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EDITORIAL

# A personalized medicine approach is warranted for optimal prehospital fluid resuscitation in the severely injured adult trauma patient

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Unfortunately, trauma remains the most common cause of death in the under 40-year-old population. Resuscitation of trauma patients is one of the most challenging aspects of emergency medicine, as immediate decisions with life-changing consequences must be made with little or no relevant clinical information. Clinicians must coordinate multiple time-sensitive interventions in a race to save their patient's life. One such time-sensitive intervention is the administration of intravenous (IV) fluids in patients with obvious hemorrhage or systolic blood pressure below 90 mm Hg. The administration of IV fluids is a critical intervention because bleeding is responsible for 30–40% of trauma mortality; of these deaths, 33–56% occur in the prehospital setting [1].

If resuscitation of the trauma patient wasn't challenging enough, practice paradigms have evolved without adequate investigations to guide best practice truly. The administration of IV fluids is a good example. The optimal degree of fluid resuscitation in the initial control and resuscitative phase of trauma care remains controversial due to patchy or contradictory evidence. The concept of hypotensive resuscitation in trauma patients was introduced as far back as 1918 and reiterated after World War II [2]. However, animal research in the 1950s and 1960s found value in supplementing the replacement of lost blood in trauma patients with both whole blood and balanced salt solution [2]. In recent years, there has been a shift from IV crystalloid administration to replacing lost blood with blood products. This shift makes intuitive sense as our patients bleed blood and not salty water, but this is far from the complete picture. Can we, and more importantly, should we get rid of non-blood products altogether? Is this even feasible?

In this issue of the Canadian Journal of Emergency Medicine (CJEM), Hebert and colleagues ask: Should we administer IV fluids at all to trauma patients in the prehospital setting [3]? They conducted a systematic review and meta-analysis to address this question with a primary outcome of 30-day all-cause mortality. They concluded that less might be more regarding prehospital IV fluid management in severely injured adult trauma patients [3]. Seven studies (six observational and one randomized trial) were included in the systematic review (3050 study participants). The authors determined that standard IV fluid administration has no significant mortality benefit over restricting/withholding IV fluids in severe hypotensive trauma. However, prehospital emergency care physicians and professionals must take these results with a grain of salt, as the systematic review authors identified few eligible studies, and the strength of the evidence was low as most studies were observational.

Furthermore, the only randomized trial included in the systematic review is a pilot trial performed to assess the feasibility and safety of controlled resuscitation (CR) versus standard resuscitation (SR) for the early resuscitation of patients with traumatic shock due to blunt or penetrating mechanisms [4]. The primary feasibility endpoint of the trial was early crystalloid volume (ECV), defined as crystalloid infused from emergency medical services (EMS) arrival at

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the scene until the end of the study period, which extended from out-of-hospital enrollment until two hours into the hospital stay or until hemorrhage control was achieved, whichever occurred first. The primary safety endpoint was 24-h mortality. The study was not powered to determine the superiority of one intervention over the other. While the difference in 24-h mortality (5.2% versus 14.7%) and in-hospital mortality (8.4% versus 16.5%) was not statistically significant between the comparator interventions, it did favor CR. However, because it was a pilot trial, the findings may be hypothesis-generating but are not definitive.

Hebert and colleagues did not prospectively register and publish a protocol for the systematic review [3]. The failure to prospectively register and publish a protocol is another significant limitation of their findings because these are critical elements in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist. Pre-registering and publishing a systematic review protocol provide transparency in the review process and safeguards against publication bias.

The controversy over prehospital fluid resuscitation in trauma has been ongoing for several decades, with a lack of high-quality evidence to guide our approach. Trauma patients are a phenotypically heterogeneous group, and it is intuitively illogical to seek a 'one-size-fits-all' prehospital fluid resuscitation strategy. A personalized medicine approach to prehospital fluid resuscitation entails a paradigm shift away from a 'one-size-fits-all' to a strategy that considers the individual needs of trauma patients. Such a tailored approach in which critical treatment decisions are made on a case-by-case basis and weighing the risk of aggravating bleeding against optimizing hemodynamic parameters while administering IV fluids has been previously proposed [5]. With a personalized approach, clinical decision-making considers critical confounding factors, such as age, optimal blood pressure, traumatic brain injury, traumatic injury patterns, prehospital transport times, and amount and types of resuscitation fluids (including crystalloids, colloids and blood products).

Hebert and colleagues are to be congratulated for providing a balanced assessment of the existing evidence for administering a small amount or no IV fluids prehospital versus standard resuscitation on mortality in adult major trauma patients. They highlight an important concept that deserves considerable attention and demonstrates that data supporting prehospital IV fluids in trauma care is incomplete at best.

So, should we start moving away from prehospital IV fluid resuscitation in severely injured adult trauma patients? Tempting, but not yet. Too many unanswered questions remain that warrant further investigation. The current prehospital fluid resuscitation controversies are due to the heterogeneous nature of trauma patients in existing studies. Small clinical trials in multiple, tightly controlled, relatively homogeneous trauma patient subgroups (to limit phenotypic variability) may have better internal and external validity in addressing some of the current controversial aspects of prehospital fluid resuscitation in trauma.

## Declarations

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

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