of correct tube placement (100% vs. 70%). The inability of the $ETCO_2$ detector to correctly identify 11 of 37 anatomically correct ETT intubations among arrested patients suggests that, in this patient population, $ETCO_2$ assessment is not a reliable indicator of ETT placement. Macleod and colleagues[1] reported similar limitations in a 1991 study.

A negative test with either device will lead emergency physicians to re-examine the patient and verify ETT placement. With only one true negative in this series, and the false-negative test reflecting a blocked tube that may have been appropriate to replace anyway, a 50% NPV for the EDD is statistically meaningless.

One remaining caveat is that, in studies to date, there have been inadequate numbers of incorrectly placed endotracheal tubes to ascertain whether the EDD will correctly identify these incidents. It should be noted that there are only 4 reported false positives in the world literature describing the use of EDD.[2]

Recommendations

The EDD is a quick, portable, easy to learn and accurate device for initial assessment of correct endotracheal tube placement. It seems to be an appropriate adjunct for both ED and prehospital providers, to quickly assure tube placement. Emergency departments should consider equipping their airway carts with this simple device. Conversely, the $ETCO_2$ detector appears to be more appropriate for continuous monitoring of tube position, ventilation and circulation.

Readers are referred to the original EDD articles by Wee.[3,4]

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SELECTED ARTICLES

Mannitol in head injuries

Clinical questions

In a head-injured patient with evidence of raised intracranial pressure (ICP), should mannitol be given? If so, in what dose and for what time period? How should patients receiving mannitol be monitored?

Article chosen

Schierhout G, Roberts I. Mannitol in acute traumatic brain injury [Systematic Review]. Cochrane Injuries Group. Cochrane Database of Systematic Reviews. Oxford; 1999. Issue 1.

Objectives

1. To compare the impact of dosing and duration on mannitol effectiveness.
2. To compare mannitol effectiveness to other ICP-lowering agents.
3. To quantify mannitol effectiveness at various stages following head injury.

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Date appraised: Apr. 9, 1999
This article has been peer reviewed.

Background

A 1995 survey by Ghajar[1] reported that 83% of US centres used osmotic diuretics in over half of severely head-injured patients. Authors of similar surveys report that 100% of neurosurgical centres in the UK use mannitol.[2,3] The 1995 Brain Trauma Foundation Guidelines[4] recommend that mannitol be reserved for patients with signs of raised ICP

or deteriorating neurological status. The effectiveness of mannitol is not well quantified.

The search

Studies were identified using the Cochrane Injuries Group (CIG) database, which is updated every 3 months. This database includes relevant articles published between 1966 and 1996 that were indexed as "randomized controlled trials" or "controlled clinical trials." In addition, 46 journals and 23 conference proceedings were hand searched. Reviewers contacted the authors of all identified studies to locate other published or unpublished trials.

Study selection

Trials were included in the review only if the subjects had suffered an acute traumatic brain injury and were assigned to mannitol treatment versus a control treatment. Control treatments included different doses of mannitol, other ICP-lowering agents, or standard care only. Crossover trials were excluded. Outcome measures included mortality and morbidity rates, and recovery comparisons between groups. Two independent reviewers evaluated the studies to determine whether they met review inclusion criteria. These reviewers corresponded with the trial authors to clarify questions and obtain additional data.

Main results

Of the studies identified, only 3 fulfilled review inclusion criteria. In these, death was the outcome measure chosen for comparison. One[5] of the 3 studies compared ICP-directed mannitol therapy to "standard care" in 77 patients and reported a possible outcome improvement with mannitol (relative risk [RR] for death = 0.83; 95% CI, 0.47 to 1.46). The second study[6] compared mannitol to pentobarbital in 59 patients and reported a similar outcome favouring mannitol (RR for death = 0.85; 95% CI, 0.52 to 1.38). The third study[7] compared prehospital mannitol to placebo in 41 patients, finding no differences in systolic blood pressure during a 2-hour observation period, and a trend toward worse outcomes in the mannitol group (RR for death = 1.59; 95% CI, 0.44 to 5.79).

Conclusion

The authors concluded that mannitol therapy for raised ICP may reduce mortality rate more than pentobarbital, that ICP-directed mannitol treatment may be better than using clinical parameters alone, and that insufficient evidence exists to recommend one form of mannitol infusion over another. There are insufficient data to make any recommendations about prehospital mannitol use.

Source of funding

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Commentary

Systematic reviews are often helpful in clarifying "best practice" when a number of studies, often with small sample sizes, provide conflicting evidence. They may be less helpful, however, when the majority of available literature is observational. This well-designed systematic review, which avoided selection and publication bias, is both interesting and thought provoking in that the authors were unable to find sufficient evidence to accomplish their stated objectives.

Trauma is the leading cause of death from ages 1 to 44. Head injury is an important determinant of outcome in half of all trauma deaths. Mannitol has been employed to reduce brain swelling for more than 40 years and is considered standard therapy for severely head-injured patients with elevated ICP; yet these authors found only two studies[6,7] that randomized head injury patients to mannitol vs. an alternate therapy (total $n = 100$ patients).

In this systematic review and another published in 1998,[8] Schierhout and coworkers cite the lack of evidence that mannitol is effective, and suggest that this is an ideal opportunity to conduct randomized controlled trials to define the role of mannitol in head-injured patients. However, lack of evidence of effectiveness does not constitute evidence of ineffectiveness, and too many clinicians have witnessed dilated pupils normalize after a mannitol bolus; therefore it is unlikely that placebo controlled trials will be clinically or ethically acceptable. Moreover, unless new osmotic agents are developed that can be compared to mannitol, future randomized clinical trials should focus on determining the most effective dose of mannitol. Finally, future researchers will have to monitor intermediate outcomes and adverse effects, since it will be difficult to show statistically significant mortality differences without very large sample sizes.

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Systematic Reviews

Systematic (structured) reviews are preferable to the narrative reviews generally published in medical journals. Systematic reviews define a clear and clinically relevant research question, retrieve previously published reviews, document their limitations, and justify the need for a more comprehensive review. They then define the search strategy used to identify primary articles and the criteria used to select the most valid of these for review. Authors of well done systematic reviews look for unpublished, as well as published studies. A systematic review specifies the method of combining data from different studies, discusses variation within and between studies, and presents specific conclusions, contrasting these with existing literature and standards of care. Authors of systematic reviews should identify the limitations of the review and suggest areas for future research. *CJEM*'s guidelines for systematic review articles are presented on page 141 of this issue. *Evidence-Based Medicine*, *ACP Journal Club*, and *The Cochrane Library* are excellent sources of systematic reviews on a broad range of topics, many relevant to emergency medicine.

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