The Role of Ventriculostomy in Severe Traumatic Brain Injury in Children—
to Drain or Not to Drain?

Ann-Christine Duhaime, MD; Patricia B. Raksin, MD

Despite their epidemiologic and functional importance, there is a dearth of clear data to determine the most effective strategies for managing severe traumatic brain injury (TBI) in children. The study by Bell et al1 attempts to fill some of the data gaps with an observational comparative effectiveness study to assess the associations of use of external ventricular drainage (EVD) vs parenchymal intracranial pressure (ICP) monitors with Glasgow Outcome Score–Extended Pediatric version (GOS-EP) score at 6 months postinjury, and with ICP during the acute care stage. From an overall pool of 1000 children, Bell et al1 used propensity matching to compare 98 pairs of children with and without ventriculostomies in a nonrandomized, intention-to-treat design. They found that there was no significant difference in GOS-EP between groups at 6 months but that the patients who received EVD had lower ICP during their acute care.1 Bell et al1 conclude that use of ventriculostomy drainage as a front-line treatment should be reconsidered.

This is the largest study, to our knowledge, to look closely and specifically at the efficacy of EVD in children with severe TBI, from a multisite, international network that has shown admirable success in collecting large amounts of data in children with TBI who undergo ICP monitoring. This is a significant accomplishment that contributes additional data regarding the potential benefit of CSF drainage within a specific context.

Choice of parenchymal monitor vs ventriculostomy was not randomized in the study by Bell et al,1 and the authors acknowledge at the outset that significant variability exists with respect to practice. The inclusion of centers spanning 8 countries and 5 continents ensures heterogeneity with respect to patient population, local resources, and individual practitioner approach. Surveys of trauma research networks have shown that most centers have both types of monitors available, and individual clinicians may choose one over the other, depending on the situation.2 From the surgeon’s point of view, the decision often is based on constellations of findings suggesting an injury pattern with a high risk for current or potentially evolving ICP elevation in the setting of acceptable risk for drain placement. In the study by Bell et al,1 approximately one-third of the patients underwent CSF drainage; two-thirds did not. Bell et al1 chose to use a propensity matching scheme in an attempt to overcome these differences. While such approaches can be helpful in comparative effectiveness studies, they still may miss combinations of factors that can influence both choice of treatment and outcome.

Bell and colleagues1 note that in the 2019 update of the “Guidelines for the management of pediatric severe traumatic brain injury,”3 a weak-level recommendation for CSF drainage to treat elevated ICP was based on level III evidence from 56 children from 3 publications.3 In the companion treatment algorithm to that update, Kochanek et al4 suggest CSF drainage as a “tier 1” option specifically for treatment of raised ICP.4 Since those publications, a randomized single-center study of placement of parenchymal monitor or ventriculostomy in patients with severe TBI involving 122 children aged 14 years and older as adults, all treated with a standard Brain Trauma Foundation–based protocol, found that patients with ventriculostomies had lower ICP and better 6-month outcomes by GOS, with similar demographic and injury factors between groups.5 All such studies come with a caveat about outcomes. Global measures, such as GOS and GOS-EP, may miss subtle neurocognitive or behavioral differences, and, additionally, large prospective observational studies have found that outcomes continue to evolve well beyond the 6-month time point.6

Open Access. This is an open access article distributed under the terms of the CC-BY License.
For these reasons, it might be reasonable to deemphasize the negative conclusion with regard to GOS-EP–determined outcomes, as CSF drainage is but a single variable with the potential to impact outcome. That is why the overall approach to treatment of patients with severe TBI involves multifaceted, interwoven interventions that most often are tailored to the specific patient at hand. While Bell et al1 were unable to demonstrate a significant GOS-EP–determined association for CSF drainage alone, this lack of differences in a broadly defined intermediate-term outcome measure that depends on many variables should not detract from their demonstration of a beneficial association of CSF drainage with lower ICP, especially in the setting of swelling-prone injuries, in which tissue shifts or other deleterious aspects of elevated pressure may be avoided. Because ventriculostomy has a real, although relatively low, risk, the study by Bell et al1 demonstrates why in a subset of patients assessed to have a risk of ICP elevation, it appropriately remains in the armamentarium of the treating neurosurgeon and critical care team. With large data sets, such as those collected in this study,1 future analyses may further refine our understanding of the characteristics of children most likely to benefit from this and other medical and surgical interventions.

REFERENCES