STRAC

Southwest Texas Regional Advisory Council

Southwest Texas Regional Advisory Council Air Medical Provider Advisory Group (AMPAG)

Pre-hospital Whole Blood

6 September 2018

Donald Jenkins MD FACS

UT Health San Antonio

Contents lists available at ScienceDirect

The American Journal of Surgery 2016

journal homepage: www.ajconline.org

Southwestern Surgical Congress

Time is the enemy: Mortality in trauma patients with hemorrhage from torso injury occurs long before the "golden hour"

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- NTDB data
- 2.5 million patients retrospective study (2012-14)
- AIS 4 chest and abd, significant TBI excluded
- Prehospital time and mortality

REVIEW ARTICLE

Whole blood for hemostatic resuscitation of major bleeding

Philip C. Spinella,[1,2] Heather F. Pidcoke,[2] Geir Strandenes,[3,4] Tor Hervig,[4] Andrew Fisher,[5] Donald Jenkins,[6] Mark Yazer,[7] James Stubbs,[8] Alan Murdock,[9] Anne Sailliol,[10] Paul M. Ness,[11] and Andrew P. Cap[2]

Trans 2016

- Logistical, economic and clinical benefits of cold stored low titer type O whole blood
- Cold stored for up to 21 days
  - Platelets OK
- Improved function compared to 1:1:1

Multi-disciplinary and Multi-National Review

SHOCK, Vol. 41, Supplement 1, pp. 70–75, 2014

LOW TITER GROUP O WHOLE BLOOD IN EMERGENCY SITUATIONS

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Conclusion: Low titer Group O is preferred alternative for emergency transfusions where safe ABO identical transfusions cannot be ensured

American Association of Blood Bankers October 2017

- Board approves petition to allow low titer group O whole blood as standard product without need for waiver
- Low titer defined locally
- No limit on amount of whole blood when used
- Transformational paradigm shift

Whole Blood in Combat

- US Vietnam > 230,000 units transfused (mostly cold stored)
- US OIF/OEF > 10,000 units transfused (almost all fresh): first transfusion October 2001

Army Blood Program

- Resurrected the Vietnam-era program for whole blood
- Collected and tested in the Continental US
- Shipped refrigerated to the combat zone
- May 2016, the first such shipment was sent from Fort Sam Houston by the Army to the combat zone…the first time in over 40 years

AIR MEDICAL BASES IN THE REGIONAL EMERGENCY HEALTHCARE SYSTEM

STRAC
Southwest Texas Regional Advisory Council

Laredo (Air Evac)
McAllen (Air Evac)
LaGrange (Air Evac)
Marble Falls (Air Evac)
Victoria (Air Life)

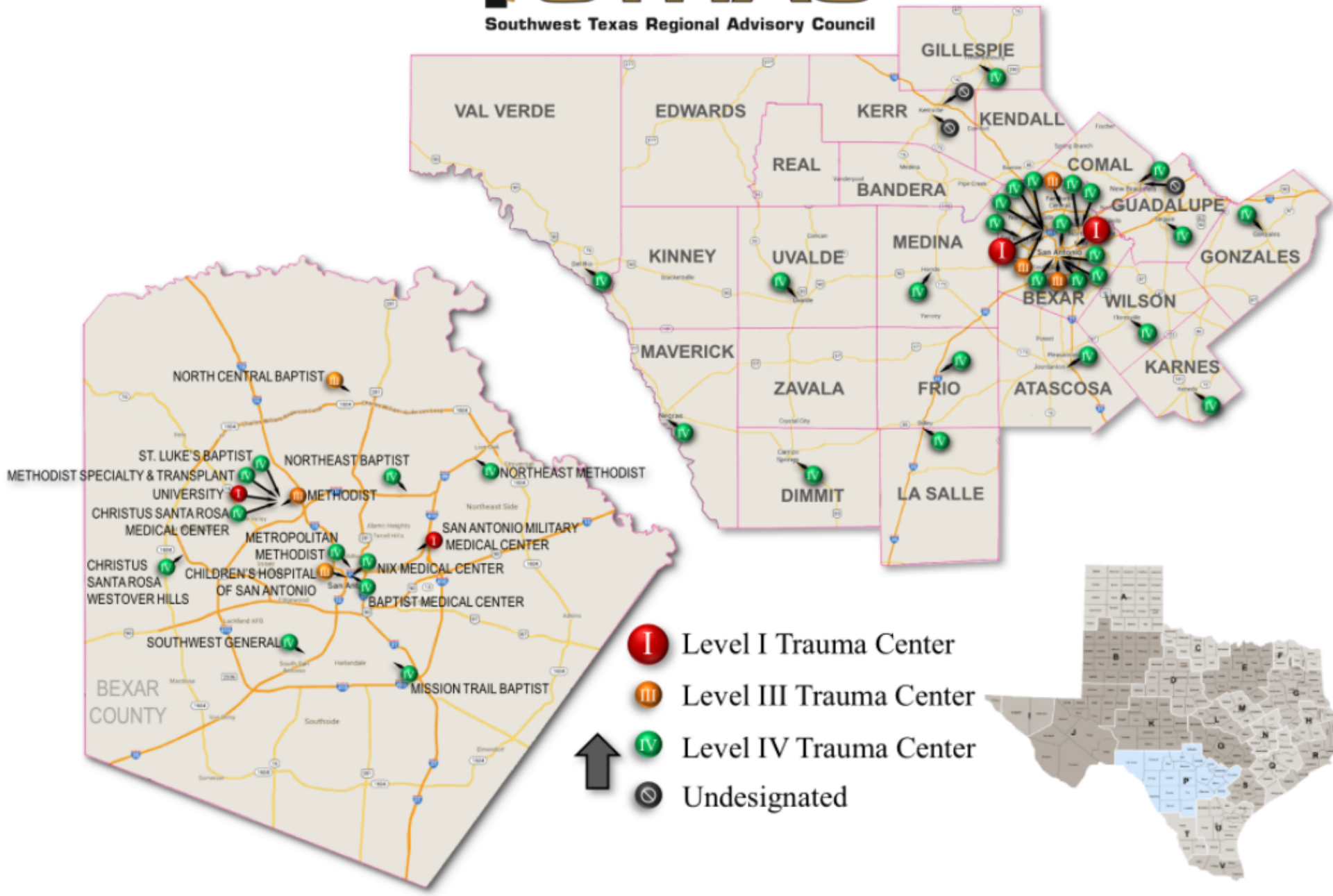
277 Miles

As of: 1 JUNE 2018

REGIONAL TRAUMA & EMERGENCY HEALTHCARE SYSTEM

STRAC

Southwest Texas Regional Advisory Council



Massive Transfusion in Trauma at UHS

- In a recent 30 month period
  - 124 MTP activations for trauma
  - 42 yo blunt injured (67%) male patients (79%)
  - SBP < 90 (died = 82, lived = 97 not significant)
  - 73% mortality, 84% due to hemorrhage
  - Majority died within 24 hours (>90%)
  - Only vital sign different in lived vs died was pulse pressure (46 vs 32 p = 0.03)
  - First hematocrit 35% (Hgb > 10 g/dl)

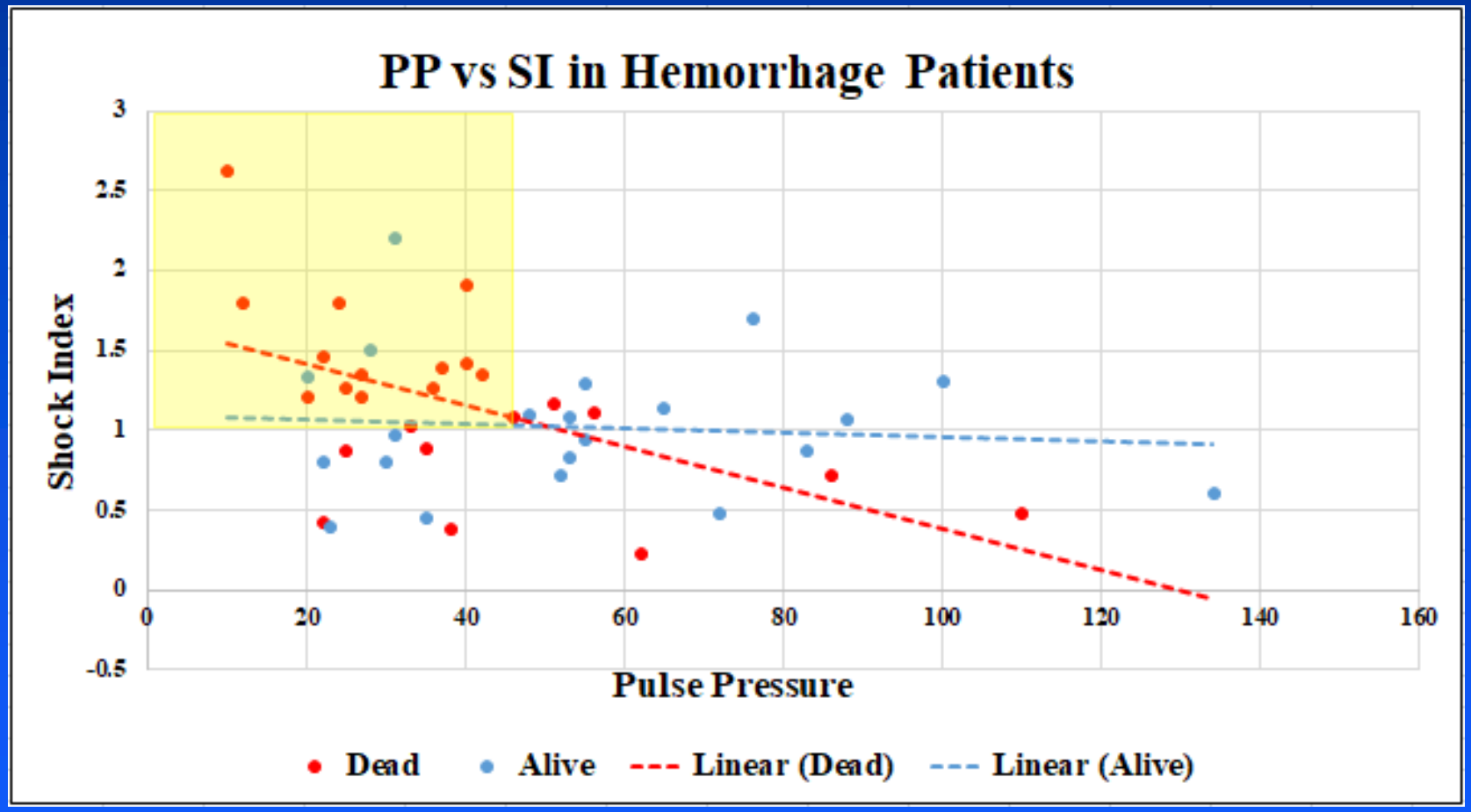
Positive Predictive Values of Death

PP<45	0.78
SI>1	0.71
SBP ≤110	0.73
SBP ≤110 and SI>1	0.73
PP<45 and SI>1	0.79
SBP ≤110 and PP<45	0.79

PP<45 and SI>1:

- 0.81 for blunt injury
- 0.92 for elderly patients

Plot of Pulse Pressure vs Shock Index



MTP Study Takeaways

- Our data demonstrate a high mortality rate in trauma patients who require MTP
- We recommend using EMS PP in combination with either SI or SBP to serve as a trigger for initiation of pre-hospital whole blood transfusion
- *This study supports the development and implementation of a pre-hospital whole blood transfusion program*

Blood Products Available

- Packed RBC
- FFP
- Thawed plasma
- Cryoprecipitate
- Pheresis Platelets (Limited Availability)
- Whole Blood
- rFVIIa
- Fresh plasma

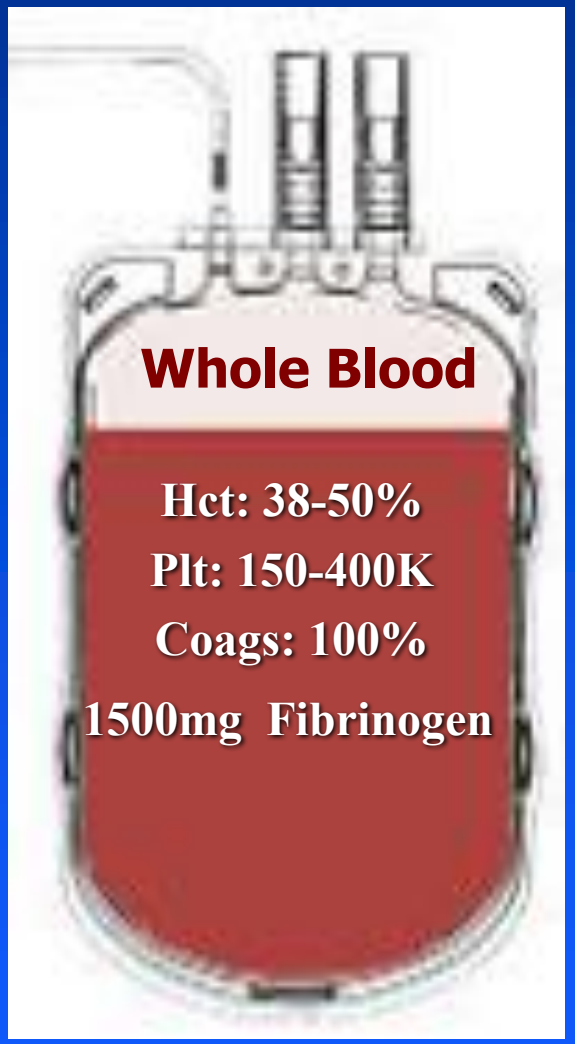
Hypothesis

- Lack of adequate blood resuscitation in remote regions of STRAC
- Very high mortality in current MTP environment
- No agreed upon transfusion triggers
- No standard hemostatic resuscitation
- No early hemostatic resuscitation

Answers

- Cold stored whole blood
- Prehospital transfusion protocols need to be written and implemented

Component Therapy vs. Whole Blood

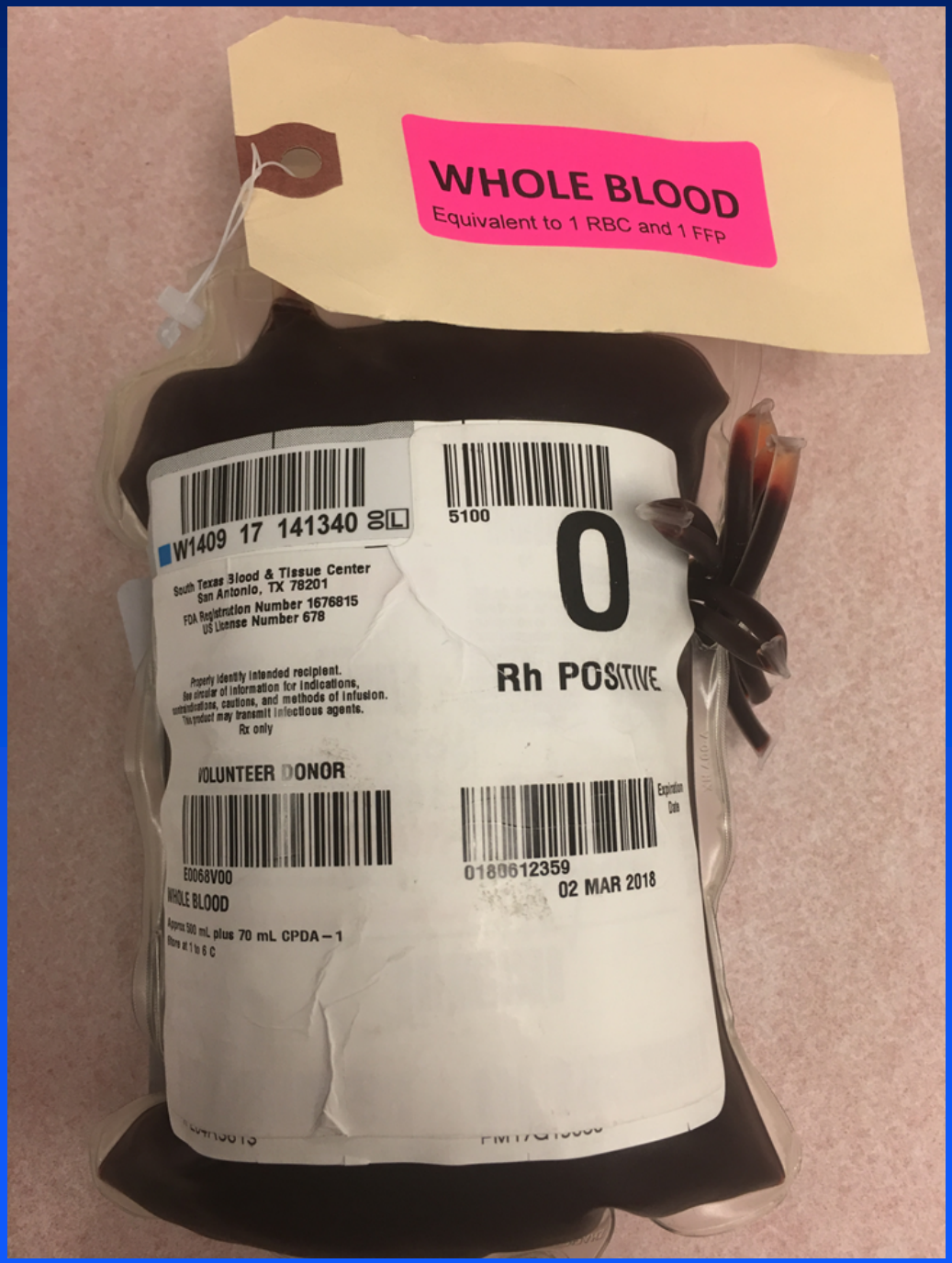


Component Therapy Gives You

1U PRBC + 1U PLT + 1U FFP + 10 pk Cryo =

- 660 mL
- Hct 29%
- Coag activity 65%
- 750 mg fibrinogen

•Armand & Hess. Transfusion Med. Rev., 2003


WHOLE BLOOD
Equivalent to 1 RBC and 1 FFP
W1409 17 141340
South Texas Blood & Tissue Center
San Antonio, TX 78201
FDA Registration Number 1676815
US License Number 678
Properly identify intended recipient.
See circular of information for indications,
contraindications, cautions, and methods of infusion.
This product may transmit infectious agents.
Rx only
VOLUNTEER DONOR
E0068V00
WHOLE BLOOD
Approx 500 mL plus 70 mL CPDA–1
Store at 1 to 6 C
5100
0
Rh POSITIVE
0180612359
Expiration Date
02 MAR 2018

RBC's vs Whole Blood

Advantages of Whole Blood

- Natural
- Organic
- Non-GMO
- Free range
- Gluten Free
- High in protein
- Low in carbs

BROTHERS IN ARMS

TRANSFORMING TRAUMA CARE

Prehospital Cold Stored O+ Whole Blood in San Antonio

- Kicked off January 29 2018
- 18 helicopters
- 2 units each
- Mayo criteria for transfusion
- Women of child bearing age not excluded
- Rh isoimmunization risk versus bleeding to death

Whole Blood Transfusion Criteria

Transfusion Criteria	
Penetrating Trauma (requires 1 physiologic parameter)	Blunt Trauma (requires 2 physiologic parameters)

Physiologic Parameters

Single reading of systolic blood pressure (SBP) < 90 mm Hg

Single reading of heart rate (HR) > 120

Shock index > 1

Pulse Pressure < 45

Positive focused assessment with sonography in trauma (FAST)

Point of care lactate greater than 5.0 mg/dl

Known or presumed anticoagulant use; or dual anti-platelet therapy

Signs of hemorrhage: (high index of suspicion of active internal bleeding or visual evidence of external bleeding)

Patient age ≥ 5

So, How's It Going?

Screened Donor Information October 1 2017 – May 31 2018		
Donors Screened	Donors Titer >1:256	% High Titer donors
2,149	356	17%

Experience and Extrapolation

- 1 January 2015 to 31 August 2017 (32 months) UHS evaluated 16,947 trauma patients.
- 715 of these patients (4.2%) received 1244 units of emergency release blood products (this is before whole blood was available)
- Red cells = 584
- Plasma = 364
- Platelets = 257
- Other = 39

Experience and Extrapolation

- 289 of those patients died (40%) with an average Injury Severity Score (ISS which has a range of 0-75) of 22
- 124 (17% of emergency release blood product patients and 0.2% of the total) adults required a massive transfusion
  - The mortality in this group was 76%
  - DOA's were excluded (no Lazarus effect)

MTP Data

- 37 months: 14,136 adult patients, 174 MTP
- Odds of MTP:
  - **1.6 x** more likely in **men** vs **women**
  - **1.8 x** more likely for **penetrating injury** vs **other injuries**
  - **Risk increases** with **each year of age**
  - **6 x** more likely in patients in **shock** vs **no shock**
    - Shock = scene SBP ≤90, pulse ≥120, SI ≥0.9

Rh- Data

- 63% Hispanic and 7% African American
- Differences in Rh prevalence based upon ethnicity:
  - Rh- in Hispanic and African American populations = 7%
  - Rh- in Caucasian populations = 18%
- > 2/3 of our possible donors and potential recipients have Rh+ blood

Rh Isoimmunization

- Of the 124 patients receiving MTP
  - 26 were women (21%)
  - 18 were age 18-50 (14%)
  - 10 of those 18 died (55%)
  - 16 of the 18 had a type and screen/cross (89%)
  - 1 was Rh negative (6.3%) (she lived)
- Published rate of isoimmunization in Rh- woman 3-6%

Rh- Data

- Risk of isoimmunization of 0.012 and 0.12 patients/year
- Would take 3000 months (250 years) to have 100 Rh- women of childbearing age receive LTO+WB, and somewhere between 3 and 30 of them would develop isoimmunization without the administration of RhIg
- Without transfusion of LTO+WB in the pre-hospital setting over this time period, nearly 500 women of childbearing age would die of hemorrhage

Prehospital Experience Thus Far

- First 31 patients
  - 23 from the scene, 8 in transfer
    - 27 trauma, 4 non trauma patients
  - 6 of 27 (22%) penetrating mechanism of injury
    - 2 died of fatal GSW to the head (33%)
    - ***0/4 (0%) died after eliminating fatal GSW to head***
  - 21 of 27 (78%) blunt mechanism of injury
    - 6/21 died (29%)
    - 5/6 dead arrested on scene, ROSC, then died again
    - ***1/16 (6%) died after eliminating dead on scene***

Prehospital Experience Thus Far

- First 31 patients
  - 4 non-trauma pts (GI bleed, epistaxis, etc)
    - 2 (50%) died
    - 1 died after withdrawal of care
    - 1 of 4 (25%) died after eliminating WOC
  - 2/23 (9%) death rate among adjusted patient population = 91% survival rate
    - Adjusted patient population = non GSW to head, DOS or WOC

Prehospital Experience Thus Far

- Gender:
  - Male- 18
  - Female-13
- Age:
  - Youngest- 12 y/o
  - Oldest-81 y/o
- Receiving Facilities:
  - BAMC , Methodist Main, Seton Medical Center (Austin), St Davids (Austin)

Experience and Extrapolation

- In the first 60 days of LTO+WB at UT/UHS
  - 32 patients received LTO+WB
  - 6 of them died
  - Mortality rate = 18.8% (includes DOA's)
- Combined Level I STRAC trauma centers average 730 pt/mos
  - 50% decrease in mortality from historical control emergency release transfusion the extrapolation is projected to save 12-14 lives/mos or 132-168 per year

First 70 Patients LTO+WB @ UHS

- Outcomes known for 59
  - 15 died = 25% mortality
  - 8 were DOA
  - DOA excluded: 7/51 died = 13.8% mortality
- 220 units given = 3/pt
- Very few MTP (3 but should have been 10-12)
- No Rh- women got LTO+WB

MCI Initiative

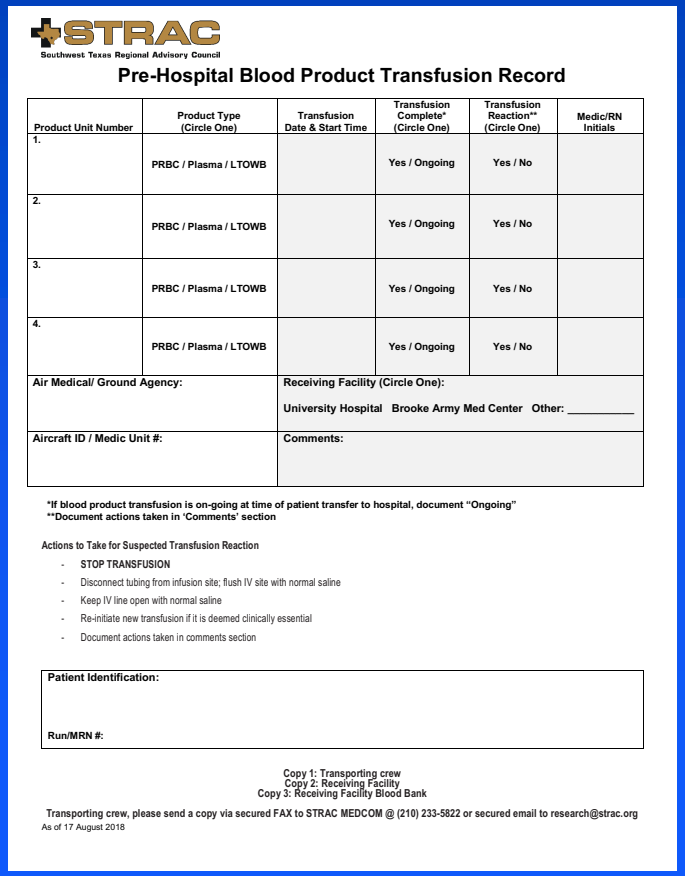
- ASPR TRACIE from 5 Nov 17 Sutherland Springs MCI (Assistant Secretary for Preparedness and Response, Technical Resources, Assistance Center, and Information Exchange)
  - Recommendation: take resources from urban to remote setting including people and blood
- South Texas Blood and Tissue Center
  - 30 units LTO+WB inventory
  - Dispatch EMS to STBTC to pick up 20 pack of whole blood and drive to scene/rural hospital or rendezvous with HEMS to fly it there

Real World Example

- Father's Day 2018
- Big Wells
  - 14 person MCI rollover MVC
    - 4 DOS
  - At least 9 HEMS agencies responded
  - 3 patients received LTO+WB on scene/transport
    - 1 died (33%)
- First MCI event known where prehospital whole blood was used for resuscitation

Clinical References/Resources

- www.strac.org/blood



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Pre-Hospital Blood Product Transfusion Record

Product Unit Number	Product Type (Circle One)	Transfusion Date & Start Time	Transfusion Complete* (Circle One)	Transfusion Reaction** (Circle One)	Medic/RN Initials
1.	PRBC / Plasma / LTOWB		Yes / Ongoing	Yes / No	
2.	PRBC / Plasma / LTOWB		Yes / Ongoing	Yes / No	
3.	PRBC / Plasma / LTOWB		Yes / Ongoing	Yes / No	
4.	PRBC / Plasma / LTOWB		Yes / Ongoing	Yes / No	
Air Medical/ Ground Agency:		Receiving Facility (Circle One): University Hospital Brooke Army Med Center Other: _____			
Aircraft ID / Medic Unit #:		Comments:			

*If blood product transfusion is on-going at time of patient transfer to hospital, document "Ongoing"
**Document actions taken in 'Comments' section

Actions to Take for Suspected Transfusion Reaction

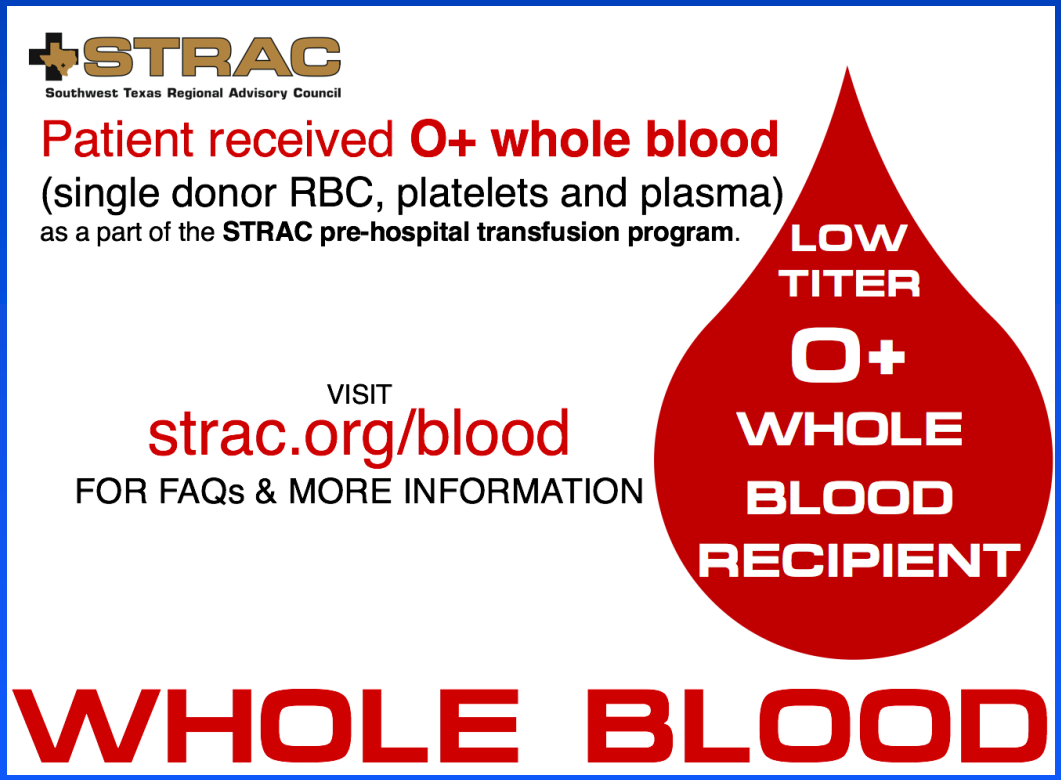
- STOP TRANSFUSION
- Disconnect tubing from infusion site; flush IV site with normal saline
- Keep IV line open with normal saline
- Re-initiate new transfusion if it is deemed clinically essential
- Document actions taken in comments section

Patient Identification:

Run/MRN #:

Copy 1: Transporting crew
Copy 2: Receiving Facility
Copy 3: Receiving Facility Blood Bank

Transporting crew, please send a copy via secured FAX to STRAC MEDCOM @ (210) 233-5822 or secured email to research@strac.org
As of 17 August 2018



This card can be given to receiving facilities

Thank You!

Questions?