



Targeting hyperosmolar therapy in pediatric traumatic brain injury

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Comment on: Rallis D, Poulos P, Kazantzzi M, *et al.* Effectiveness of 7.5% hypertonic saline in children with severe traumatic brain injury. *J Crit Care* 2017;38:52-6.

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In a recent issue of this Journal, Rallis *et al.* report on the effectiveness of 7.5% hypertonic saline (HTS) for the treatment of raised intracranial pressure (ICP) in children with severe traumatic brain injury (TBI) (1). This is a highly relevant and timely contribution. Across all ages, the incidence of TBI is highest in the age group 0–4 years. Data from the Centers for Disease Control (CDC) in the US show that US emergency department visits for TBI increased by 37.8% between 2007 and 2013 for the 0–4 years, to 1,592 cases per 100,000 people (2). The disease course in children with TBI can be very different from adults and is often characterized by substantial brain swelling causing raised ICP.

In their study, Rallis *et al.* administered a total of 136 HTS infusions to 29 children with raised ICP who insufficiently responded to mannitol infusions. These patients formed the large majority of a case series of 36 patients undergoing ICP monitoring. Of these 36, two did not require any hyperosmolar therapy and five responded well to mannitol. The overall response rate to mannitol was therefore 15%. In the non-responders to mannitol, the authors describe a significant reduction of ICP for at least 2 hours in the overall population. The data presented, however, do not permit calculation of the number of responders. Nevertheless, it would appear that HTS administration resulted in a lasting reduction of ICP in the majority of patients as the median number of HTS administrations per patient per day was only 1.5.

If that be the case, might the ostensibly better response

to HTS compared to mannitol simply reflect a greater osmolar load or could it be related to a different mechanism of action? As the authors describe, mannitol is primarily a dehydrating agent and may lead to fluid depletion, in particular in patients with relative hypovolaemia. Conversely, HTS is considered a “small volume resuscitation fluid” that leads to intravascular volume expansion. This effect may be more relevant to children than to adults. These considerations point to the need to better understand the pathophysiologic mechanisms ongoing in individual patients and to the opportunities then provided to target therapeutic modalities more appropriately—in line with the concept of precision medicine (3). Advanced monitoring may help in this regard, but also—as the authors have done—careful observation of response to therapy.

It would be important to know if the raised ICP in children mainly results from edema, as the authors presume, or that it may more reflect a vascular phenomenon with dilation of cerebral vessels. Improving volume status (as may be accomplished by HTS), mild hyperventilation or barbiturates might then be the treatment of choice. Although perhaps difficult to accomplish in routine clinical settings, differentiation between cytotoxic/vasogenic edema and vasodilation as cause of raised ICP might be obtained in research-oriented settings utilizing for example, magnetic resonance (MR) examinations and other advanced monitoring modalities. It is important that such studies are not restricted to adult patients, but also target the pediatric patient with TBI.

TBI can be considered “the most complex disease in the most complex organ”. The complexity is even further multiplied in the developing brain.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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