Protocol management of severe traumatic brain injury in intensive care units: a systematic review

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CRD summary
The review concluded that management protocols (or care pathways) for severe traumatic brain injury were associated with reductions in death rate and improved neurologic outcome, although no definitive conclusions about efficacy can be made due to limitations of the included studies. These conclusions were suitably cautious in reflecting the limited evidence available, and the recommendations for further research were appropriate.

Authors' objectives
To compare the use of management protocols (or care pathways) versus usual care for adult intensive care unit patients with acute severe traumatic brain injury.

Searching
Ten databases (including MEDLINE, EMBASE, and DARE) were searched with no language restrictions up to April 2011. The search strategy was reported as a separate online appendix. Grey literature was identified by searching relevant conference proceedings and web sites. Reference lists of included studies and relevant reviews were also handsearched.

Study selection
Randomised controlled trials and observational studies that compared protocol-based care with a control group were eligible for inclusion; the control group had to be managed by usual care with no protocol-based care. Eligible participants were adult patients (age 18 years and older) with severe traumatic brain injury (post-resuscitation Glasgow Coma Scale score ≤8). Protocols must have been based on the medical management (with or without decompressive craniotomy) of patients in an intensive/acute care unit setting. The primary outcome was Glasgow Outcome Scale score at six months (or later).

In all but one of the studies, patients were managed on the principles endorsed by the Brain Trauma Foundation guidelines. Most intervention protocols consisted of intracranial pressure/cerebral perfusion pressure targeted algorithms or descriptive algorithms. Most studies were set in Europe or the USA. In around half the studies, the control group enrolment periods preceded the existence of management guidelines. Mean admission Glasgow Coma Scale scores of participants ranged from 3.5 to 6.9. Mean patient ages ranged from 29.5 to 41.4 years; around two-thirds were men.

Two reviewers independently selected studies.

Assessment of study quality
Studies were awarded a score out of 32 using a modified Downs and Black checklist. Two reviewers independently performed the assessments.

Data extraction
Data were extracted to obtain odds ratios with 95% confidence intervals. A favourable Glasgow Outcome Scale score was defined as 4 or 5; an unfavourable score was defined as 1, 2, or 3.

Two reviewers independently extracted data, with disagreements resolved by discussion, or by a third reviewer.

Methods of synthesis
Meta-analyses were performed to calculate pooled odds ratios with 95% confidence intervals, using a random-effects model. Heterogeneity was assessed using $I^2$. Pre-specified sensitivity analyses assessed the effect of risk of bias, use of co-interventions, and protocols designed in accordance with the Brain Trauma Foundation management guidelines.
Results of the review

Thirteen observational studies were included in the review. Sample sizes ranged from 24 to 830 patients. Six studies were retrospective. Eleven studies used a historic control group. Downs and Black quality scores ranged from 9 to 20, out of 32. Common problems included lack of power, risk of confounding and study reporting.

The use of management protocols was associated with a favourable neurological outcomes (as defined by Glasgow Outcome Scale scores) at six months (OR 3.84, 95% CI 2.47 to 5.96; I²=33%; five studies) but not at 12 months (one study). Use of management protocols was associated with reduced mortality at hospital discharge (OR 0.74, 95% CI 0.47 to 1.15; I²=81%; eight studies) and six months (OR 0.33, 95% CI 0.13 to 0.82; I²=68%; four studies), but not at 12 months (one study). Exclusion of the three studies with clear co-interventions increased the size of effect and removed the heterogeneity from the analyses for neurological outcomes at six months and mortality at six months (both I²=0%). Meta-regression analyses were not possible due to the small number of included studies.

Further results were reported in a narrative synthesis.

Authors’ conclusions

Management protocols for severe traumatic brain injury were associated with reductions in death rate and improved neurologic outcomes. Although no definitive conclusions about efficacy could be made, the review results should encourage the conduct of randomised controlled trials to more rigorously examine the efficacy of management protocols for severe traumatic brain injury.

CRD commentary

The review addressed a clear question and was supported by reproducible eligibility criteria. Efforts to identify relevant studies were undertaken using several methods (including attempts to identify unpublished studies) with no language restrictions. Suitable methods (such as independent duplicate processes) were used to reduce the risk of reviewer error and bias throughout the review.

Study quality/risk of bias was assessed, with the results used appropriately to inform interpretation of the review results. Appropriate methods were used to pool data and to assess and investigate heterogeneity.

The authors’ conclusions were suitably cautious in reflecting the limited evidence available, and their recommendations for further research were appropriate.

Implications of the review for practice and research

Practice: The authors did not state any implications for practice.

Research: The authors stated that the review results should encourage the conduct of randomised controlled trials to more rigorously examine the efficacy of management protocols for severe traumatic brain injury.

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