



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 in the United States. Often, these patients require supermassive transfusion (SMT), which we define as receipt of >80 mL/kg blood products, double the proposed volume for standard pediatric massive transfusion (MT). Evaluating the blood volumes, injury patterns, clinical findings, and prehospital interventions predictive for SMT are critical to reducing pediatric mortality. We describe the pediatric casualties, injury patterns, and clinical findings that comprise SMT.

Methods: We retrospectively analyzed pediatric trauma data from the Department of Defense Trauma Registry from January 2007–2016. We stratified patients into two cohorts based on blood products received in the first 24 h after injury: 1) those who received 40–80 mL/kg (MT), or 2) those who received >80 mL/kg (SMT). We evaluated demographics, injury patterns, prehospital interventions, and clinical findings.

Results: Our original dataset included 3439 pediatric casualties. We identified 536 patients who met inclusion parameters (receipt of ≥40 mL/kg of blood products [whole blood, packed red blood cells, fresh frozen plasma, platelets, or cryoprecipitate]). The MT cohort included 271 patients (50.6%), and the SMT cohort comprised 265 patients (49.4%). Survival to discharge was significantly lower (78% for SMT, 86% for MT; $p < 0.011$) in the SMT cohort. Multivariable analysis of injury patterns 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 dressings (41% versus 29%; $p = 0.003$), tourniquets (23% vs 12%; $p = 0.001$), and IO access (17% vs 10%; $p = 0.013$) were more common in the SMT group. Age-adjusted hypotension was significantly higher in the SMT group (41%, $n = 100$ vs 23%, $n = 59$; $p < 0.001$) with no statistical difference detected in tachycardia (87%, $n = 223$ vs 87%, $n = 228$; $p = 0.932$).

Conclusions: Our research demonstrates that pediatric SMT patients are at increased risk of mortality. Our study highlights the seriousness of extremity injuries in pediatric trauma patients, identifying associations between severe injuries to the extremities and abdomen with the receipt of SMT. Prehospital interventions of wound dressing, tourniquets, and IO access were more frequent in the SMT cohort. Our research determined that hypotension was associated with SMT, but tachycardia was not a reliable predictor of SMT over MT.

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