MASSIVE TRANSFUSION PROTOCOL AND BLOOD MANAGEMENT OF THE SICKLE CELL PATIENT

ERIC FILLMAN, MD

GRMC LUNCH AND LEARN

APRIL 6, 2022

PRIMARY LEARNING OBJECTIVES

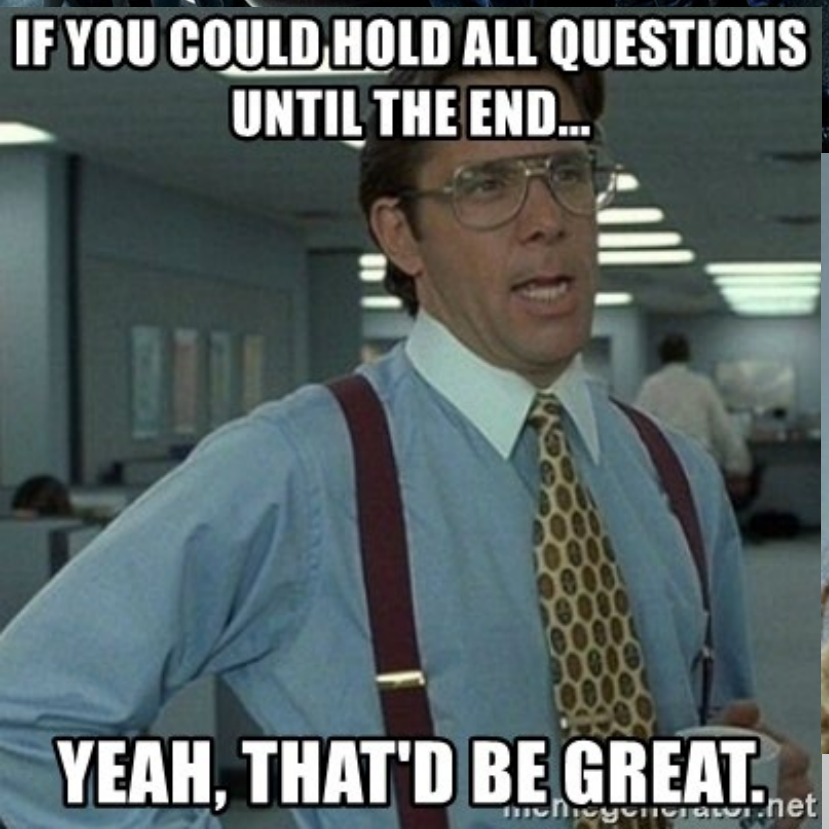
- DISCUSS MASSIVE TRANSFUSION PROTOCOLS (MTPS) WITH SPECIFIC FOCUS ON OUR NEW GRMC MTP.
- BLOOD MANAGEMENT OF SICKLE CELL DISEASE PATIENTS FROM BOTH CLINICAL AND BLOOD BANK PERSPECTIVE.
- BRIEF REVIEW OF KEY POINTS FROM PRIOR LECTURE ON BLOOD UTILIZATION, TRANSFUSION REACTIONS, AND WHOLE BLOOD.

FINANCIAL DISCLOSURES

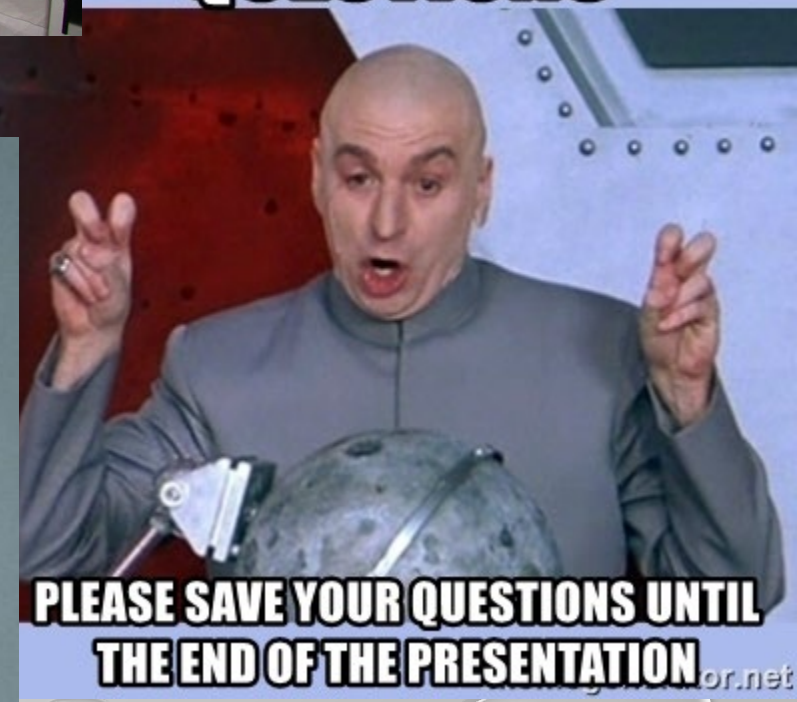
- NO RELEVANT FINANCIAL DISCLOSURES
- THE VIEWS PRESENTED ARE NOT A REFLECTION OF CPA, GRMC, OR THE US ARMY

" QUESTIONS "

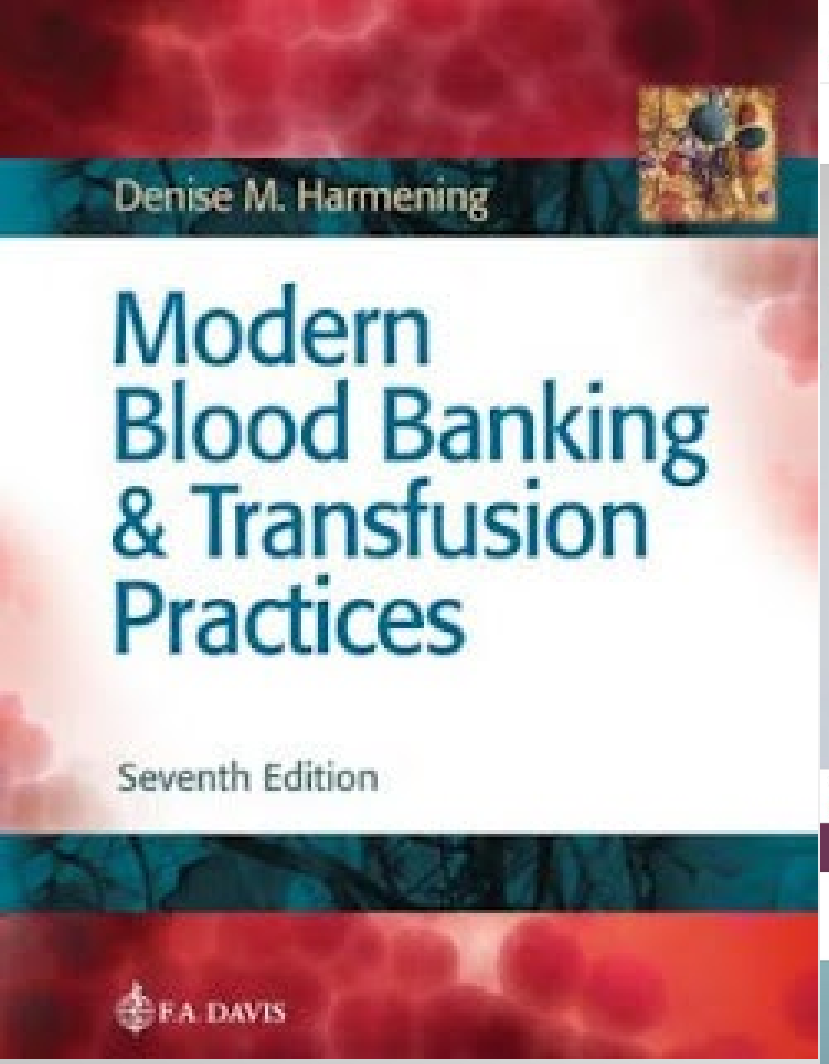
IF YOU COULD HOLD ALL QUESTIONS UNTIL THE END...



YEAH, THAT'D BE GREAT.



PLEASE SAVE YOUR QUESTIONS UNTIL THE END OF THE PRESENTATION



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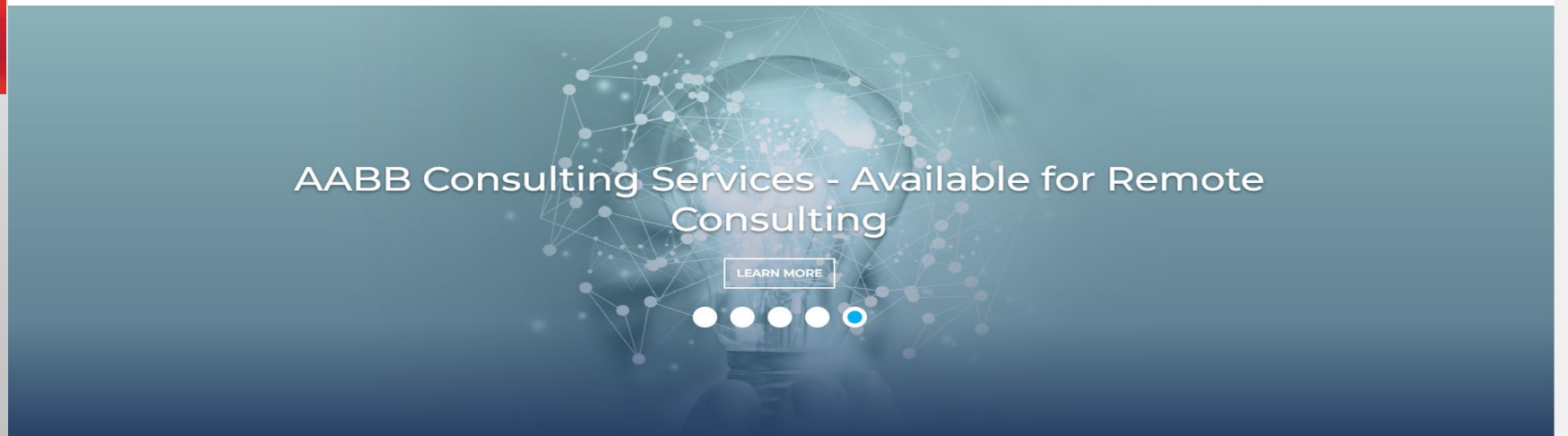
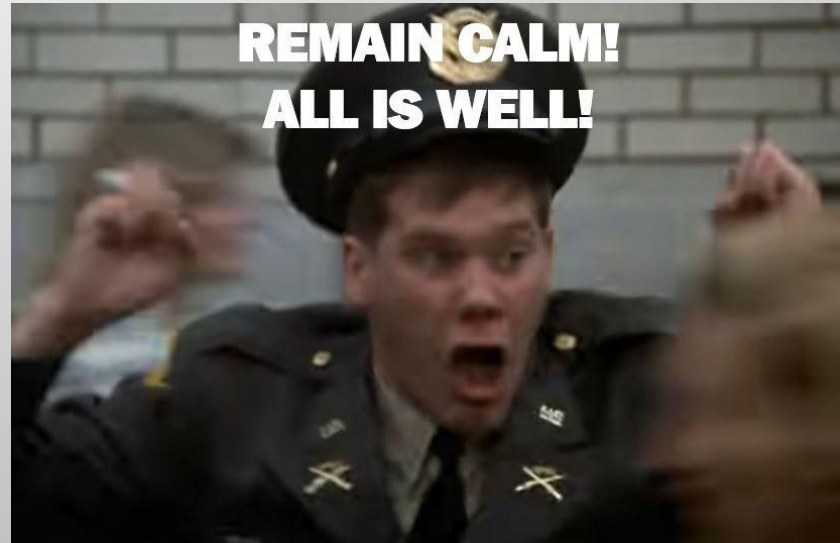


My consiglieres, Ms Edna Pasadilla, MT and Ms Maria Courriveau, MT (aka Tom Hagen)

- “I ALWAYS TELL PEOPLE IN LABS WHERE I WORK, THAT THE WORK OF MASSIVE TRANSFUSION IS LARGELY DONE—-AND THIS MIGHT BE OVER SIMPLIFYING —-BUT THE WORK IS LARGELY DONE, THE GROUND WORK HAS TO BE DONE WAY BEFORE IT HAPPENS. BECAUSE IF YOU’RE TRYING TO FIGURE OUT THE PROCESS WHILE IT’S OCCURRING, YOU'RE DEAD!”
  - DR. JOE CHAFFIN

MASSIVE TRANSFUSION BACKGROUND (WHO, WHAT, WHERE, WHEN, WHY, AND HOW)

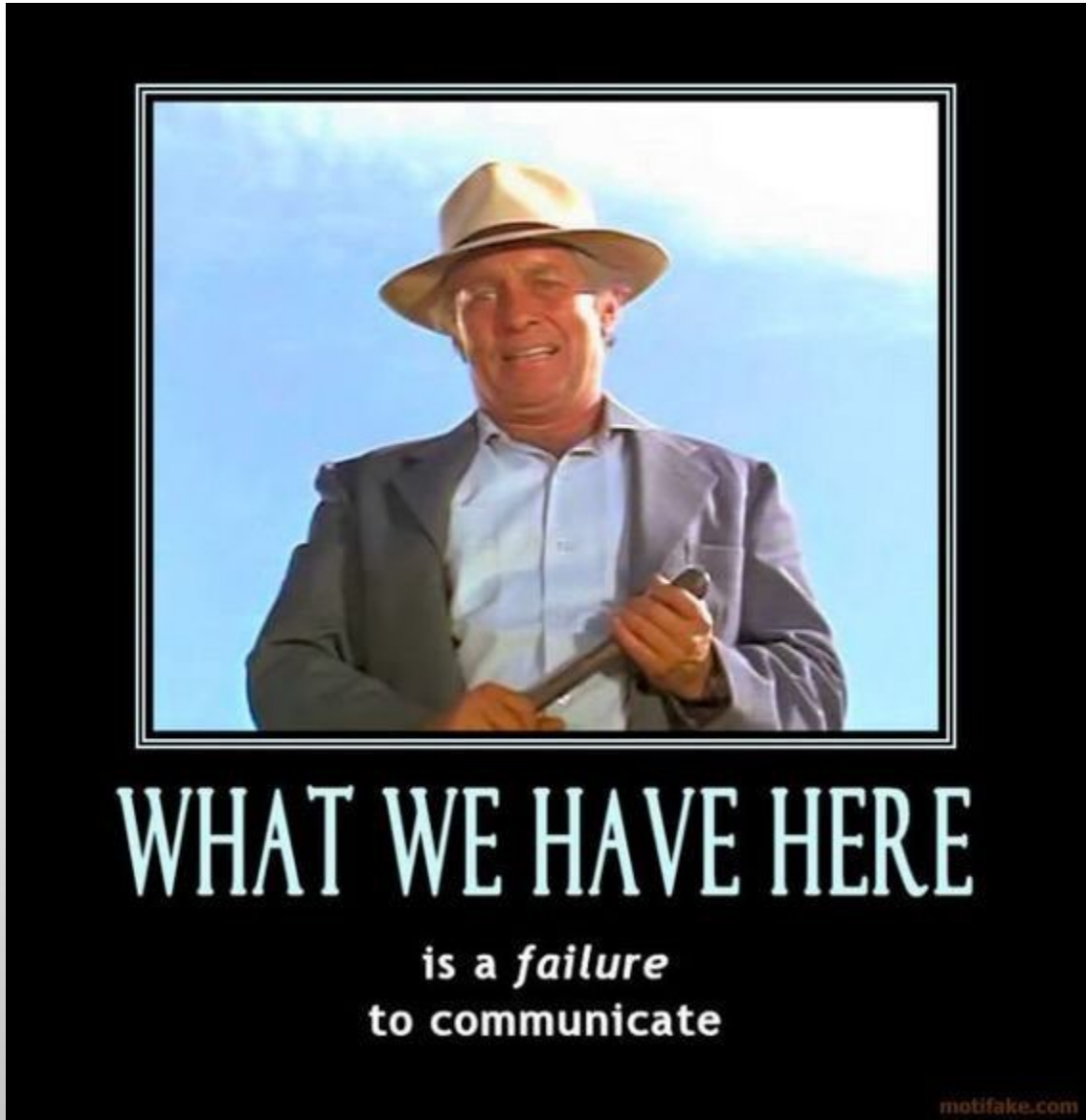
- WHO? MASSIVE TRANSFUSION OFTEN TRAUMA PATIENTS (OB MATERNAL HEMORRHAGE OR ANY EXSANGUINATING BLEEDING—GI BLEED) WHO RECEIVE 10 OR MORE UNITS OF PRBCS OVER 24 HOURS; **OR** MORE THAN FOUR UNITS OVER 1 HOUR; **OR** GREATER THAN 50% BV IN 3 HOURS.
  - THESE ARE SOMETIMES AND OBVIOUSLY RETROSPECTIVE CRITERIA.
- STRESSFUL SITUATION.



SUMMARY

- PATIENTS WHO MEET MASSIVE TRANSFUSION CRITERIA, THESE CRITERIA HAVE BEEN VARIOUSLY DEFINED, BUT THE COMMON DEFINITION OUT THERE IS TEN UNITS OF RED CELLS IN 24 HOURS.
- MASSIVE TRANSFUSION IS NOT JUST FOR TRAUMA PATIENTS ANYMORE. IT'S NOW COMMONLY BEING APPLIED TO OB PATIENTS AND OTHER PATIENTS AROUND THE HOSPITAL WITH EXSANGUINATING BLEEDS AND MAY BENEFIT FROM THIS AS WELL.
- A RECENT RANDOMIZED CONTROLLED TRIAL OF 1:1:1 VS 2:1:1 FOUND NO DIFFERENCE IN 24 HOURS OR 30 DAY MORTALITY BETWEEN THESE TWO DIFFERENT RATIOS.
- TIMING AND COMMUNICATION ARE CRITICAL DURING MASSIVE TRANSFUSION. TELL US WHERE THE PATIENT IS, AND WHERE YOU NEED THE BLOOD, AND IF YOU NEED ANOTHER ROUND OF MASSIVE TRANSFUSION PRODUCT.
- ONE OF THE EMERGING THINGS IS THAT GROUP A PLASMA APPEARS TO BE SUPPLANTING AB AS UNIVERSAL DONOR PLASMA, AS DEMONSTRATED IN THE BEST COLLABORATIVE REPORT, BUT FURTHER RESEARCH OBVIOUSLY IS NEEDED REGARDING THE OVERALL SAFETY AND EFFICACY OF THAT APPROACH.


CAN'T BE BAD AT COMMUNICATION
IF WE NEVER COMMUNICATE AT ALL


WHAT WE HAVE HERE
is a *failure*
to communicate
motifake.com


COMMUNICATION
THE KEY IS
memegenerator.net

ABC SCORE

- PENETRATING MECHANISM - YES OR NO
- SYSTOLIC BLOOD PRESSURE OF 90 MM OR LESS
- HEART RATE 120 OR GREATER
- FOCUS ASSESSMENT WITH STENOGRAPHY FOR TRAUMA SCAN OR FAST SCAN BEING POSITIVE
- SCORES OF 2 OR HIGHER WERE FOUND TO ACCURATELY PREDICT THOSE WHO WENT ON TO HAVE A SUBSEQUENT NEED FOR MASSIVE TRANSFUSION. THE SENSITIVITY AND SPECIFICITY WERE AROUND 75 AND 86%. SO THAT'S A NICE QUICK WAY TO PREDICT WHO'S GOING ON TO GET MASSIVE TRANSFUSION

Early Prediction of Massive Transfusion in Trauma: Simple as ABC (Assessment of Blood Consumption)?

Timothy C. Nunez, MD, Igor V. Voskresensky, MD, Lesly A. Dossett, MD, MPH, Ricky Shinall, BS, William D. Dutton, MD, and Bryan A. Cotton, MD

Background: Massive transfusion (MT) occurs in about 3% of civilian and 8% of military trauma patients. Although many centers have implemented MT protocols, most do not have a standardized initiation policy. The purpose of this study was to validate previously described MT scoring systems and compare these to a simplified nonlaboratory dependent scoring system (Assessment of Blood Consumption [ABC] score).

Methods: Retrospective cohort of all level 1 adult trauma patients transported directly from the scene (July 2005 to June 2006). Trauma-Associated Severe Hemorrhage (TASH) and McLaughlin scores calculated according to published methods. ABC score was assigned based on four nonweighted parameters: penetrating mechanism, positive focused assessment sonography for trauma, arrival systolic blood pressure of 90 mm Hg or less, and arrival heart rate ≥120 bpm. Area under the receiver operating characteristic curve (AUROC) used to compare scoring systems.

Results: Five hundred ninety-six patients were available for analysis; and the overall MT rate of 12.4%. Patients receiving MT had higher TASH (median, 6 vs. 13; $p < 0.001$), McLaughlin (median, 2.4 vs. 3.4; $p < 0.001$) and ABC (median, 1 vs. 2; $p < 0.001$) scores. TASH (AUROC = 0.842), McLaughlin (AUROC = 0.846), and ABC (AUROC = 0.842) scores were all good predictors of MT, and the difference between the scores was not statistically significant. ABC score of 2 or greater was 75% sensitive and 86% specific for predicting MT (correctly classified 85%).

Conclusions: The ABC score, which uses nonlaboratory, nonweighted parameters, is a simple and accurate in identifying patients who will require MT as compared with those previously published scores.

Key Words: Hemorrhage, Trauma, Massive transfusion, Prediction, Scoring systems.

J Trauma. 2009;66:346–352.

Table 1 Demographic and Clinical Characteristics of Patients by MT Status

	No MT (n = 510)	MT (n = 76)	p
Age (yr)	48 ± 24	40 ± 18	0.06
Males, n (%)	357 (69)	54 (73)	0.43
Blunt mechanism, n (%)	432 (83)	53 (72)	0.02
ISS, median (25th, 75th IQR)	22 (10, 34)	34 (22, 41)	<0.001
ED systolic blood pressure (mm Hg), mean ± SD	121 ± 33	89 ± 34	<0.001
ED heart rate (beats/min), mean ± SD	95 ± 26	111 ± 28	<0.001
ED GCS, mean ± SD	11.5 ± 5.1	9.0 ± 5.5	<0.001
TASH, mean ± SD	6.3 ± 4.4	13.4 ± 5.6	<0.001
Mortality, n (%)	75 (14%)	33 (45%)	<0.001

MT, massive transfusion; ISS, injury severity scores; IQR, interquartile range; ED, emergency department; SD, standard deviation; GCS, Glasgow coma scale; TASH, Trauma Associated Severity of Hemorrhage.

Assessment of Blood Consumption(ABC)			
	No	Yes	OR for Predicting MT
Penetrating Mechanism	0	1	1.9
SBP ≤ 90	0	1	13.0
HR ≥ 120	0	1	3.9
+ FAST	0	1	8.2

ABC	Sens	Spec	Correctly Classified
≥ 0	100%	0%	13%
≥ 1	95%	55%	61%
≥ 2	75%	86%	84%
≥ 3	25%	97%	87%
≥ 4	6%	100%	88%

J Trauma. 2009 Feb;66(2):346-52. doi: 10.1097/TA.0b013e3181961c35.

Early prediction of massive transfusion in trauma: simple as ABC (assessment of blood consumption)?

Timothy C Nunez [1], Igor V Voskresensky, Lesly A Dossett, Ricky Shinall, William D Dutton, Bryan A Cotton

Affiliations + expand

PMID: 19204506 DOI: 10.1097/TA.0b013e3181961c35

Abstract

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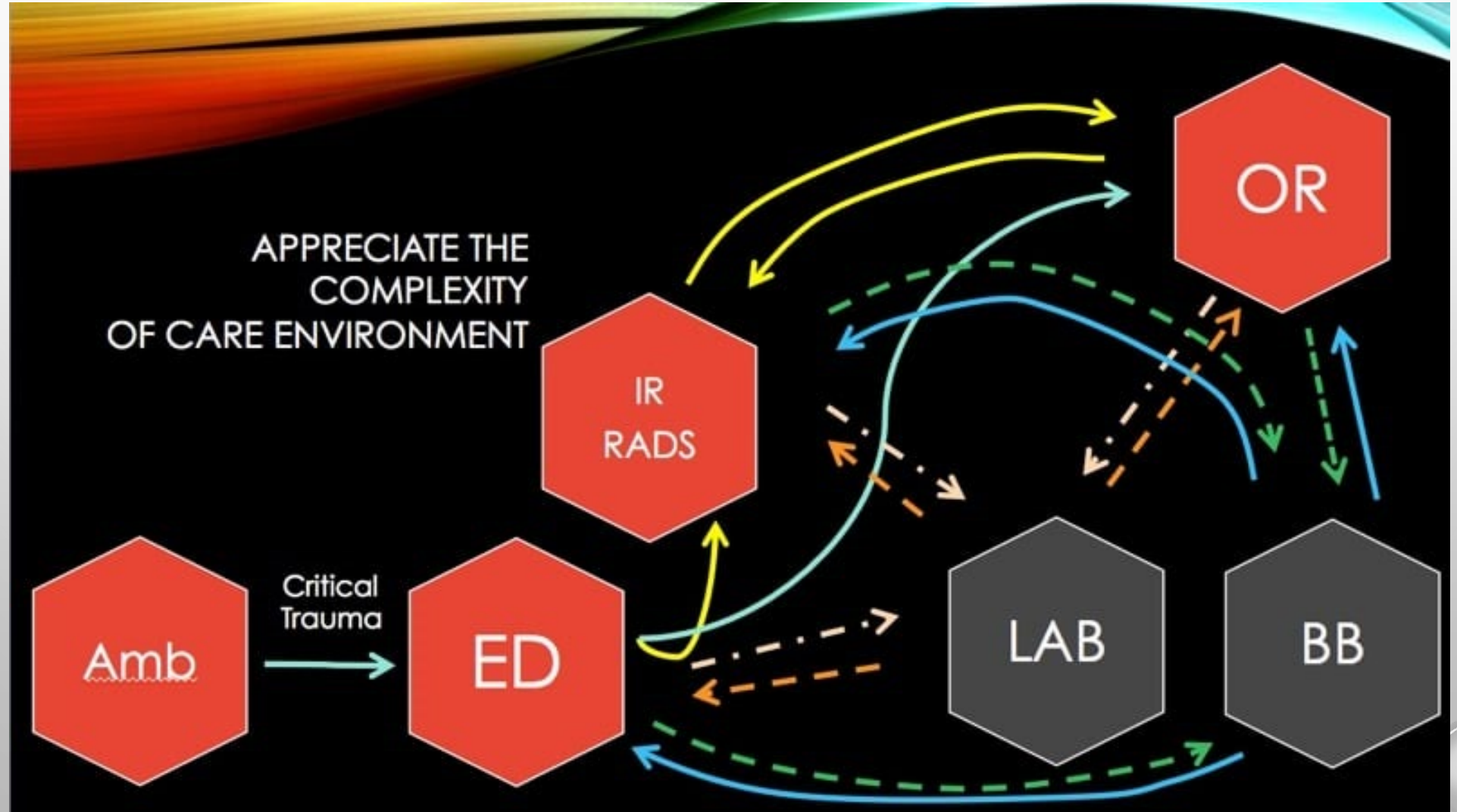
- MTP IS ACTIVATED BY SURGEON, PHYSICIAN, ANESTHESIOLOGIST, OR ED PHYSICIAN. FOR INSTANCES IN WHICH THE PROVIDER IS UNABLE TO SPEAK DIRECTLY TO BLOOD BANK, A VERBAL ORDER CAN BE GIVEN TO A REGISTERED NURSE.
- OVERHEAD PAGE: “ATTENTION, ATTENTION, MASSIVE TRANSFUSION PROTOCOL TO (LOCATION)” THREE TIMES; BLOOD BANK AND HOUSE OFFICER.

Dotted lines-Specimens
Solid lines-Blood products

WHO AND WHERE? (COMPLEXITY AND COMMUNICATION BETWEEN STAKEHOLDERS)



WHAT?

- FIXED RATIO TRANSFUSION (RBC:PLASMA:PLTS)

DEFINE HIGH RATIO TRANSFUSION

"6:4:1" or "6:6:1"

	FRBC	FFP	Platelet	Cryoprecipitate
1ST MTP Pack	4	6	1	Provider will indicate when to thaw. Cryoprecipitate comes in a pool of 5
2nd MTP Pack	6	6	0	
3rd MTP Pack	6	6	1	
4th MTP Pack	6	6	0	

- “OK, THIS PATIENT MERITS MASSIVE TRANSFUSION.” THEY CALL THE BLOOD BANK AND SAY, “WE’RE ACTIVATING MASSIVE TRANSFUSION PROTOCOL. SEND US THE FIRST ROUND OF PRODUCT.” WE SEND THE WHOLE “6:6:1 PACK” DOWN TO WHEREVER THEY ARE. THEY TRANSFUSE THE WHOLE PACK—-EVERYTHING, AND THEN THEY REEVALUATE AND SAY, “YOU KNOW WHAT? WE NEED ANOTHER ONE.” SO THEY CALL US BACK, REQUEST ANOTHER. WE SEND IT. IN THE MEANTIME, YOU SEND IT AND, THE BLOOD BANK, BECAUSE NOW YOU’RE ON MASSIVE TRANSFUSION PROTOCOL, IS NOW THAWING THE NEXT ROUND OF PLASMA, ALLOCATING THE NEXT APHERESIS PLATELET PACK, THEY’RE PREPARING THE NEXT RED CELL UNITS AND LABELING, DOING ALL THAT STUFF SO IT’S READY TO GO AS SOON AS WE GET THE WORD FROM THE TEAM.

The Journal of TRAUMA® Injury, Infection, and Critical Care

The Ratio of Blood Products Transfused Affects Mortality in Patients Receiving Massive Transfusions at a Combat Support Hospital

Matthew A. Borgman, MD, Philip C. Spinella, MD, Jeremy G. Perkins, MD, Kurt W. Grathwohl, MD, Thomas Repine, MD, Alec C. Beekley, MD, James Sebesta, MD, Donald Jenkins, MD, Charles E. Wade, PhD, and John B. Holcomb, MD

Background: Patients with severe traumatic injuries often present with coagulopathy and require massive transfusion. The risk of death from hemorrhagic shock increases in this population. To treat the coagulopathy of trauma, some have suggested early, aggressive correction using a 1:1 ratio of plasma to red blood cell (RBC) units.

Methods: We performed a retrospective chart review of 246 patients at a US Army combat support hospital, each of who received a massive transfusion (≥10 units of RBCs in 24 hours). Three groups of patients were constructed according to the plasma to RBC ratio transfused during massive transfusion. Mortality rates and the cause of death were compared among groups.

Results: For the low ratio group the plasma to RBC median ratio was 1:8 (interquartile range, 0:12–1:5), for the medium ratio group, 1:2.5 (interquartile range, 1:3.0–1:2.3), and for the high ratio group, 1:1.4 (interquartile range, 1:1.7–1:1.2) ($p < 0.001$). Median Injury Severity Score (ISS) was 18 for all groups (interquartile range, 14–25). For low, medium, and high plasma to RBC ratios, overall mortality rates were 65%, 34%, and 19%, ($p < 0.001$); and hemorrhage mortality rates were 92.5%, 78%, and 37%, respectively, ($p < 0.001$). Upon logistic regression, plasma to RBC ratio was independently associated with survival (odds ratio 8.6, 95% confidence interval 2.1–35.2).

Conclusions: In patients with combat-related trauma requiring massive transfusion, a high 1:1.4 plasma to RBC ratio is independently associated with improved survival to hospital discharge, primarily by decreasing death from hemorrhage. For practical purposes, massive transfusion protocols should utilize a 1:1 ratio of plasma to RBCs for all patients who are hypocoagulable with traumatic injuries.

Key Words: Blood components, Fresh frozen plasma, Trauma, Coagulopathy.

J Trauma. 2007;63:805–813.

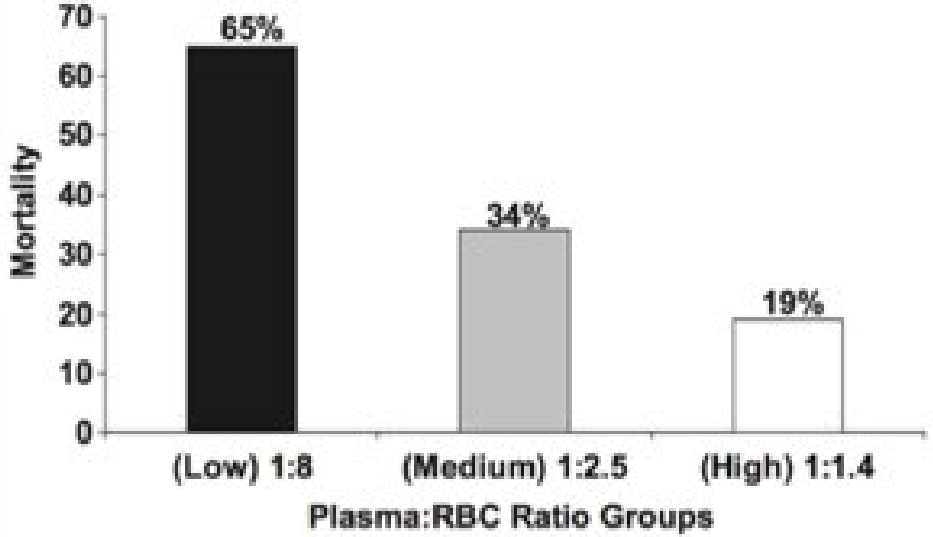


Fig. 1. *Percentage mortality associated with low, medium, and high plasma to RBC ratios transfused at admission. Ratios are median ratios per group and include units of fresh whole blood counted both as plasma and RBCs.*

Table 1 Descriptive Statistics for Each Plasma to RBC Ratio Group

Variable Median (IQR)	Low Ratio Group,* n = 31 1:8 (0:12–1:5)	Medium Ratio Group, n = 53 1:2.5 (1:3.0–1:2.3)	High Ratio Group, n = 162 1:1.4 (1:1.7–1:1.2)
ISS†	18 (16–25)	17 (13–25)	18 (16–25)
ISS >25 (%)	23	21	22
AIS score (% 4 or 5)			
Head/neck	16	6	10
Face	0	0	0.6
Thorax§	26[a]	9[ab]	7[b]
Abdomen	26	23	27
Pelvis/extremity	19	23	28
% penetrating trauma	94	92	95
% blunt trauma	6	8	5
INR, n = 212	1.78 (1.00–2.86), n = 21	1.57 (1.31–2.10), n = 42	1.54 (1.30–2.20), n = 149
Hgb,‡ n = 234	9.4 (7.1–11.1), n = 27[a]	10.8 (8.5–12.7), n = 48[ab]	10.9 (9.1–13.1), n = 159[b]
Plt concentration, n = 174	225 (120–281), n = 14	177 (128–241), n = 33	218 (154–278), n = 127
Base deficit, n = 201	13 (4–14), n = 22	9 (3–14), n = 42	8 (4–13), n = 137
Temperature (°F), n = 195	97 (94.9–97.6), n = 18	96.2 (94.1–98.0), n = 45	95.9 (94.0–97.3), n = 132
Heart rate, n = 233	122 (97–149), n = 29	118 (104–133), n = 51	111 (90–128), n = 153
SBP, n = 231	90 (80–106), n = 29	98 (74–116), n = 49	97 (80–122), n = 153

Hemorrhage (%)	92.5%	78%	37%
Sepsis (%)	5	6	19
MOF (%)	0	11	13
Airway/Breathing (%)	0	6	8
Time to Death (hrs)	2 (1-4)	4 (2-16)	38 (4-155)

WHEN AND WHY?

- EARLIER TRANSFUSION WITH HIGHER BLOOD PRODUCT RATIOS (PLASMA, PLATELETS, AND RED BLOOD CELLS), DEFINED AS DAMAGE CONTROL RESUSCITATION, HAS BEEN ASSOCIATED WITH IMPROVED OUTCOMES.

Transfusion of Plasma, Platelets, and Red Blood Cells in a 1:1:1 vs a 1:1:2 Ratio and Mortality in Patients With Severe Trauma The PROPPR Randomized Clinical Trial

JAMA. 2015;313(5):471-482. doi:10.1001/jama.2015.12

John B. Holcomb, MD; Barbara C. Tilley, PhD; Sarah Baraniuk, PhD; Erin E. Fox, PhD; Charles E. Wade, PhD; Jeannette M. Podbielski, RN; Deborah J. del Junco, PhD; Karen J. Brasel, MD, MPH; Eileen M. Bulger, MD; Rachael A. Callcut, MD, MSPH; Mitchell Jay Cohen, MD; Bryan A. Cotton, MD, MPH; Timothy C. Fabian, MD; Kenji Inaba, MD; Jeffrey D. Kerby, MD, PhD; Peter Muskat, MD; Terence O'Keeffe, MBChB, MSPH; Sandro Rizoli, MD, PhD; Bryce R. H. Robinson, MD; Thomas M. Scalea, MD; Martin A. Schreiber, MS; Deborah M. Stein, MD; Jordan A. Weinberg, MD; Jeannie L. Callum, MD; John R. Hess, MD, MPH; Nena Matijevic, PhD; Christopher N. Miller, MD; Jean-Francois Pittet, MD; David B. Hoyt, MD; Gail D. Pearson, MD, ScD; Brian Leroux, PhD; Gerald van Belle, PhD; for the PROPPR Study Group

ACM-ALL-CAUSE MORTALITY
PROPPR-PRAGMATIC, RANDOMIZED OPTIMAL PLATELET AND PLASMA RATIOS
Plasma, platelets, and red blood cells

Eligible
- Highest Trauma Level Activation
- Received directly from injury scene
- ABC score ≥ 2

Excluded
- Devastating injuries and expected to die within 1 hour of admission
- Thoracotomy prior to receiving blood products
- Burns >20% TBSA

R

FFP:Plt:RBC	ACM 24 hours	ACM 30 days
1:1:1 (n=338)	12.7%	22.4%
1:1:2 (n=342)	17.0%	26.1%
	-4.2% [-9.6, 1.1] P=0.12	-3.7% [-10.2, 2.7] P=0.26

Sample size of 580 was planned to detect a clinically meaningful 10% difference in 24 hour mortality (11% vs 21%) and 12% difference in 30 day mortality (23% vs 35%). Increase in sample size to 680 provided the PROPPR trial with 95% power to detect the prespecified 10% difference at 24 hours and 92% power to detected the prespecified 12% difference at 30 days, if such differences existed.

ONLINE FIRST

The Prospective, Observational, Multicenter, Major Trauma Transfusion (PROMMTT) Study

Comparative Effectiveness of a Time-Varying Treatment With Competing Risks

John B. Holcomb, MD; Deborah J. del Junco, PhD; Erin E. Fox, PhD; Charles E. Wade, PhD; Mitchell J. Cohen, MD; Martin A. Schreiber, MD; Louis H. Alarcon, MD; Yu Bai, MD, PhD; Karen J. Brasel, MD, MPH; Eileen M. Bulger, MD; Bryan A. Cotton, MD, MPH; Nena Matijevic, PhD; Peter Muskat, MD; John G. Myers, MD; Herb A. Phelan, MD, MSCS; Christopher E. White, MD; Jiajie Zhang, PhD; Mohammad H. Rahbar, PhD; for the PROMMTT Study Group

- **Multicenter, observational, cohort study**
  - All centers followed their own Massive Transfusion Protocols

- **Population**
  - >16 y/o, non-pregnant trauma patient,
  - ≥1 RBC unit within 6 hours of admission (n=1245, original study group – mortality 21%) and
  - ≥ 3 units (of RBC, plasma, or platelets) within 24 hours (n=905, analysis cohort – mortality 25%)

- **Primary Outcome: In hospital mortality**
  - Follow up time at risk of death began at minute 31 or start of 3rd overall unit

  - Cumulative ratios of plasma:RBC and platelets:RBC computed at baseline and for up to 14 consecutive time intervals:
    - 1) Two 15 minute intervals between minute 31 and hour 1
    - 2) Ten 30 minute intervals between more than 1 and 6 hours
    - 3) One 18 hour interval between more than 6 and 24 hours
      - 94% of hemorrhagic deaths occurred by 24 hours; of these 60% occurred by hour 3 with median time to Hemorrhagic Death = 2.6 hrs (IQR 1.7-5.4 hours)
    - 4) One 29 day interval between more than 24 hours and 30 days
      - (principle causes of death in this timeframe were multiple organ failure and brain injury

SUMMARY

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- MASSIVE TRANSFUSION IS NOT JUST FOR TRAUMA PATIENTS ANYMORE, AS WE DISCUSSED, IT'S NOW COMMONLY BEING APPLIED TO OB PATIENTS AND OTHER PATIENTS AROUND THE HOSPITAL WITH EXSANGUINATING BLEEDS MAY BENEFIT FROM THIS AS WELL.
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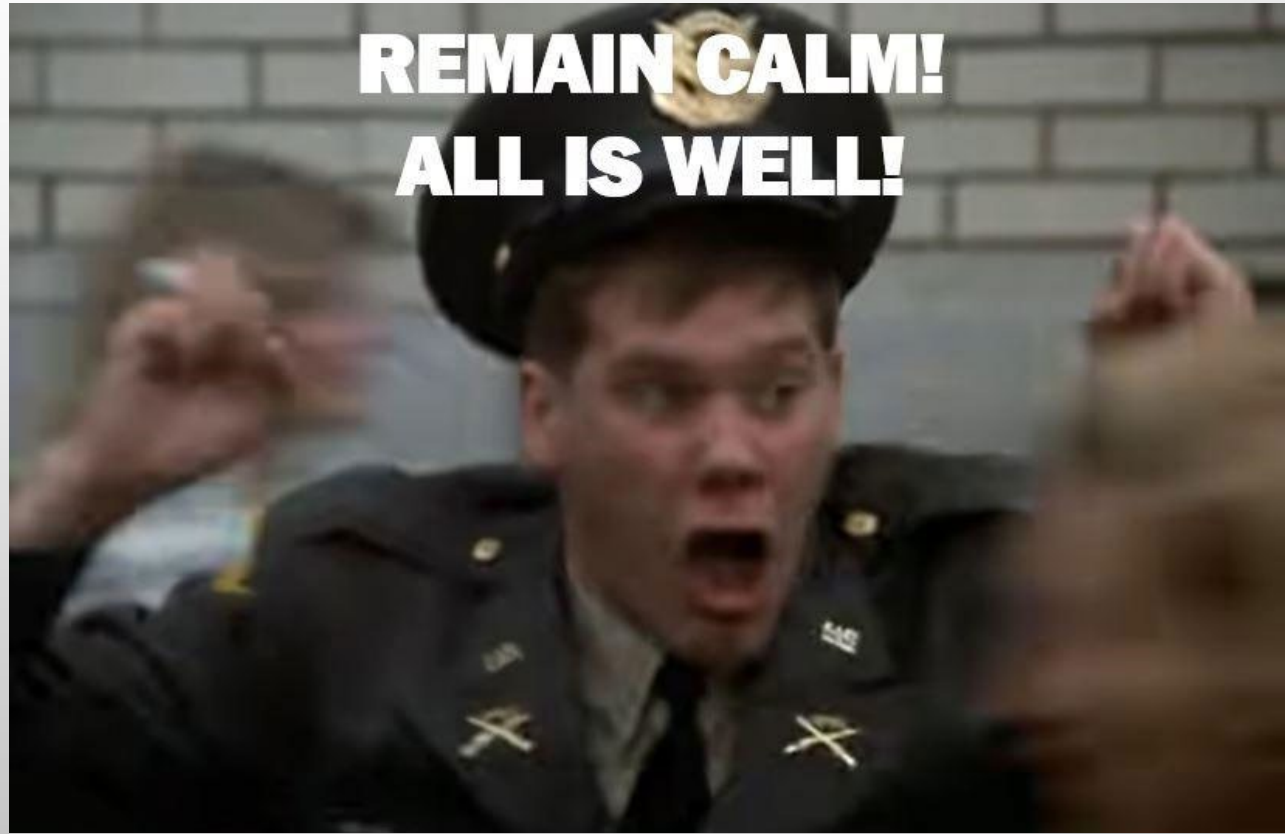
MASSIVE TRANSFUSION REQUESTED

- **REMEMBER TO STAY CALM AND THAT YOU ARE NOT ALONE.**



I AM BEING CALLED ABOUT A MASSIVE TRANSFUSION, WHAT TO I DO?

- POSSIBLE MASSIVE
- MASSIVE TRANSFUSION REQUESTED

POSSIBLE MASSIVE

- POSSIBLE MASSIVE COMES AS A RESULT OF CRITERIA GIVEN TO THE TECH TO CALL THE PATHOLOGIST.
- I.E. THE PATIENT HAS RECEIVED X AMOUNT OF RED BLOOD CELLS, PLASMA, PLATELETS CRYO.

POSSIBLE MASSIVE

- ASK FOR ALL THE BLOOD PRODUCTS THAT HAVE BEEN GIVEN.
- MAKE SURE THEY ARE “ON TRACK” WITH A RATIO OF 6 RBC, 6 FFP, 1 DOSE OF CRYO AND 1 PLATELET.
  - EX. IF THEY HAVE RECEIVED ALL RED BLOOD CELLS AND NO FFP, CRYO OR PLATELET, YOU MAY CALL TO SUGGEST THESE PRODUCTS.
- CALL TO THE ORDERING CLINICIAN, IF ORDERING LOOKS APPROPRIATE IS NOT REQUIRED.

MASSIVE TRANSFUSION REQUESTED

- IF THE TECH CALLS TO NOTIFY THAT A MASSIVE TRANSFUSION HAS BEEN REQUESTED, INVOLVEMENT OF THE PATHOLOGIST IS REQUIRED.
- OBTAIN THE FOLLOWING INFORMATION FROM THE TECH:
  - NAME, DOB, AGE AND GENDER OF PATIENT.
  - INVENTORY OF O PRODUCTS (NEGATIVE AND POSITIVE) AND AB PLASMA.
  - WHETHER TESTING HAS BEEN PERFORMED ON NOT/BLOOD TYPE IF AVAILABLE.
  - LOCATION OF PATIENT, ORDERING PERSON IF KNOWN AND PHONE NUMBER.

MASSIVE TRANSFUSION REQUESTED

- CALL THE ORDERING CLINICIAN OR MEMBER OF THE TEAM AND OFFER TO AID WITH COMMUNICATION TO THE BLOOD BANK.
- LET THEM KNOW THAT THE PRODUCTS WILL BE UNCROSSMATCHED O NEGATIVE RED BLOOD CELLS AND AB NEGATIVE PLASMA.
  - IF THEY CHOOSE NOT TO RECEIVE UNCROSSMATCHED PRODUCTS, LET THEM KNOW THAT THEY WILL NEED TO PUT IN AN ORDER FOR QUANTITY OF TYPES OF PRODUCTS DESIRED AND THAT A READ-BACK WILL BE REQUIRED.
  - IF THEY ASK HOW LONG IT WILL TAKE TO RECEIVE CROSSMATCHED PRODUCTS, THIS WILL DEPEND ON WHETHER A TYPE AND RE-TYPE IS COMPLETED.
    - IF COMPLETE, APPROXIMATELY 20 MINUTES.
    - IF INCOMPLETE, AT LEAST 1 HOUR FOR TESTING AND ISSUING BLOOD.

MASSIVE TRANSFUSION REQUESTED

- REMIND THEM THAT THEY WILL CONTINUE TO RECEIVE BLOOD PRODUCTS IN THE FOLLOWING RATIO UNTIL THEY TELL UP TO STOP: 6 UNITS RBC, 6 UNITS FFP, 1 DOSE CRYO, 1 APHERESIS PLATELET.
- REMIND THEM TO LET THE BLOOD BANK KNOW WHEN THEY WOULD LIKE TO DISCONTINUE THE MASSIVE TRANSFUSION PROTOCOL.
- CALL THE BLOOD BANK TECH BACK REGARDLESS TO LET THEM KNOW OF THE RESULT OF THE CONVERSATION.
- ASSESS INVENTORY AND DETERMINE WHETHER ADDITIONAL PRODUCTS NEED TO BE ORDERED OR REQUESTED FROM ANOTHER HOSPITAL.

BLOOD MANAGEMENT OF THE SICKLE CELL PATIENT

- WORLDWIDE DISEASE ORIGINATING FROM SUB-SAHARAN
- 100K PTS IN THE US WITH SS DZ (HOMOZYGOUS SS OR S BETA THAL)
- SICKLING MOST NOTABLY CAUSES MICROINFARCTS/VASO-OCCLUSION (LUNG, SPLEEN, JOINTS, AND CNS—10% OF CHILDREN PRESENT WITH STROKES)
- NO DEFINITIVE CURE AT THIS TIME (GENE THERAPY? AND BMT)
- TRANSFUSION DEPENDENT WITH ISSUES OF IRON OVERLOAD (HEART, LIVER, BM DEPOSITION)

WHY ARE SS DZ PTS SO DIFFICULT TO TREAT?

- ALLOIMMUNIZATION, ALLOIMMUNIZATION, ALLOIMMUNIZATION FROM CHRONIC TRANSFUSIONS DUE TO LARGELY RH (D, C, AND E) AND BIG K (KELL) ANTIGENS
  - 30% OF SS DZ PATIENTS WILL HAVE A POSITIVE AB SCREEN COMPARED TO GENERAL POPULATION (10%)
- RISK FOR DHTR DUE TO THESE ANTIBODIES
- HYDROXYUREA TO INCREASE HG F (FETAL HEMOGLOBIN)
- BLOOD HYPERVISCOSITY; DON'T OVER-TRANSFUSE

ALLOIMMUNIZATION

- RH, KELL KIDD, DUFFY
  - ANTIBODIES FORM AND FUTURE TRANSFUSIONS NEED TO BE NEGATIVE FOR THE ANTIGEN TO PREVENT A DELAYED HTR OR IMMEDIATE HTR
  - THIS IS NOT TRUE FOR ALL SS PATIENTS
  - PHENOTYPING IS CRITICAL FOR FUTURE TRANSFUSIONS
- BEST DONORS ARE OTHER AFRICAN AMERICANS AS MANY OF THE AFRICAN AMERICAN POPULATIONS HAVE SIMILAR RH, KELL, KIDD, AND DUFFY ANTIGENS

EVIDENCE REPORT

Evidence-Based Management of Sickle Cell Disease

Expert Panel Report, 2014

U.S. Department of Health and Human Services
National Institutes of Health

CLINICAL GUIDELINES

blood advances

American Society of Hematology 2020 guidelines for sickle cell disease: transfusion support

Prophylactic red cell antigen matching

RECOMMENDATION 2. The ASH guideline panel *recommends* prophylactic red cell antigen matching for Rh (C, E or C/c, E/e) and K antigens over only ABO/RhD matching for patients with SCD (all genotypes) receiving transfusions (strong recommendation based on moderate certainty in the evidence about effects ⊕⊕⊕◯).

Remarks:

- The extended red cell antigen profile may be determined by genotype or serology.
- Extended red cell antigen matching (Jk^a/Jk^b, Fy^a/Fy^b, S/s) may provide further protection from alloimmunization.
- Patients who have a GATA mutation in the *ACKR1* gene, which encodes Fy antigens, are not at risk for anti-Fy^b and do not require Fy^b negative red cells.
- Patients identified by genotype with the hybrid *RHD*DIIIa-CE (4-7)-D* or *RHCE*CeRN* alleles, which encode partial C antigen, and no conventional *RHCE*Ce* or **CE* allele should be transfused with C-negative red cells to prevent allo-anti-C development.

Strong recommendation

- For patients: most individuals in this situation would want the recommended course of action; only a small proportion would not.
- For clinicians: most individuals should follow the recommended course of action. Formal decision aids are not likely to be needed to help individual patients make decisions consistent with their values and preferences.
- For policy makers: the recommendation can be adopted as policy in most situations. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator.
- For researchers: the recommendation is supported by credible research or other convincing judgments that make additional research unlikely to alter the recommendation. On occasion, a strong recommendation is based on low or very low certainty of the evidence. In such instances, further research may provide important information that alters the recommendations.

Sickle cell disease: when and how to transfuse

Jo Howard

Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom; and King's College London, United Kingdom

How to transfuse

Transfusions can be administered as a simple transfusion or as an exchange transfusion (Table 1). The aims of transfusion in SCD are both to increase oxygen-carrying capacity and to decrease the proportion of sickle hemoglobin (HbS) relative to hemoglobin A (HbA) to prevent or reverse the complications of vaso-occlusion. In the acute situation, simple transfusion will increase oxygen-carrying capacity but with a risk of hyperviscosity if the Hb is increased to significantly over the patient's baseline. Therefore, the target Hb should be 10 g/dL in patients with homozygous HbS (HbSS).[13] Exchange transfusion has the advantage of both increasing oxygen-carrying capacity and reducing HbS%. In patients on long-term transfusion, both repeated simple or exchange transfusion can maintain a low HbS%, and if HbS% is maintained below 30% to 40%, Hb can safely be maintained at a higher level with less risk of hyperviscosity. Simple transfusion is the most common method of transfusion used in chronic transfusion programs, particularly in children, but at the cost of high rates of iron loading. Most patients on long-term simple transfusion will need iron chelation therapy after approximately 1 year of transfusion, and lack of adherence to iron chelation will result in iron overload.

SO WHAT IS AN ESTABLISHED REASONABLE HGB TRANSFUSION TRIGGER?

A. 9 G/DL

B. 10 G/DL

C. 7 G/DL

D. 8 G/DL

E. 6 G/DL

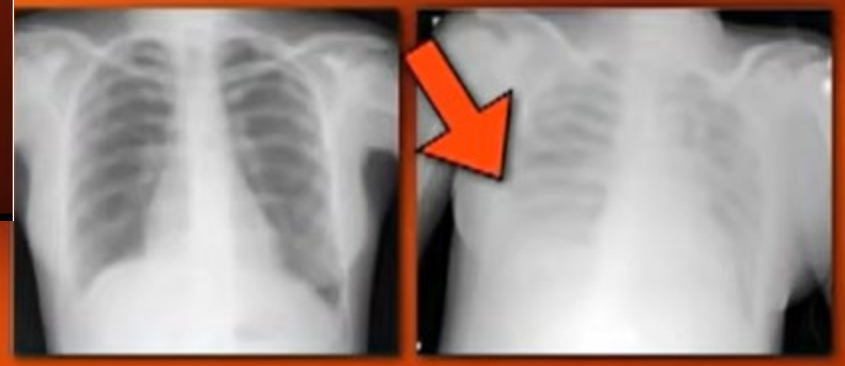
TRALI

- Standard Definition
  - NHLBI, Canadian Consensus Conf.
  - New ALI <6 hrs after transfusion
    - ALI: Hypoxemia ($PaO_2/FiO_2 \leq 300$ or O_2 sat <90%), bilateral CXR infiltrates
  - No other known risk factors for pulmonary edema

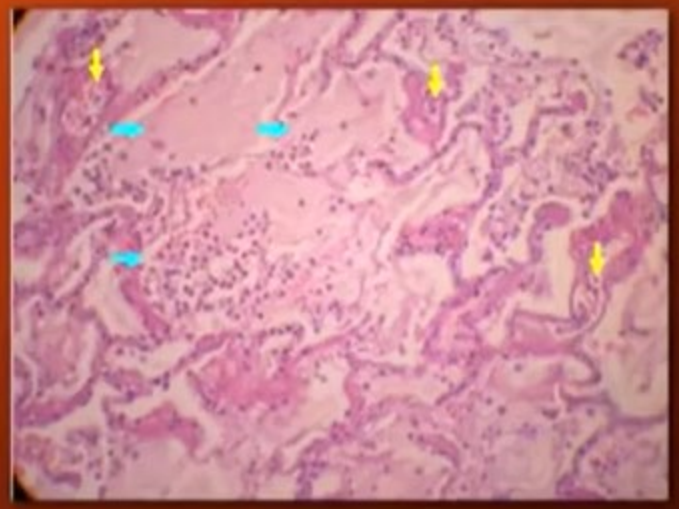
December 2012 www.bbguy.org

Pathophysiology is simply priming of neutrophils in the lung by usually anti-HLA and/or anti-neutrophil antibodies in the donor units. 30% of our body's neutrophils live in the lungs. Donor females pregnant and/or prior blood transfusion recipient donors.

TRALI



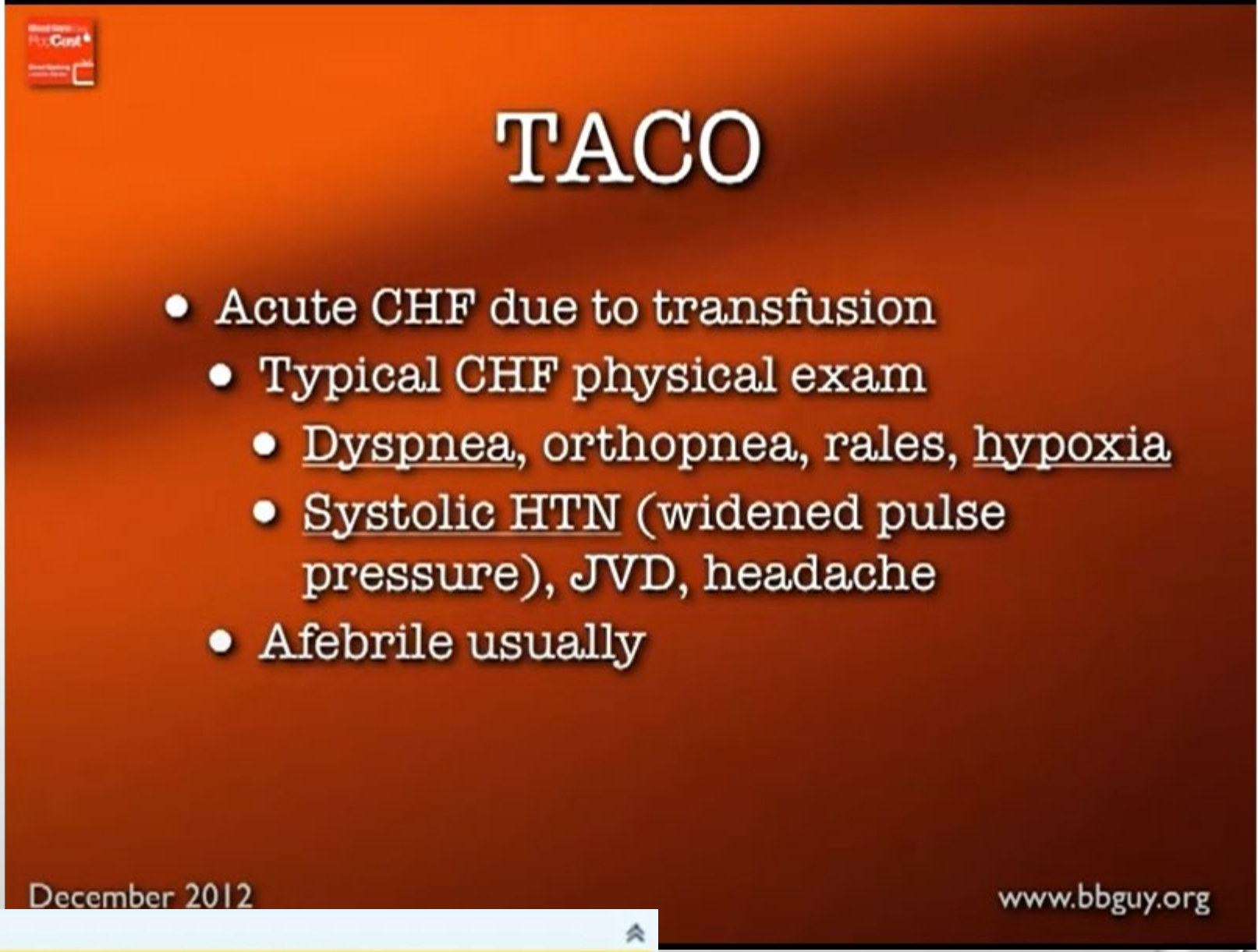
Pretransfusion Post-transfusion



Images courtesy of Dr. Chris Silliman

December 2012 www.bbguy.org

This is a transfusion reaction! Consider a pt with CHF or an old frail patient who comes in with chronic symptomatic anemia and you give he or she two or three units of pRBCs for an H/H of 6/18. What's gonna happen? Young and old; Renal failure.



Care Guidance (1)

The patient has a last measured hemoglobin result of ≥7 g/dL (or hematocrit ≥21%), or has had neither measured within the past 24 hours. In hospitalized, hemodynamically stable patients, a transfusion trigger of hemoglobin <7g/dL or hematocrit <21% decreases transfusion requirements and reduces adverse outcomes. If transfusion is required, single unit transfusion and clinical re-evaluation is recommended.

TACO VS. TRAIL (DIFFICULT)

TRANSFUSION ASSOCIATED CIRCULATORY OVERLOAD (TACO)

- AT RISK: CHF, VERY YOUNG/VERY OLD, RF, CHRONIC COMPENSATED ANEMIAS. "WHY DO 2 WHEN 1 WILL DO?" TRANSFUSE SLOW.
- NO FEVER; USUALLY.
- HYPERTENSION.
- ELEVATED BNP.
- DYSPNEA OFTEN OVER THE LENGTH OF THE TRANSFUSIONS.
- DIURETIC RESPONSIVE.
- TX: LIKE CHF; SLOW OR SPLIT TRANSFUSION.

TRANSFUSION-RELATED ACUTE LUNG INJURY (TRALI)

- FEVER.
- HYPOTENSION.
- ACUTE DYSPNEA.**
- DIURETIC UNRESPONSIVE.

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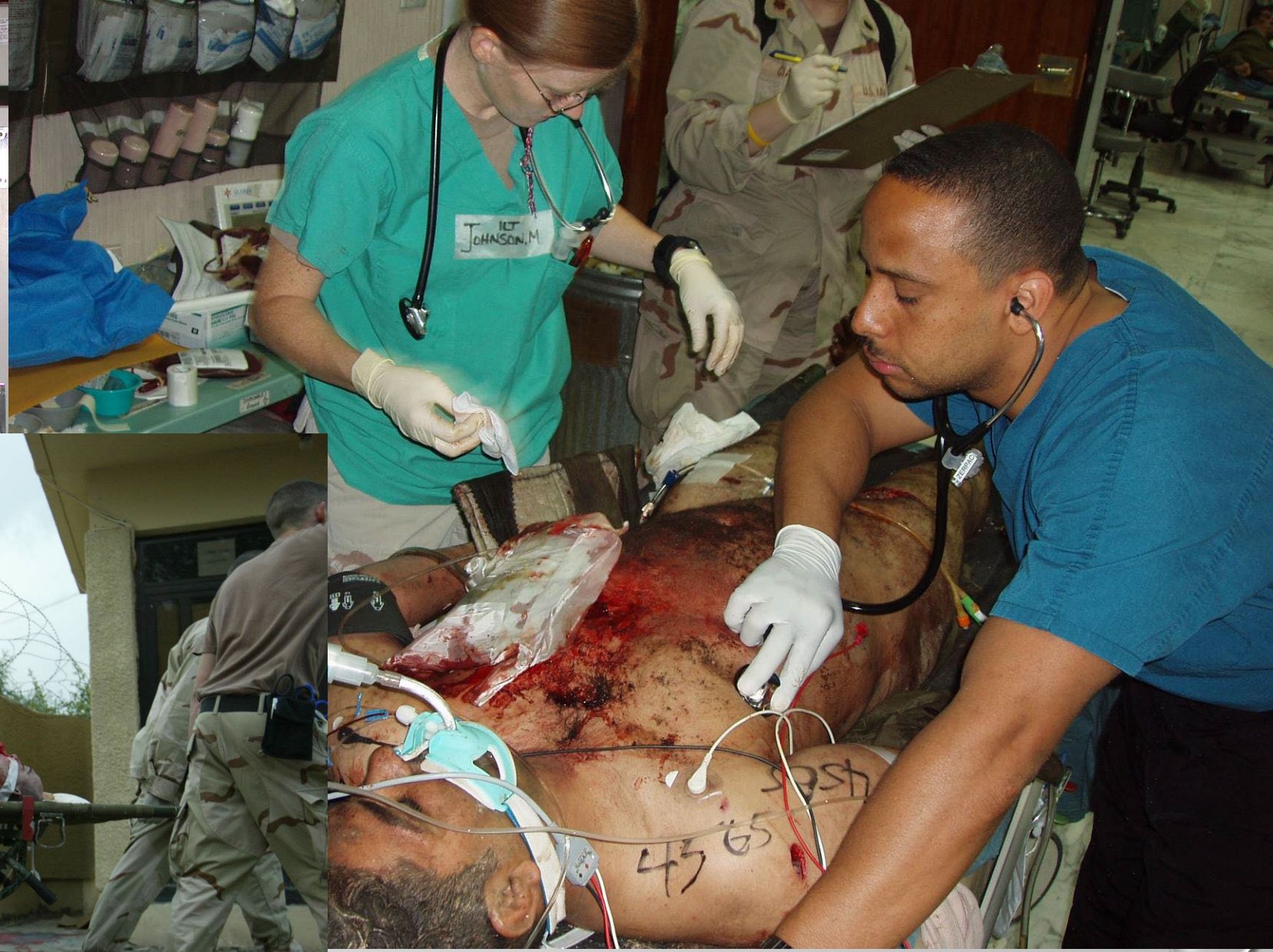
- CELL: 210-823-4500


CARPENTER
U.S.ARMY
FILLMAN
U.S.ARMY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JOHNSON,M

CRITICAL TRAUMA PATIENTS

- 19 JUN 2005 (FATHER'S DAY)
  - RIGHT LEG TRAUMATIC AMPUTATION FOLLOWING AN IED.
  - 203 BLOOD PRODUCTS.

EMT TRAUMAS

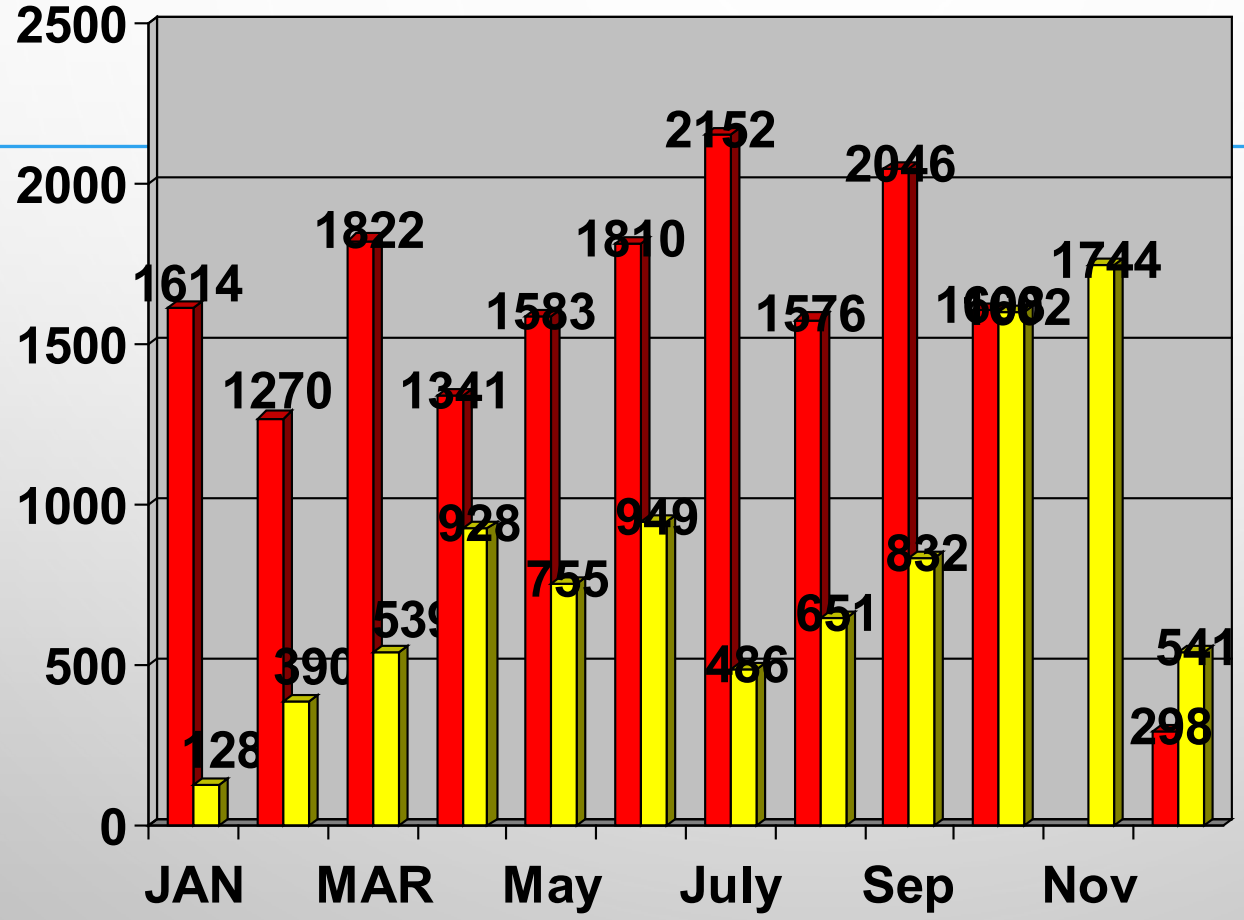
- Blood bank has 4 units of O Pos prepared to deliver to the ER for "Emergency Release"

- "Trauma Panel" for lab specimens

Medical Task Force 86

Units Transfused

As of 11 SEP 05



Total Transfused

86th CSH : 17,187

31st CSH : 9,711

The 86th CSH assumed blood operations on 24 Dec 04

CRITICAL TRAUMA PATIENTS

- 19 JUN 2005 (FATHER'S DAY)
  - RIGHT LEG TRAUMATIC AMPUTATION FOLLOWING AN IED.
  - 203 BLOOD PRODUCTS.

CRITICAL TRAUMA PATIENTS

- 7 SEP 05: IED, SHRAPNEL LEFT BUTTOCK, BACK, AND LEFT LOWER EXTREMITY
  - CRYO: 20 UNITS
  - FFP: 64 UNITS
  - PLT: 6 UNITS
  - RBC: 82 UNITS
  - WB: 35 UNITS
  - TOTAL: 207 UNITS OF BLOOD PRODUCTS
- SOLDIER IS FROM THE SAME MP UNIT WHO LOST A SOLDIER AT WRAMC AFTER RECEIVING 203 UNITS ON 19 JUN 05

https://thefallen.militarytimes.com/army-pfc-timothy-j-hines-jr/980492

MilitaryTimes

HONOR THE FALLEN

Honoring those who fought and died in Operation Enduring Freedom, Operation Iraqi Freedom and Operation New Dawn

HOME

NATO KOSOVO FORCE

OPERATION ALLIES REFUGE

OPERATION ENDURING FREEDOM

OPERATION FREEDOM'S SENTINEL

OPERATION INHERENT RESOLVE

OPERATION IRAQI FREEDOM

OPERATION NEW DAWN

OPERATION OCTAVE SHIELD

OPERATION ODYSSEY LIGHTNING

OPERATION SPARTAN SHIELD

TASK FORCE SINAI

U.S. AFRICA COMMAND OPERATIONS

SHARE

Army Pfc. Timothy J. Hines Jr.

Died July 14, 2005 Serving During Operation Iraqi Freedom

21, of Fairfield, Ohio; assigned to the 64th Military Police Company, 720th Military Police Battalion, 89th Military Police Brigade, Fort Hood, Texas; died July 14 at the Walter Reed Army Medical Center, Washington, D.C., of wounds sustained on June 19 when an improvised explosive device detonated near his Humvee in Baghdad.

Fort Hood soldier dies of Iraq wounds

Associated Press

A Fort Hood soldier has died of injuries from a bomb explosion last month in Baghdad, the Pentagon confirmed Sunday.

Pfc. Tim Hines, 21, of Fairfield, Ohio, died Thursday night at Walter Reed Army Medical Center in Washington. His grandmother, Florence Thomas, said Friday that his wife, mother and other family members were with him.

An anonymous donor has given $130,000 to pay private school tuition for Hines' two-year-old daughter and unborn son, The Cincinnati Enquirer reported in Monday's editions.

Family members said Hines was the gunner on a Humvee in a convoy when a bomb detonated on a Baghdad highway on Father's Day. He suffered kidney and tissue damage and internal bleeding, and his right leg was amputated in a Baghdad hospital. He was having emergency surgery Thursday when he died.

Hines enlisted in December 2003 and was stationed at Fort Hood, Texas, with the 720th Battalion, 89th Military Police Brigade, 64th Military Police Unit, before shipping out to Iraq in February.

Hundreds mourn soldier who died of Iraq injuries

SPRINGDALE, Ohio — If Pfc. Tim Hines Jr. could have held on for another few weeks, he would have been able see his second child.

The 21-year-old from Fairfield died last week at Walter Reed Army Medical Center in Washington, D.C., after battling injuries he received in a bomb explosion in Baghdad for almost a month.

More than 400 family members and friends gathered for his funeral Friday in this Cincinnati