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Transfusion Ratios Following Activation of a Massive Transfusion Protocol: An Evidence Based Practice Project

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Background

Accidental injury is one of the leading causes of death in the United States and worldwide. Severe hemorrhage from injury is the leading cause of preventable death. Effective management of hemorrhaging trauma patients has been evolving since the early 1900's. Recent studies have demonstrated the benefits of using a balanced resuscitation technique, revolving around the goal of recreating whole blood.

The purpose of this project was to identify what ratios of blood products are being transfused at Providence Sacred Heart Medical Center (PSHMC) and Providence Holy Family Hospital (PHFH).

Methods

- A literature review was performed identifying seven high quality peer-reviewed studies.
- Institutional approval and IRB review for exemption determination completed. Human subjects were protected.
- Registry data extraction in an anonymized fashion.
- Patients who received no packed red blood cells or had no age specified were excluded.
- Patients organized by demographic and clinical characteristics.
- 24-hour mortality rates extracted from the electronic health record.
- Post hoc power analysis was completed.
- High ratio transfusion was defined as a ratio approaching or greater than 1:1 with packed red blood cells always being the denominator (i.e. FFP:PRBC, PLT:PRBC).

PROVIDENCE Sacred Heart Medical Center & Children's Hospital

Providence Sacred Heart Medical Center
Gonzaga University
Nurse Anesthesia Program

GONZAGA UNIVERSITY School of Nursing & Human Physiology

Findings

Table 1. Participant Characteristics

All Patients		Variable (n=305)	
		n	%
Gender	Male	188	62
	Female	117	38
Trauma	Yes	119	39
	No	186	61
Location	ER	128	42
	ICU	70	23
	OR	39	13
	Cardiac ICU	27	9
	L&D	10	3
	Other Units	31	11
		Mean	SD
	Mean Age (years)	52	19
Trauma Patients		**Variable (n=119)**	
		n	%
Gender	Male	87	73
	Female	32	27
		Mean	SD
	Mean Age (years)	46	17

Table 2. High and Low Transfusion Ratios

24-Hour Mortality Rates FFP

Ratio	Expired	Survived	Total	Risk	RR
High	25	58	83	30.1%	1.26
Low	59	97	156	37.8%	
Total	84	155	239		

24-Hour Mortality Rates Platelets

Ratio	Expired	Survived	Total	Risk	RR
High	37	81	118	31.4%	1.24
Low	47	74	121	38.8%	
Total	84	155	239		

(FFP 95% CI 0.85-1.84, P=0.25, Platelets 95% CI 0.87-1.75, P=0.23)
66 transfusions did not receive RBC and therefore were removed from the initial 305 MTP activations.

Findings (cont.)

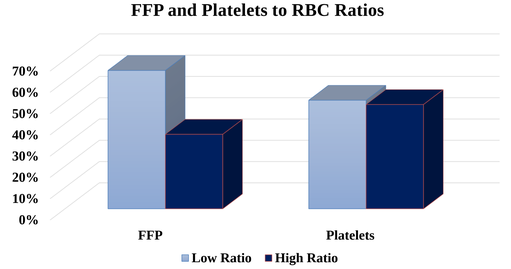

Figure 1. MTP Activations by Blood Component Ratios

- 73% of MTP activations for trauma were for male patients average age 46
- High transfusion ratios are occurring in less than half of MTP activations

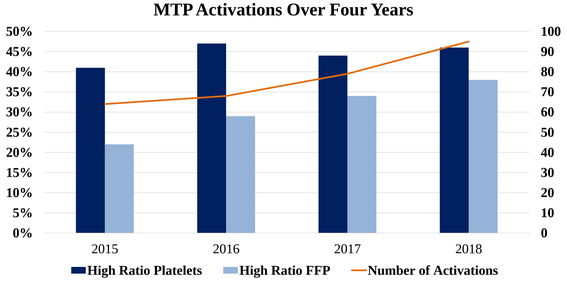

Figure 2. MTP Activations by Year

Discussion

Massive transfusion ratios among hemorrhaging patients at PSHMC and PHFH were observed at high ratio 35% of the time, when comparing fresh frozen plasma to packed red blood cells, and 49% of the time, when comparing platelets to packed red blood cells. Trauma patients account for 39% of all massive transfusions at PSHMC and PHFH.

Though some cases of massive transfusions observed in this project did achieve high transfusion ratios, it is unclear what reasons prevented high transfusion ratios. Research evidence suggest that mortality risk is higher when lower ratios are utilized during massive transfusions. However, this project was not powered to detect mortality differences by ratios.

References

Baraniuk, S., Tilley, B. C., Del Junco, D. J., Fox, E. E., Van Belle, G., Wade, C. E., … Holcomb, J. B. (2014). Pragmatic Randomized Optimal Platelet and Plasma Ratios (PROPPR) Trial: Design, rationale and implementation. *Injury*. https://doi.org/10.1016/j.injury.2014.06.001

Borgman, M. A., Spinella, P. C., Perkins, J. G., Grathwohl, K. W., Repine, T., Beekley, A. C., … Holcomb, J. B. (2007). The ratio of blood products transfused affects mortality in patients receiving massive transfusions at a combat support hospital. *Journal of Trauma - Injury, Infection and Critical Care*. https://doi.org/10.1097/TA.0b013e3181271ba3

Holcomb, J. B., Del Junco, D. J., Fox, E. E., Wade, C. E., Cohen, M. J., Schreiber, M. A., … Rahbar, M. H. (2013). The prospective, observational, multicenter, major trauma transfusion (PROMMTT) study: Comparative effectiveness of\ a time-varying treatment with competing risks. *JAMA Surgery*. https://doi.org/10.1001/2013.jamasurg.387

Holcomb, J. B., Tilley, B. C., Baraniuk, S., Fox, E. E., Wade, C. E., Podbielski, J. M., Van Belle, G. (2015). *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*.

Holcomb, J. B., Wade, C. E., Michalek, J. E., Chisholm, G. B., Zarzabal, L. A., Schreiber, M. A., … Park, M. S. (2008). Increased plasma and platelet to red blood cell ratios improves outcome in 466 massively transfused civilian trauma patients. *Annals of Surgery*. https://doi.org/10.1097/SLA.0b013e318185a9ad

Kutcher, M. E., Kornblith, L. Z., Narayan, R., Curd, V., Daley, A. T., Redick, B. J., … Cohen, M. J. (2013). A paradigm shift in trauma resuscitation: Evaluation of evolving massive transfusion practices. *JAMA Surgery*.

Kutcher, M. E., Kornblith, L. Z., Vilardi, R. F., Redick, B. J., Nelson, M. F., & Cohen, M. J. (2014). The natural history and effect of resuscitation ratio on coagulation after trauma: A prospective cohort study. *Annals of Surgery*.

Miller, T. E. (2013). *New evidence in trauma resuscitation-is 1:1:1 the answer?* Retrieved from http://www.perioperativemedicinejournal.com/content/2/1/13

Stephens, C. T., Gumbert, S., & Holcomb, J. B. (2016). Trauma-Associated bleeding: Management of massive transfusion. *Current Opinion in Anaesthesiology*.