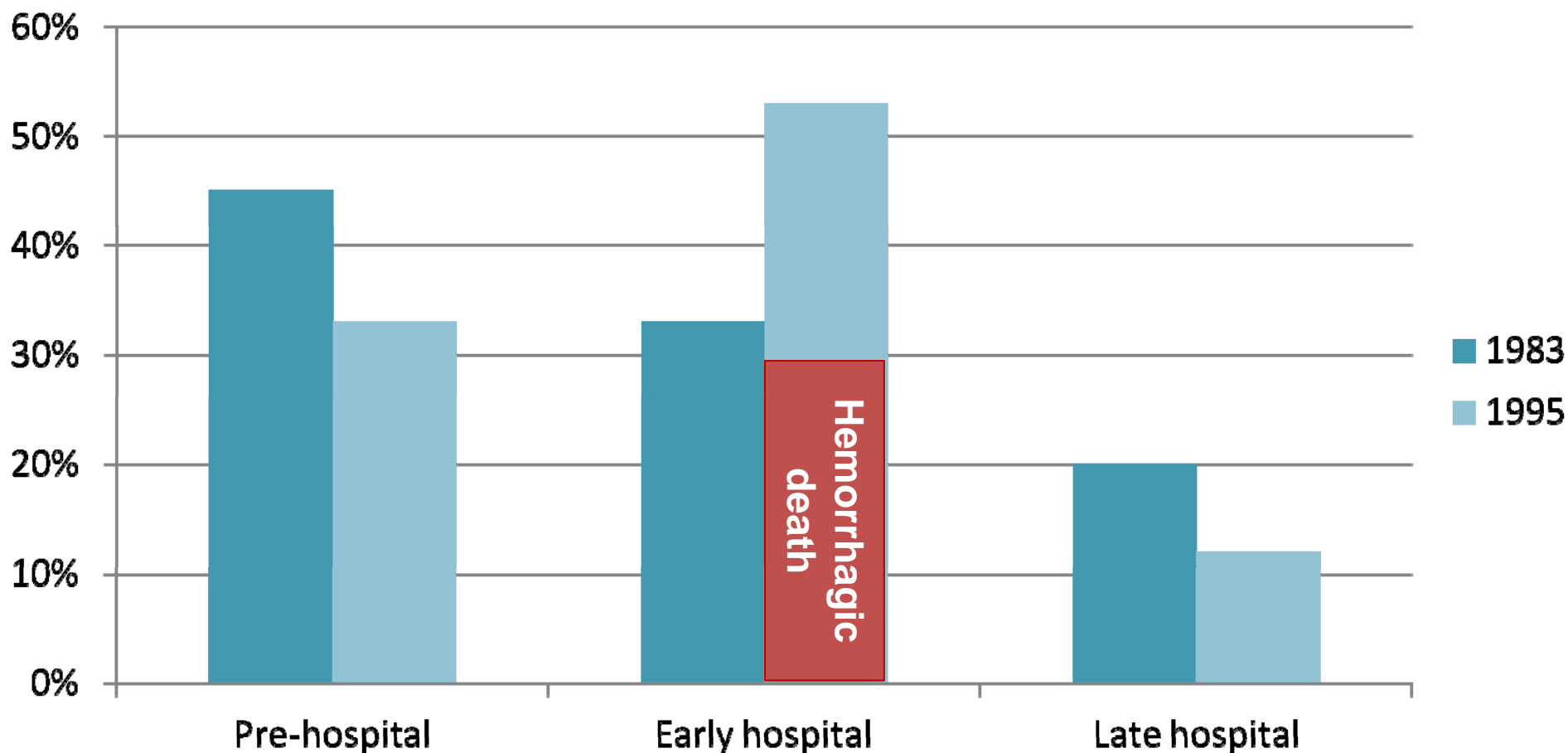
- Massive transfusion occurs in ~1% of patients, but they consume 50-75% of all blood products!
- Hemorrhage responsible for 45% of deaths in first 48 hours
- 6–15% of trauma patients present to hospital in shock



Vaslef SN et al. J Trauma. 2002;53:291–295.

Cotton et al, J Trauma 2010; 68:6 Johannsen + Stensbelle Transfusion 2010, 50:701

A window of opportunity for quality care

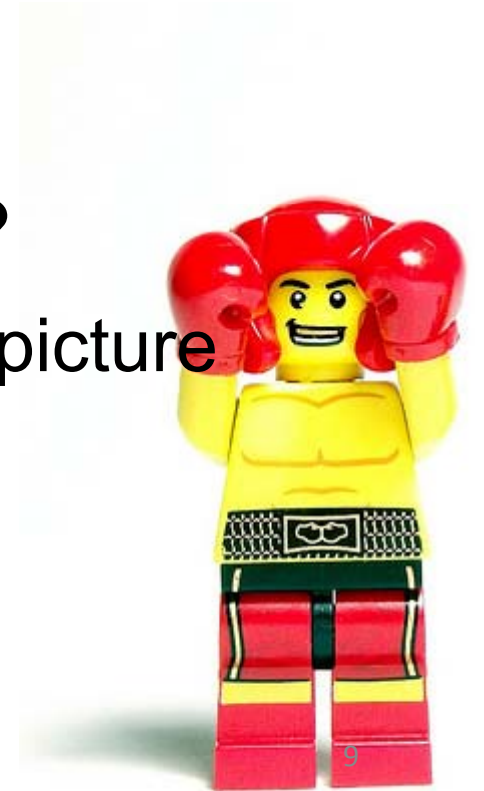


Trunkey DD. Sci Am 1983.
Suaia A. J Trauma 1995.



PRINCIPLES OF MASSIVE HEMORRHAGE CONTROL

- What is the “appropriate” way to use pRBCs, FFP, platelets and cryoprecipitate in massive hemorrhage?
- Do you use a ratio of pRBC:FFP?
 - No, I keep up with labs and clinical picture
 - Yes, 1:1 (equal amounts)
 - Yes, <1:1 (more FFP than pRBC)
 - Yes, >1:1 (more pRBC than FFP)



Survival of trauma patients after massive red blood cell transfusion using a high or low red blood cell to plasma transfusion ratio*

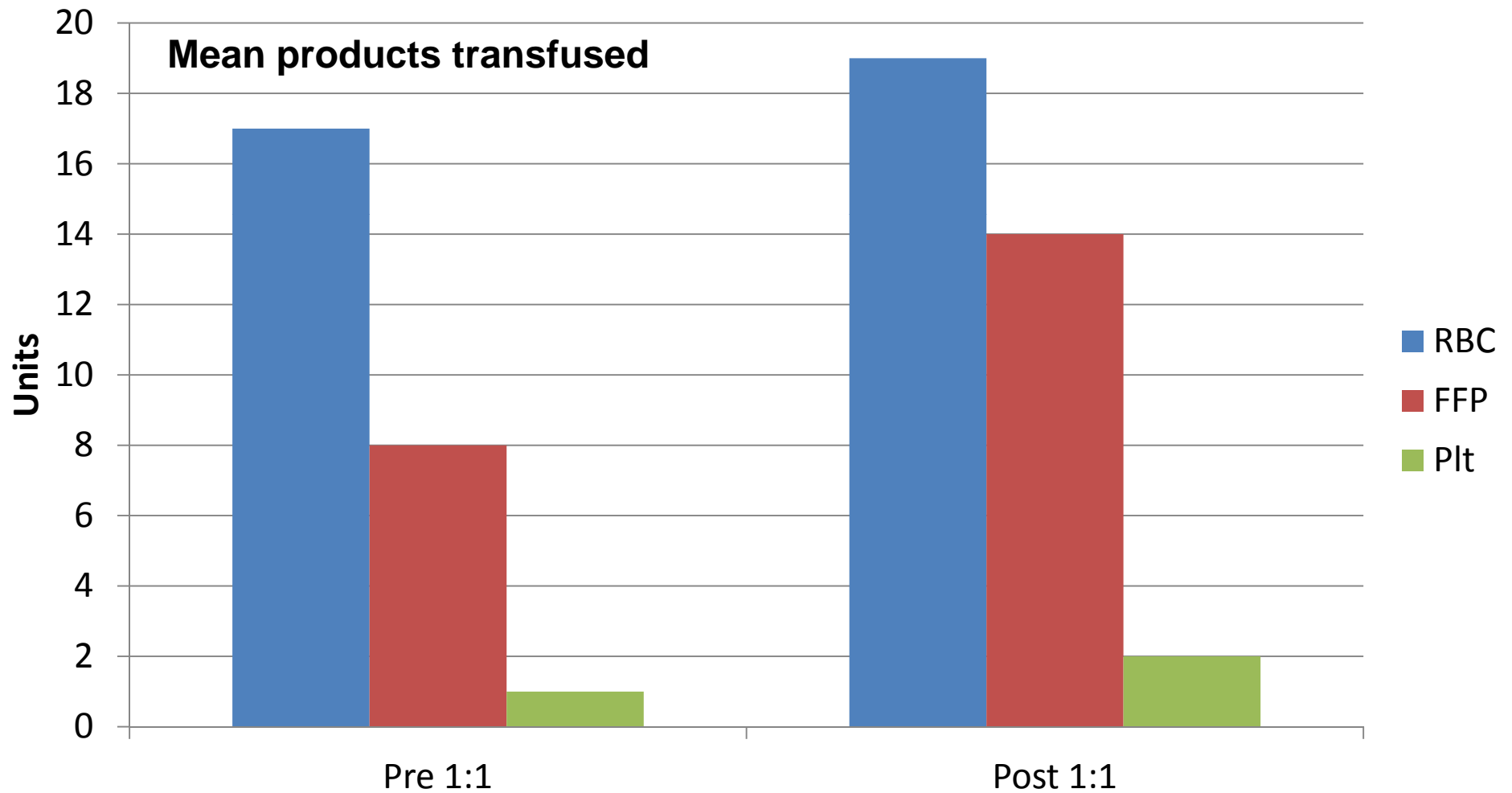
Anita Rajasekhar, MD; Rob Gowing, MD, MSc, FRCSC; Ryan Zarychanski, MD, MSc, FRCPC;
Donald M. Arnold, MD, MSc; Wendy Lim, MD, MSc, FRCPC; Mark A. Crowther, MD, MSc, FRCPC;
Richard Lottenberg, MD

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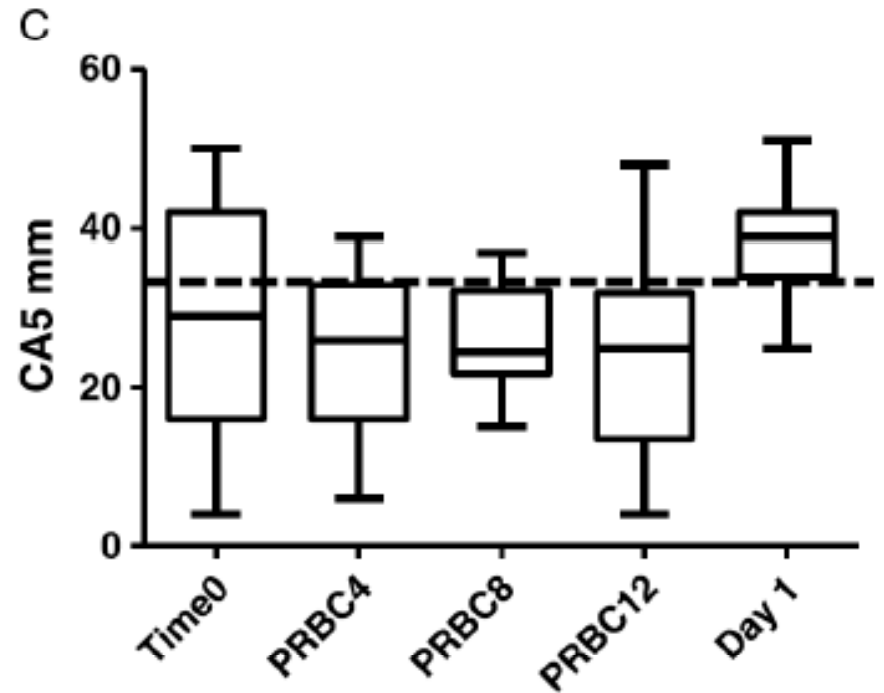
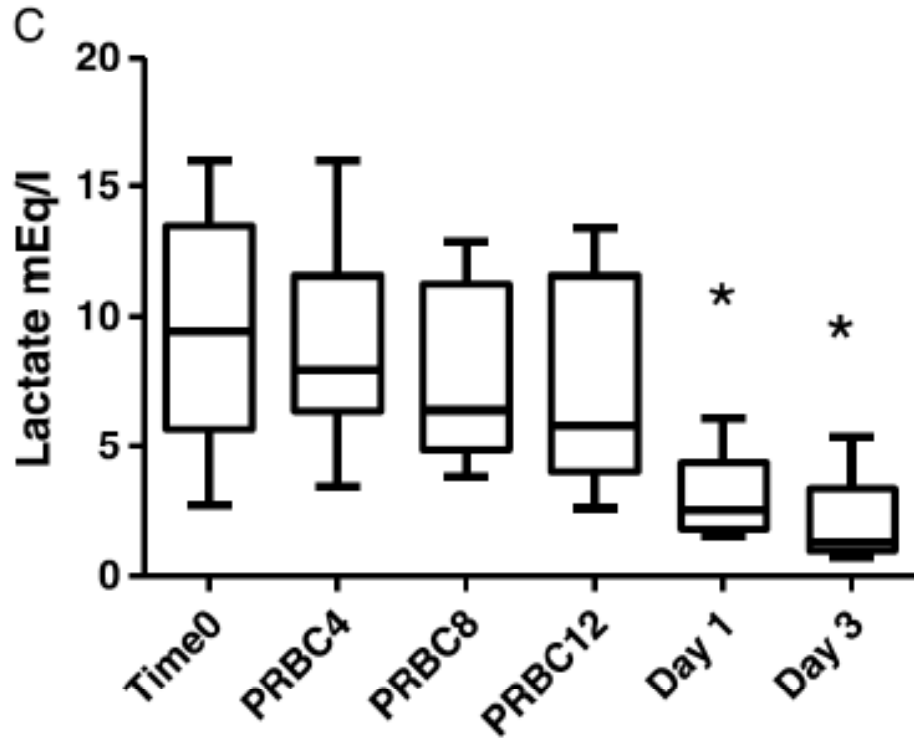
- Goal was to determine clinical benefit of different FFP:RBC ratios in severely bleeding patients
- 11 studies enrolling 3,107 patients
- **Higher FFP:RBC ratios *may* be associated with improved survival**



U.S. Military found no difference in mortality before and after 1:1 directive



Trauma surgeons found 1:1:1 ratio didn't lead to improved tissue perfusion or coagulation status



Lactate used to measure tissue perfusion
(higher lactate = worse perfusion)

ROTEM used to measure coagulopathy
(higher CA5 = more coagulopathic)

The guidelines suggest monitoring in “real time”

- College of American Pathologists (1994)
- American Society of Anesthesiologists (1996)
- European Task Force for Advanced Bleeding Care in Trauma (2007)

**EASIER SAID THAN
DONE!**

We still don't know what the best approach is

- PROPPR study will be informative
- **Until then, use common sense**
- Use 1:1:1 ratios until more data is available, and **don't get behind!**
- Cryoprecipitate if fibrinogen drops below 1 g/L
- Blood warmer to reduce hypothermia
- Consider a Liquid Plasma Bank



Other interventions have been shown to help, too

Rapid identification of coagulopathic patients

Permissive hypotension

Limited use of crystalloid

Adjunctive hemostatic agents

- Massive hemorrhage control protocols put it all together by **protocolizing management**
 - Communication between clinical and non-clinical services
 - Monitoring of patients
 - Ordering, transport and infusion of blood products and fluid
 - Use of a reasonable ratio of blood products
 - Use of hemostatic agents

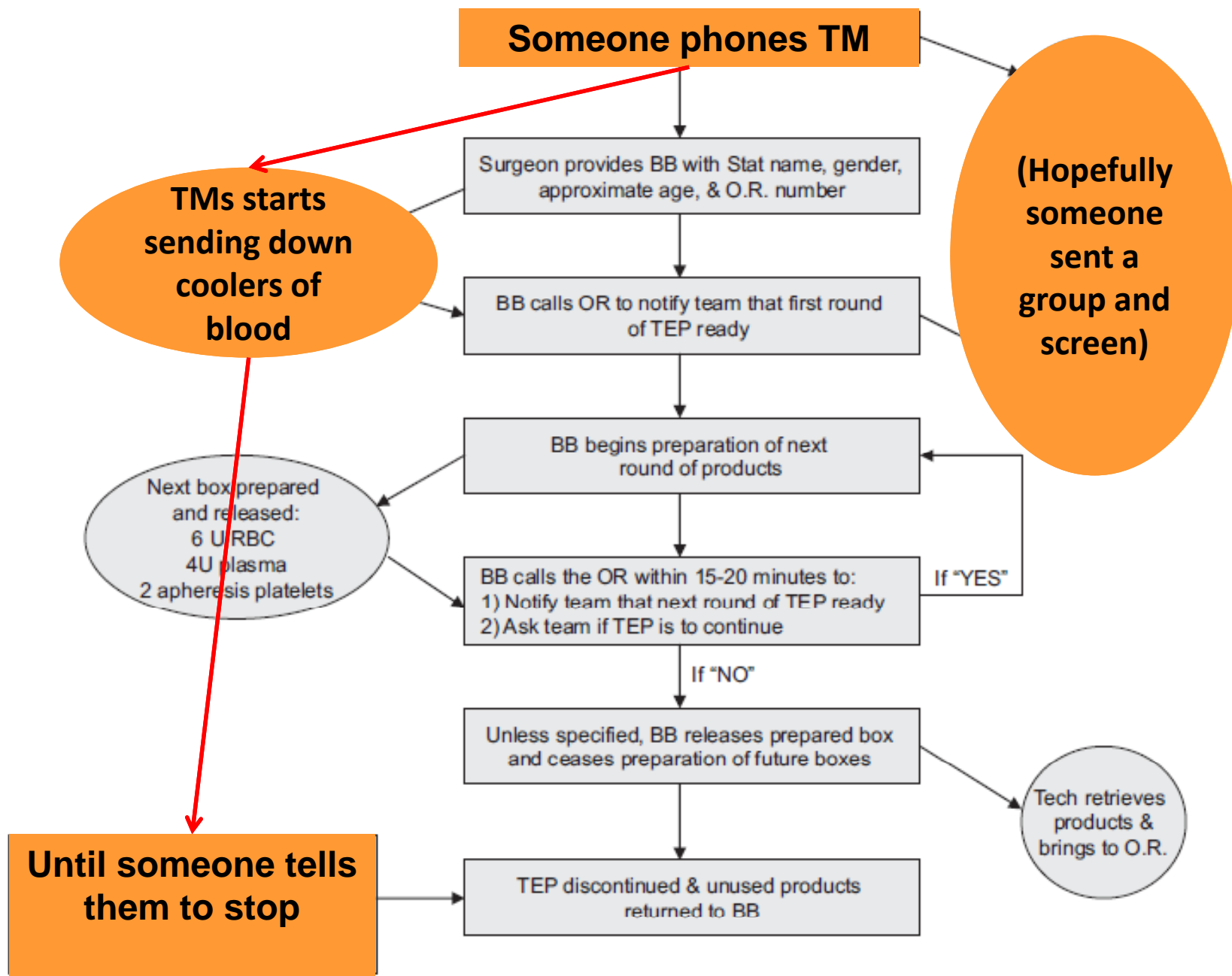
Damage Control Resuscitation Is Associated With a Reduction in Resuscitation Volumes and Improvement in Survival in 390 Damage Control Laparotomy Patients

Bryan A. Cotton, MD, MPH,† Neeti Reddy, BS,† Quinton M. Hatch, MD,† Eric LeFebvre, BS,† Charles E. Wade, PhD,† Rosemary A. Kozar, MD, PhD,* Brijesh S. Gill, MD,* Rondel Albarado, MD,* Michelle K. McNutt, MD,* and John B. Holcomb, MD*†*

TABLE 4. Multivariate Logistic Regression Model Predicting 30-day Survival

	Odds ratio	95% CI	P
Damage control resuscitation	2.48	1.10–5.58	0.028
ED arrival base value	1.10	1.02–1.20	0.011
ED arrival INR value	0.93	0.79–1.10	0.414
ED arrival SBP, mm Hg	1.02	0.99–1.02	0.075
Age, yr	0.98	0.96–1.01	0.192

95% CI indicates 95 percent confidence interval; ED, emergency department; INR, international normalized ratio; SBP, systolic blood pressure.



Massive Hemorrhage Control Protocols (MHCPs) seem to work

- Mortality rate improved
 - 45% before MHCP
 - 19% after MHCP (p value = 0.02)
- Participants reported:
 - Improved communication
 - Better systems flow
 - Optimized blood product availability

Product	Pre-MTP, mean (95% CI)	Post-MTP, mean (95% CI)	p Value
PRBCs	115 (85–146)	71 (49–93)	0.02*
FFP	254 (185–323)	169 (130–209)	0.04*
Platelets	418 (316–519)	241 (169–311)	0.01*
Plt:PRBCs	1:1.7 (1:1.4–1:2.1)	1:1.3 (1:1.1–1:1.5)	0.05*

But only if you use them correctly

- Compliance evaluated for:
 - MHCP activation by ER doc or trauma attending
 - Protocol discontinuation on leaving OR
 - Type & screen sent from ER
 - Use of ~1:1:1 transfusion ratio
 - No blood products wasted
- **Full compliance predicted for survival (86.7% vs 45%; $p < 0.001$)**



THE MHCP JOURNEY AT HHS

Collaborative, multidisciplinary effort!



Nursing
Portering
Paging
Transfusion Med
Core Laboratory
Anaesthesia
Trauma
Critical care
Emergency Med
Surgery
Hematology
Obs-gyn
Pediatrics

Patient's Name:

Adult Massive Hemorrhage Control Protocol

MRP or delegate must activate Massive Hemorrhage Control Protocol
 Page "Stat Massive Hemorrhage Control" + Location via extension 46311

The following departments/personnel will be automatically paged/called as a result of calling 46311:

- Porter Services
- Transfusion medicine
- Core Lab – HGH x46173
 MUMC x75022
 JHCC x42048

Consider a page to:

- General Surgeon on call
- Obstetrician on call
- Interventional Radiologist on call
- Hematologist on call

Vitals/Monitoring

Vitals

- T, HR, RR, BP, SpO₂ q15minutes
- Maintain Core Temp greater than 35°C
- Target SBP 90 mmHg

Lab Investigations

Draw blood work as soon as possible and send stat

Initial Labs

Enter / MHC via Meditech.

This will include:

- CBC, INR, Group & Screen, Fibrinogen, Electrolytes, Ca, Albumin, Creatinine

Labs post first pack

Enter /MHC2 via Meditech.

- CBC, INR, PTT, Fibrinogen

Lines

Insert two 16 gauge IV Angiocaths OR Physician to insert an 8.5 F central line

Complete all areas in signature box. Orders will not be processed without a written signature and bradma on each page

 Signature: _____ Page # _____ Date _____ Time _____
Signature/Printed Name/Designation (YYYYMMDD)

 Co-Signature: _____ Page # _____ Date _____ Time _____
Signature/Printed Name/Designation (YYYYMMDD)

 Transcribed By: _____ Date _____ Time _____
Signature/Printed Name/Designation (YYYYMMDD)

 Checked By: _____ Date _____ Time _____
Signature/Printed Name/Designation (YYYYMMDD)

**Copy Made For
Pharmacy**



Patient's Name:

Adult Massive Hemorrhage Control Protocol

IV Fluids/Volume Replacement

Transfusion medicine to continue sending packs until MRP or delegate notifies Transfusion Medicine to cancel "Massive Hemorrhage Control Protocol"

Notify MRP immediately of Acute Transfusion reactions

IV Fluid:

Infuse 500cc of warmed Normal Saline stat then run at 30 mL/hr

All IV fluids, blood and blood products to be administered via fluid warming device

Administer first pack as sent by transfusion medicine

- 5 red blood cells
- 4 fresh frozen plasma

Subsequent packs will contain the above plus one adult pack platelets

Consider

- Administering tranexamic acid 1 Gm IV now
- Administering tranexamic acid 1 Gm IV over the next 8 hours
- Administering 1 gram calcium chloride IV
- Administering prothrombin complex concentrate (octaplex) for patients on warfarin

Complete all areas in signature box. Orders will not be processed without a written signature and bradma on each page

 Signature: _____ Page # _____ Date _____ Time _____
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IS YOUR PATIENT HAVING A MASSIVE HEMORRHAGE?

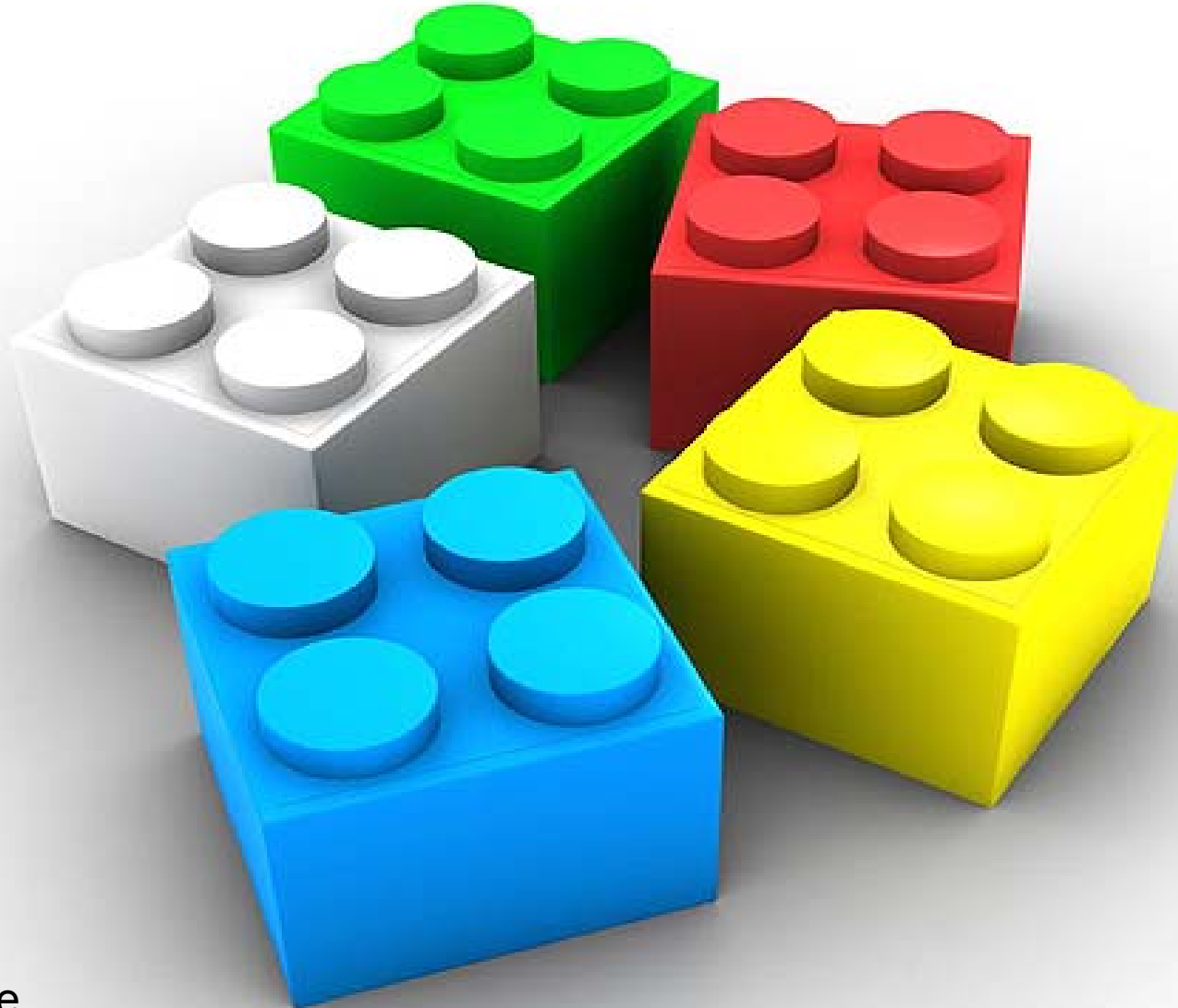
(Witnessed or anticipated blood loss ≥ 10 units of PRBC in six hours)

**MD gives stat verbal order:
“Activate Massive Hemorrhage
Control Protocol”**

- Paging will contact Porter, Core Lab and Blood Bank
- Stat bloodwork will be drawn by RN
 - CBC, INR, PTT, Fibrinogen (initially and after first delivery of blood)
 - Group & Screen, Electrolytes, Ca, Albumin, Creatinine (initially)
- Transfusion Medicine will continuously send you blood via Porter. If the Porter is not immediately available, you must temporarily assign someone (EA, RN, MD, clinical clerk) to run between Transfusion Medicine (3rd floor, HGH) and your clinical area.
 - **First pack: 5 red blood cells + 4 plasma**
 - **Subsequent packs: 5 red blood cells + 4 plasma + 1 dose platelets**

**Contact Blood Bank when you stop the protocol, and return blood products
(i.e., resuscitation effort stops or bleeding stabilizes)**

Getting back on track: General Recommendations



Suggestions for Quality Improvement in MHCP Design

- Redirect products
 - O-neg red cells only for females under age 50
 - Real risk of D alloimmunization small (but still controversial)
 - How are sex and age communicated to TM?
- Replace products
 - Use A plasma instead of AB plasma
 - Some evidence that it has lower antibody titres
- Restrict products
 - Eliminate thawed plasma bank and remove plasma from first cooler (will delay plasma arrival at bedside)
 - Decreased units of thawed plasma from 4 to 2 in first cooler (evidence supporting this from other centres)
 - No release of second or third cooler until group and screen received (may have minimal effect, as we are usually asked to “slow down” at this point)

Suggestions for Quality Improvement in MHCP Implementation

- Maintain communication between TM and clinicians
 - “We are not nagging, we are helping you give good care!”
 - Use non-verbal communication methods
 - Note on first cooler: “Have you drawn a group and screen?”
 - No third cooler until first cooler sent back
- Use TM variables as quality indicators
 - “Pain points” for our blood supply reflect non-optimal clinical practice
 - Clinical areas need to know how much uncrossmatched product they are using!
 - TM generates reports
 - Clinical areas charged with disseminating information appropriately

Suggestions for Quality Improvement in MHCP Implementation

- Invest support and resources into implementation
 - MHCPs are complex, multidisciplinary, multisite protocols!
 - Need to draw on:
 - Clinical staff (including trauma team leaders, surgeons, anaesthetists, intensive care physicians, hematologists, laboratorians, residents, nurses)
 - Laboratory staff
 - Educators
 - Data analysts
 - Administrators (enforce performance and adherence)
- Remember that massively bleeding patients have *always* been complex and resource-intensive
 - MHCP will expose the cracks in your system
 - Motivates all stakeholders to deliver highest quality care
 - Underscores need for protocolization and standardization

Thank you for your attention!

