Life Threatening Hyperkalemia with Massive Transfusion: What Factors put Patients at Risk?

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Introduction: Massive hemorrhage in traumatic injury patients is a major cause of morbidity and mortality in 1st 24 hours and blood component support can be lifesaving (1). Potential complications of massive blood transfusions including hyperkalemia have been known for decades (2,3), however studies to date have failed to uncover risk factors associated with the development of hyperkalemia. In fact, some studies have shown that massive transfusion is not a risk factor for the development of Hyperkalemia (2,3). The current literature lacks sequential following of potassium levels during massive transfusion and adjustments for possible confounding factors such as delivery of lower potassium fluids such as crystalloid, fresh frozen plasma, platelets and albumin, all used commonly during surgery for trauma. Our study focuses on identifying patient and surgical risk factors associated with hyperkalemia (Potassium levels >5.5 mM/L) in trauma surgery patients receiving massive transfusion in one tertiary care hospital.

Methods: A retrospective chart analysis of patients from 2008-2016 who required initiation of the Massive Transfusion Protocol (MTP) was conducted. Patient demographic data as well as intraoperative vitals, medications, fluids and events were collected. Total potassium load delivered to patients was estimated with a formula accounting for the age and volume of the stored products delivered. Statistical analysis was done to look for independent risk factors for the development of hyperkalemia.

Results: Initial data analysis shows that patient hyperkalemia is linked to the rate and total potassium load given to the patient and therefore to the age of the stored PRBC. Hyperkalemia was also more likely to occur when the ratio of crystalloid to colloid given to the patient was less than one (which would be related to the rate of delivery of potassium). Our results show that PRBC transfusions were independently linked with hyperkalemia. Patients who were transfused more than 20 units of PRBC had higher intraoperative mortality when compared to patients who were transfused fewer units of PRBC. Duration of surgery was not seen as a risk factor for hyperkalemia and had no correlation with intraoperative mortality. Patients preoperative creatinine, potassium and pH were not associated with the development of hyperkalemia.

Discussion: Current literature remains unclear about the causative factors of hyperkalemia in massively transfused patients. These factors are likely multi-factorial. Our study positively links the total potassium load delivered to high blood potassium levels. As studies have shown that extracellular potassium levels increase with time in storage (4,5), this result suggests that hyperkalemia could also be linked to the age of the blood given. Our study further looks at the rate
of rise of potassium levels during surgery as well as other factors such as the rate of transfusion, the volume of crystalloid delivered, and other medications. Detailed results will be presented.

Conclusion: Infusion of a large potassium load during blood product delivery by the MTP are independently linked to hyperkalemia and higher intraoperative mortality, particularly with lower volumes of crystalloid delivery. Prophylactic measures should be started in massively transfused patients to avoid hyperkalemia associated cardiac arrest and subsequent mortality.


