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How do we better predict the need for emergent uncrossed-matched blood?

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KEY POINTS

- Hemorrhage is a leading cause of death
- Early resuscitation improves mortality
- Heart rate, systolic blood pressure, and shock index are different between patients who receive and do not receive blood products
- The best algorithm to predict massive transfusion will be institution dependent

Death from hemorrhage following traumatic injury remains a leading cause of death in patients under the age of 40. Approximately 25% of patients will present to the emergency department with coagulopathy. On average, one-third of patients requiring blood products will require massive transfusion. Timely and appropriate early resuscitation following traumatic injury improves mortality. However, assessing whether a patient will need massive transfusion with replacement of coagulation factors can be difficult to determine in a timely manner. Those patients that arrive with overt bleeding or in cardiac arrest may have transfusions started empirically based on clinical judgement. However, those with compensated shock are more difficult to diagnose during the initial assessment. Several predictive scoring systems have been developed with the intention of a quick "one-minute" evaluation to quickly get products to the bedside whether in the emergency room or operating room.

A recent retrospective review performed by trauma surgeons at R Adams Cowley Shock Trauma Center at the University of Maryland Medical Center evaluated data collected from 10,636 patients admitted from January 2009 to December 2012.[1] They compared vital signs including heart rate (HR) and systolic blood pressure (SBP) obtained prehospital to admission at minutes 5, 10 and 15 with trends assessed intermittently or, if available, continuously.[1] The transfusion requirements of the patients were also analyzed and divided into groups containing those who received uncrossed-matched (UnXRBC), defined as those patients receiving 4 units within 4 hours(MT1), and those who received 10 or more units within 24 hours(MT2).[1] Using this information and calculating the Shock Index (SI), a stepwise logistic regression model was employed to determine a relationship between the variables.[1] By obtaining vitals continuously for 15 minutes following admission, they determined that patients who required transfusions were noted to have significantly different HR, SBP and SI(see figure 1).[1] The need for MT could be predicted without further clinical input.[1] Those patients who present with lower SBP and higher HR and SI were most likely to require transfusion.[1] Additionally, those patients who had continuous monitoring over 15 minutes, were persistently hypotensive and tachycardic with a high SI, were more likely to need MT2.[1]

Figure 1. Average Heart Rate (HR), Systolic Blood Pressure (SBP), and Shock Index (SI) for patients who did not receive a blood transfusion, received uncrossmatched blood, 4 units in 4 hours, and 10 units in 24 hours (modified from Parimi et al.)[1]

Several other scoring systems have been developed over the years involving both military and civilian patient populations with screening performed at varying intervals during the resuscitation. Brockamp, et al reviewed and compared six additional scores including: trauma-associated severe hemorrhage (TASH) score, Prince of Wales Hospital/Rainer score (PWH), Vandromme score, assessment of blood consumption (ABC) score, Schreiber score and Larson score (see Table 1).[2] The comparison analysis determined a higher sensitivity and

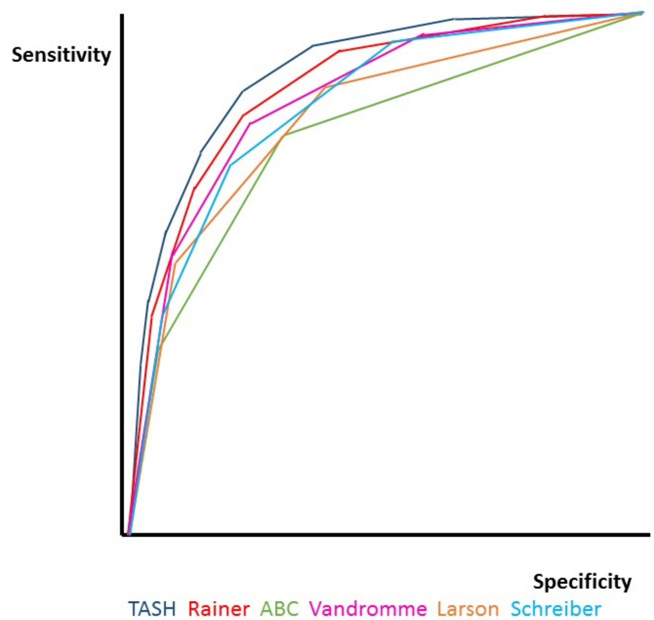
Gender (Pts)	Pelvic Fracture (Pts)	Femur Fracture (Pts)	Fast Positive (Pts)	Heart Rate (Pts)	Systolic Blood Pressure (Pts)	Hemoglobin (Pts)	Base Excess (Pts)	Mechanism of injury (Pts)	INR (Pts)	GCS (Pts)	Lactate (Pts)
TASH (1)	TASH (6)	TASH (3)	TASH (3)	TASH (2)	TASH (1-4)	TASH (2-8)	TASH (1-4)				
	Rainer (1)		Rainer (2)	Rainer (1)	Rainer (3)	Rainer (1)	Rainer (1)			Rainer (1)	
			ABC (1)	ABC (1)	ABC (1)			ABC (1)			
				Vandromme (1)	Vandromme (1)	Vandromme (1)			Vandromme (1)		Vandromme (1)
				Larson (1)	Larson (1)	Larson (1)	Larson (1)				
						Schreiber (1)		Schreiber (1)	Schreiber (1)		

Table 1. Contributions of points for various factors used in massive transfusion predicting algorithms (modified from Brockamp et al.)[2]

specificity noted with the TASH score (84.4%, 78.4% respectively), with the PWH (80.6%, 77.7%) following with a a statistically significant difference between the two systems (see figure 2).[2] A TASH score >16 predicts the need for MT >50%, and incorporates the SBP, sex, hemoglobin, focused abdominal sonography for trauma (FAST), HR, base excess and the presence of extremity or pelvic fractures.[2] A considerable limitation to this scoring system is the need for laboratory information including the hemoglobin and base excess.[2] However, the use of point-of-care devices in the emergency room may improve the timeliness of this information.

The benefit of employing these scoring systems is to quickly identify trauma patients who present with significant risk of requiring blood transfusion and concurrently have a high likelihood of developing significant coagulopathy in which a timely and effective resuscitation with MT products will potentially improve outcomes and mortality. Another major limitation of the systems discussed is the lack of inclusion of age, known comorbidities or known anticoagulation or antiplatelet therapy which can significantly influence the need for product transfusion. Therefore, it is important to remember that these are "predictive" models and are mere guidelines on which clinical acumen must also be employed. Although, there are several different models, the most effective system may differ upon the patient population and resources available to each institution.

Figure 2. Sensitivity vs Specificity of 6 predictive algorithms for massive transfusion (modified from Brockamp et al)[2]



References

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