Hussmann et al. BMC Emergency Medicine (2019) 19:13
https://doi.org/10.1186/s12873-019-0221-x

BMC Emergency Medicine

RESEARCH ARTICLE Open Access

Enhanced prehospital volume therapy does not lead to improved outcomes in severely injured patients with severe traumatic brain injury

Bjoern Hussmann[1*], Carsten Schoeneberg[1], Pascal Jungbluth[2], Matthias Heuer[3], Rolf Lefering[4], Teresa Maek[1], Frank Hildebrand[5], Sven Lendemans[1] and Hans-Christoph Pape[6]

Abstract

Background: Whether enhanced prehospital volume therapy leads to outcome improvements in severely injured patients with severe traumatic brain injury (TBI) remains controversial. The aim of this study was to investigate the influence of prehospital volume therapy on the clinical course of severely injured patients with severe TBI.

Methods: Data for 122,672 patients from TraumaRegister DGU® (TR-DGU) was analyzed. Inclusion criteria were defined as follows: Injury Severety Score (ISS) ≥ 16, primary admission, age ≥ 16 years, Abbreviated Injury Scale (AIS) head ≥3, administration of at least one unit of packed red blood cells (pRBCs), and available volume and blood pressure data. Stratification based on the following matched-pair criteria was performed: group 1: prehospital volumes of 0-1000 ml; group 2: prehospital volumes of ≥1501 ml; AIS head (3, 4, 5 + 6 and higher than for other body regions); age (16-54, 55-69, ≥ 70 years); gender; prehospital intubation (yes/no); emergency treatment time +/− 30 min.; rescue resources (rescue helicopter, emergency ambulance); blood pressure (20-60, 61-90, ≥ 91 mmHg); year of accident (2002-2005, 2006-2009, 2010-2012); AIS thorax, abdomen, and extremities plus pelvis.

Results: A total of 169 patients per group fulfilled the inclusion criteria. Increasing volume administration was associated with reduced coagulation capability and reduced hemoglobin (Hb) levels (prothrombin ratio: group 1: 68%, group 2: 63.7%; $p \leq 0.04$; Hb: group 1: 11.2 mg/dl, group 2: 10.2 mg/dl; $p \leq 0.001$). It was not possible to show a significant reduction in the mortality rate with increasing volumes (group 1: 45.6, group 2: 45.6; $p = 1$).

Conclusions: The data presented in this study demonstrates that prehospital volume administration of more than 1500 ml does not improve severely injured patients with severe traumatic brain injury (TBI).

Keywords: Trauma, Prehospital replacement volume, Severe traumatic brain injury, Trauma registry, Hemorrhagic shock, emergency medicine

Background

For severely injured patients, the objective of prehospital volume therapy is to control bleeding and the resulting hemorrhagic shock. In such patients, uncontrollable bleeding following trauma is still considered the most common preventable cause of death [1–4]. The immediate effects of bleeding and shock may result in direct and indirect sequelae in surviving patients. For example, 20% of patients develop multi-organ failure during hospitalization, and 20% experience episodes of sepsis. Multi-organ failure and septic conditions, in addition to thromboembolic complications, increase mortality after severe trauma significantly [5]. Hence, hemorrhagic shock and its consequences represent the second most common cause of death, with severe traumatic brain injury (TBI) being the number one cause of death [6]. It is difficult to treat patients with severe TBIs in a prehospital setting. Currently, two therapy options for severe

* Correspondence: bjoern.hussmann@krupp-krankenhaus.de
[1]Trauma Surgery Department, Alfried Krupp Hospital, Alfried-Krupp-Str. 21, 45131 Essen, Germany
Full list of author information is available at the end of the article