Characterizing Pediatric Supermassive Transfusion and the Contributing Injury Patterns in the Combat Environment

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ABSTRACT

Background:
Trauma is the leading cause of pediatric mortality. Pediatric trauma patients often require supermassive transfusion (SMT), which we define as receipt of >80mL/kg blood products (double the proposed volume for massive transfusion [MT]). Evaluating the injuries, clinical findings, and prehospital interventions predictive for SMT are critical to reducing mortality.

Methods:
We analyzed pediatric trauma data from the DOD Trauma Registry from January 2007 – 2016, stratifying patients into two cohorts based on blood products received in the first 24 hours post-injury: 1) 40-80mL/kg for MT; or 2) >80mL/kg for SMT. We evaluated demographics, injuries, prehospital interventions, and clinical findings.

Results:
Our dataset included 3439 pediatric casualties, of which 536 met inclusion parameters (>40mL/kg of blood products received [whole blood, packed red blood cells, fresh frozen plasma, platelets, or cryoprecipitate]). The MT cohort included 271 patients (50.6%) versus 265 patients (49.4%) in the SMT cohort. Survival to discharge was reduced in the SMT cohort (78% vs 86% for MT; p<0.011). Multivariable analysis of injuries revealed serious injuries (Abbreviated Injury Scale 3-6) to the extremities (OR 2.13, 95% CI 1.45-3.12) and abdomen (OR 1.65, 1.08-2.53) were associated with SMT. Wound dressing (41% versus 29%; p=0.011), tourniquet (23% vs 12%; p=0.001), and IO access (17% vs 10%; p=0.013) usage were increased in the SMT group. Age-adjusted hypotension was greater in the SMT group (41%, n=100 vs 23%, n=59; p<0.001), with no statistical difference in tachycardia (87%, n=223 vs 87%, n=228; p=0.932).

Conclusions:
Our research demonstrates that pediatric SMT patients have increased risk of mortality and highlights the seriousness of extremity injuries in pediatric trauma patients. Prehospital interventions of wound dressing, tourniquets, and IO access were more frequent in the SMT cohort. Though tachycardia was not a reliable predictor of SMT over MT, our research determined that hypotension was associated with SMT.