

## Traumatic Brain Injury in Children: Review Questions

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### QUESTIONS

Choose the single best answer for each question.

- Which one of the following statements regarding the epidemiology of traumatic brain injury (TBI) in the United States is correct?**
  - There are more than 2 million head injuries every year in the United States
  - Fewer than 100,000 patients with TBI are admitted to the hospital each year in the United States
  - Pediatric TBI survival is better than that of similarly injured adults
  - 75,000 children die or become permanently disabled because of head injuries every year in the United States
  - Head injuries are the leading cause of death and disability in children and adolescents
- Which of the following factors has the greatest predictive value in the development of seizures following head trauma?**
  - Patient age
  - Occipital lobe injury
  - Concomitant use of illicit drugs
  - Glasgow coma score (GCS)  $\leq 8$
  - Generalized brain injury
- Which one of the following statements regarding hyperventilation using assisted ventilation ( $\text{PaCO}_2 \leq 25$  mm Hg) in the setting of TBI in children is correct?**
  - It has no significant role except in certain patients who are deteriorating rapidly
  - It should be used in all children regardless of the presence of elevated intracranial pressure (ICP)
  - It is effective for several days after the initial injury occurs
  - It produces cerebral vasodilatation
  - It is associated with an improved neurologic outcome when compared with patients who are kept normocapnic
- All of the following measures can be used in attempting to control elevated ICP in children with TBI EXCEPT:**
  - Elevate the head of the bed to 30 degrees
  - Administration of mannitol
  - Pentobarbital
  - Therapeutic hyperthermia (core temperature  $> 38.5^\circ\text{C}$ )
  - Ventriculostomy with cerebrospinal fluid removal

*(turn page for answers)*

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### ANSWERS AND EXPLANATIONS

1. **(C) Pediatric TBI survival is better than that of similarly injured adults.** TBI is the leading cause of death and disability in children and young adults; approximately 25,000 children die or become permanently disabled because of head injuries every year.<sup>1</sup> It is estimated that there are nearly 1.6 million head injuries every year in the United States, with more than 250,000 of these patients being admitted to the hospital.<sup>2,3</sup> The survival of children with head injuries is better than that of similarly injured adults.<sup>4</sup>
2. **(D) GCS  $\leq$  8.** The factor most predictive of posttraumatic seizures is a GCS of  $\leq$  8; 38.7% of patients with a GCS of  $\leq$  8 will develop seizures compared with 3.8% of patients with a GCS  $>$  8. Patient age, occipital lobe injury, concomitant use of illicit drugs, and generalized brain injury have not been shown to be predictive of posttraumatic seizures.<sup>2</sup>
3. **(A) It has no significant role except in certain patients who are deteriorating rapidly.** Therapeutic hyperventilation using assisted mechanical ventilation ( $\text{PaCO}_2 \leq 25$  mm Hg) was once considered a cornerstone in the management of TBI because it causes a rapid reduction in ICP. However, hyperventilation reduces ICP by causing cerebral vasoconstriction with a subsequent reduction in cerebral blood flow. Studies have demonstrated that when hyperventilation is used in children with severe head injury, there is an increased risk of brain ischemia and worse neurologic outcomes. Based on this data, chronic hyperventilation is no longer recommended.<sup>5</sup> Short-term hyperventilation, however, has a role in reducing ICP in patients who are rapidly deteriorating before other measures can be instituted.
4. **(D) Therapeutic hyperthermia (core temperature  $>$  38.5°C).** Experimental and initial clinical data suggest that moderate hypothermia (33°C) for 24 hours after severe head injury may improve outcome,<sup>6</sup> but therapeutic hyperthermia has no role in this setting.

Elevation of the head of the bed to 30 degrees increases venous drainage, thereby decreasing intravascular volume in the skull.<sup>7</sup> In patients with a ventriculostomy, cerebrospinal fluid removal may be effective in reducing ICP.<sup>2</sup> Mannitol (a hyperosmotic agent) may be used to decrease cerebral interstitial fluid.<sup>8</sup> However, mannitol should not be used unless the child is hemodynamically stable or shows clinical or radiographic signs of impending herniation. Although mannitol can increase cerebral blood flow and decrease ICP in patients with head injury, prolonged administration may lead to intravascular dehydration, hypotension, and prerenal azotemia as well as a reduction of cerebral blood flow. The benefit of mannitol in head injured patients has yet to be determined. Pentobarbital may be used to control agitation and thus prevent further elevation of ICP.

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