Active hypothermia in the management of head injuries

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For over half a century scientists and clinicians have been attempting to discover if moderate therapeutic hypothermia (32–34°C) is beneficial in the treatment of severe brain injury. Deep hypothermia (15–22°C) has long been recognized as one method of achieving neuroprotection, but is not without serious implications and risks to the patient. However, hyperthermia among head-injured patients is known to be associated with a worse outcome as compared to a normothermic cohort. Early work suggested that hypothermia could protect the brain after traumatic head injury.

Since then various trials have come to conflicting conclusions, perhaps because of differing trial criteria and design. Trials have differed in the degree and duration of cooling, and in the timing between injury and initiation of cooling. Because moderate hypothermia reduces elevated intracranial pressure many centres have introduced cooling into protocol-driven treatment regimens for brain injury, despite no evidence that it improves outcome.

In 2001 the results of the National Acute Brain Injuries Study: Hypothermia (NABIS:H) were published (Clifton et al, 2001). This trial began in 1994 and aimed to collect data on 500 patients who were randomized to receive either normothermic or hypothermic treatment (33°C within 6 hours of a closed head injury and maintained for 48 hours). It was halted in 1998 after collecting data on only 392 patients, because hypothermia was not effective in improving outcome.

Importantly this study found that individuals over the age of 45 years in the hypothermic group had a higher incidence of 'poor outcomes' as compared to normothermic patients of the same age. Another observation was that individuals who were spontaneously hypothermic on admission to the emergency department appeared to have more severe brain injuries.

Marion et al's study in 1997 came to the opposite conclusion. They found that moderate hypothermia (33°C initiated a mean of 10 hours post closed head injury for 24 hours) in patients with severe traumatic brain injury (Glasgow Coma Score 5 to 7 on admission) hastened recovery and may have improved outcome. These results, however, may have been caused by a detrimental effect of active rewarming of spontaneously hypothermic patients randomized to the normothermic treatment group. Patients admitted who were already hypothermic and were assigned to the normothermic group in the NABIS:H study (Clifton et al, 2001) were allowed to warm spontaneously over 24 hours.

In 2002 the issue was addressed in a Cochrane review entitled 'Therapeutic hypothermia for head injuries' (Gadkary et al, 2002). This meta-analysis studied 12 randomized controlled trials with a total of 812 participants comparing mild hypothermia (34–35°C for at least 12 hours duration) *vs* normothermia in patients admitted with closed head injuries. The analysis revealed no evidence overall to support the hypothesis that hypothermia benefits head injured patients. Furthermore it highlighted that fact that active cooling of patients significantly increases the risk of developing pneumonia.

IMPORTANCE OF TIMING

Perhaps of importance to all the recent studies is the precise timing of the initiation of cooling. Early animal studies showed that cooling was effective at reducing brain injury if initiated within 90 minutes of the injury occurring. In the two studies mentioned the average time from injury to target temperature were 8 (Clifton et al, 2001) and 10 hours (Marion et al, 1997) respectively. Could it be that we are just not able to initiate cooling early enough (for practical reasons) to see a beneficial outcome?

CONCLUSION

With the evidence available to date, it seems that active cooling of head injury patients is not effective in improving outcome after head injury. In addition, the active warming of patients with severe head injuries who present with spontaneous hypothermia (a practice commonly adopted with 'trauma' patients in the accident and emergency department) may be detrimental (Narayan, 2001). However, pyrexia should be avoided. HM

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