EMS State of the Science XXIII

A Gathering of Eagles 2022

All Kidding Aside -- We Should Also Transfuse Kids:

Providing Whole Blood to Children As Well

Peter Antevy, MD

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Davie Fire Rescue

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Questions

- What are the AGE and VS criteria for Whole Blood in children?
- Should Calcium be administered in the pre-hospital environment?

Florida Whole Blood Leaders

Dr. Jim Roach

Chief Heath Clarke

Chief Charles Coyle

LifeFlow & QinFlow

SPEED

HEAT

Is There Data?

PREHOSPITAL EMERGENCY CARE
2021, VOL. 25, NO. 5, 615-619
https://doi-org.ezproxy.lib.utexas.edu/10.1080/10903127.2020.1817216

Taylor & Francis
Taylor & Francis Group

Analysis of Prehospital Administration of Blood Products to Pediatric Casualties in Iraq and Afghanistan

Ryann S. Lauby, Sarah A. Johnson, Matthew A. Borgman, MD, James Bynum, PhD, Guyon J. Hill, MD, and Steven G. Schauer, DO, MSCR

Dept of Defense Trauma Registry (2007-2016)

- 3439 total pediatric casualties
- Mechanism of injury: explosive or firearm
- **Only 22 received a blood product**

Demographics

- <1 (0%)
- 1-4 (23%)
- 5-9 (18%)
- **10-14 (41%)**
- 15-17 (18%)

Table 2. Breakdown of blood products administered prehospital (Table view)

Product	Number of Casualties*
Packed red blood cells	17
Fresh frozen plasma	3
Whole blood	2
Blood (not otherwise specified)	3

* Casualties could have received more than one product.

Table 3. Emergency department arrival data (Table view)

Age-adjusted tachycardia	90% (20)
Age-adjusted hypotension	33% (7)
Hematocrit (%)	31.1 (28–33.6)
Base deficit (mEq/L)	11.3 (14.4–8.2)
International normalized ratio	1.6 (1.2–2.0)

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Table 4. Concomitant prehospital interventions

Wound dressing	50% (11)
Chest needle decompression	4% (1)
Tourniquet	31% (7)
Intubation	40% (9)
Intraosseous access	31% (7)
IV fluids	40% (9)
Ketamine	31% (7)
Tranexamic acid	9% (2)
Opioid	36% (8)

Pediatr Surg Int (2017) 33:787–792
DOI 10.1007/s00383-017-4092-5

ORIGINAL ARTICLE

Prehospital blood transfusions in pediatric trauma and nontrauma patients: a single-center review of safety and outcomes

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Pediatric (<40 kg) Prehospital Transfusion Guidelines

Pediatric patients should be given blood products if two 20 mL/kg boluses of crystalloid have been given and shock is still present. Crystalloid will be given prior to blood products unless it's obvious that the patient will need products immediately. Blood product transfusion should begin with plasma (if available) 10 ML/kg bolus x 2 followed pRBC 10 mL/kg, based on the patient's clinical condition and hemodynamic status. Crystalloids (or additional pRBC's if needed) should be continued.

Diagnoses & Mechanism

Table 1 Diagnoses of nontrauma and trauma patients and mechanisms of traumatic injuries

Nontrauma diagnoses	Trauma diagnoses	Traumatic mechanisms
Neonatal anemia		
Fetal maternal hemorrhage ($n = 3$)	Splenic lacerations ($n = 5$)	MVA ($n = 9$)
Coagulopathy secondary to maternal ITP ($n = 1$)	Liver lacerations ($n = 2$)	GSW ($n = 2$)
Coagulopathy secondary to liver failure ($n = 1$)	Pelvic bleeding ($n = 2$)	ATV ($n = 1$)
With sepsis ($n = 2$)	Chest wound (GSW) ($n = 1$)	Blunt farm machinery ($n = 2$)
With cardiac defects ($n = 1$)	Facial wound (GSW) ($n = 1$)	Falling ice sheet ($n = 1$)
	Intracranial hemorrhage ($n = 3$)	Blunt sports injury ($n = 1$)
GI bleed		
Meckel's diverticulum ($n = 1$)	Unclear (expired ($n = 2$))	
Post-interventions		
Post-tonsillectomy bleed ($n = 1$)		
Post-ERC GI Bleed ($n = 1$)		
ECMO Bleeding ($n = 1$)		

Trauma vs. Non-Trauma

	Trauma patients ($n = 16$)	Nontrauma patients ($n = 12$)	p value
Age (mean)	12.8 (±4.4)	3.3 (±6.1)	<0.01
Surgical intervention	68.7%	33.3%	0.02
Endoscopy	0%	16.6%	0.05
LOS (days)	13.4	8.9	0.12
Discharge to rehab	37%	0%	0.007
30 day mortality	12%	17%	0.39

Hemorrhaging Kids

Hemorrhaging Adults


5100
O
Rh POSITIVE
VOLUNTEER DONOR
E0336V00
RED BLOOD CELLS
ADENINE-SALINE (AS-1) ADDED
LEUKOCYTES REDUCED
from 500 mL CPD Whole Blood
store at 1 to 6 C
0170692359
10 MAR 2017
Expiration Date
2FE04R1590

SSM Health
Cardinal Glennon
Children's Hospital

- 22 WB transfusions in last 12 months
- 3 Deaths (tracheal lac, IVC transection, GSW brainstem)

Age Breakdown

- 13 YR and over = 13 patients (9 GSW, 3 MVC, 1 Auto-Ped)
- 5 – 12 YR = 5 patients (4 MVC, 1 GSW)
- Less than 5 YR = 3 patients (All GSW)

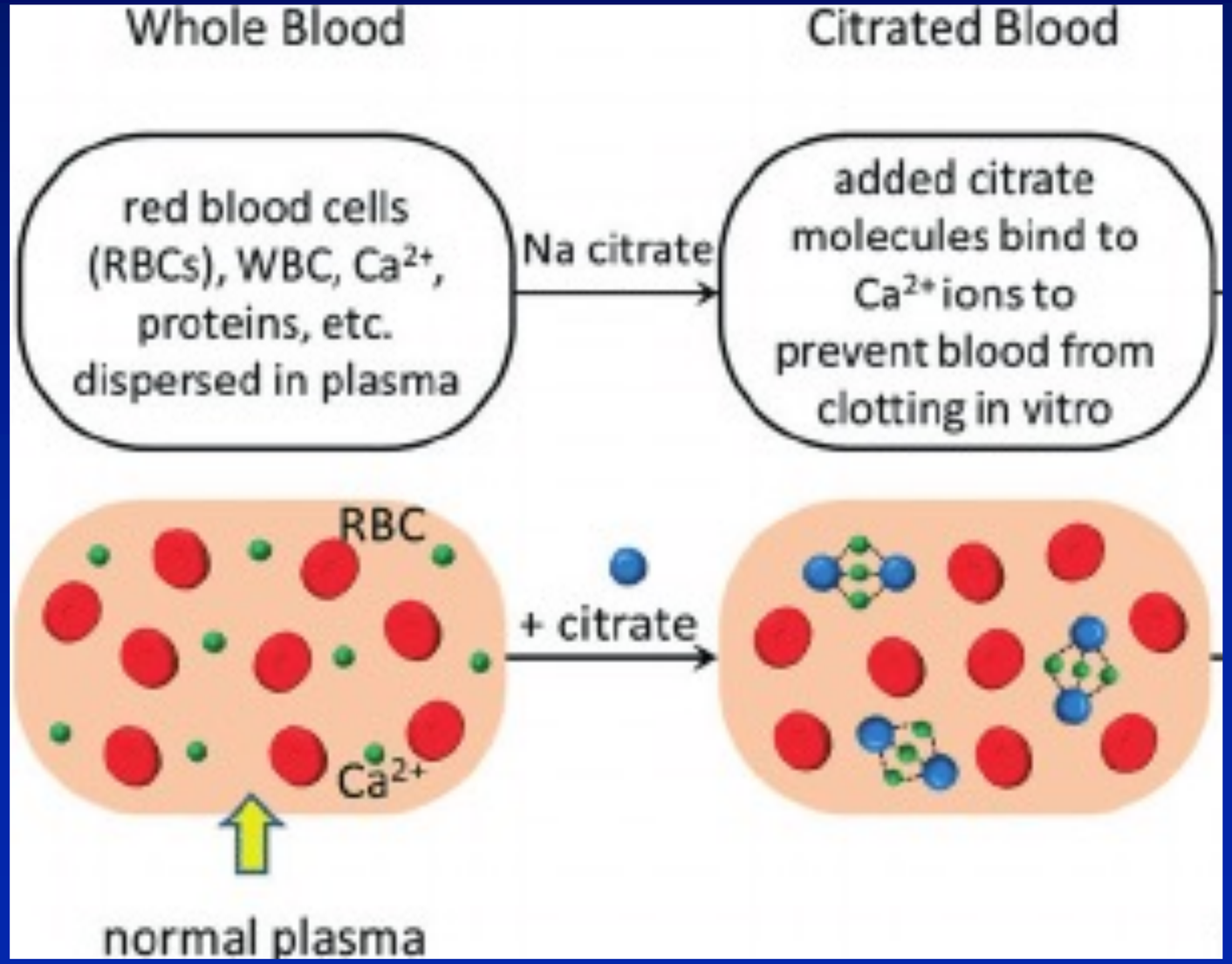
SSM Health Cardinal Glennon Children's Hospital

16 kg

		Dose/Standard Volume All blood products (except cryo): standard dose is 10 mL/kg	Volume to administer
Emergency Release Product			
1	**Whole Blood** *Substitute PRBC if Whole blood is not available*	1-unit Whole Blood Standard volume: 500 mL 1-unit PRBC Standard Volume: 300 mL	**160 mL**
2	**CaCl 10%** Dose: 20mg/kg	Standard Concentration: 100mg/mL	**3.2 mL** **320 mg**
3	**Whole Blood** *Substitute PRBC if Whole blood is not available	1-unit Whole Blood Standard volume: 500 mL 1-unit PRBC Standard Volume: 300 mL	**160 mL**
4	**TXA** Dose: 15mg/kg	Standard Concentration: 100mg/mL	**2.4 mL** **240 mg**

***Continue to give whole blood up to 40mL/kg. Administer CaCl after every other dose of whole blood. If PRBCs are only product available, administer 2 doses, then move to MTP Packs.**

Why the Calcium?



Hypocalcemia in trauma patients receiving massive transfusion

- **152/156 (97%) developed hypocalcemia**
- **111/156 (71%) developed severe hypocalcemia**

J Surg Res 2016 May 1;202(1):182-7..

ADMINISTRATION

- For Adult and Pediatric dosages, titrate to maintain peripheral pulses
- Flow blood products through warmer to completion and/or hemodynamic stability
- Pressure infuser or LifeFlow fluid infuser shall be utilized
- Document transfusion start time

- **WHOLE BLOOD**:
  - **Adult**
    - Titrate to maintain peripheral pulses
    - Max 2 units
  - **Pediatric**
  - 5-years old to signs of puberty
    - 10mL/kg
    - May repeat 1x prn
    - Max 1 unit
    - LifeFlow delivers 10mL per squeeze of the trigger
    - Refer to HANDTEVY app to determine vital sign parameters and exact dose
  - For patients under 5-years of age, contact the On-Call Medical Director for orders to administer Whole Blood

WB Vital Requirements

Pediatrics

- SBP < 70 mmHg
- SBP < 80 mmHg **AND** HR > 120 bpm

Adults

- SBP < 70 mmHg
- SBP < 90 mmHg AND HR > 110 bpm
- Age ≥ 65: SBP < 100 mmHg AND HR > 100 bpm

Tulane Blood Registry

Juan Duchesne, MD

Summary

- Hemorrhaging kids need blood….at any age!
- Citrate in the WB unit binds free calcium
  - Calcium is required, especially with MTP
- Reach out to us to R&D our SOG & Protocol
- Contribute to the Tulane Blood Registry

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