Pre-hospital tracheal intubation in patients with traumatic brain injury: systematic review of current evidence
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CRD summary
The authors concluded that available evidence did not provide support for any benefit from pre-hospital intubation and mechanical ventilation in traumatic brain injury. Overall the review was well-conducted and clearly reported. The authors’ conclusions reflected the limited evidence from poor quality studies and are likely to be reliable.

Authors’ objectives
To evaluate the harms and benefits of pre-hospital tracheal intubation and mechanical ventilation in patients with traumatic brain injury.

Searching
MEDLINE, EMBASE, CINAHL and the Cochrane Library were searched for studies published in full, in any language, up to December 2007. Search terms were reported. Reference lists in retrieved reports and reviews were screened. Meeting abstracts and letters were excluded.

Study selection
Studies of any design that compared patients with traumatic brain injury receiving pre-hospital tracheal intubation plus mechanical ventilation versus those receiving another type of pre-hospital airway management were eligible for inclusion. Studies had to assess patient-relevant outcomes, such as mortality or functional outcome at hospital discharge; studies were excluded if they assessed surrogate outcomes. Studies of patients with multiple injuries were included provided data from patients with traumatic brain injury were reported separately.

The review assessed benefits (in-hospital mortality and functional outcomes reported using discharge destination or a scoring system) and harms (side-effects or complications including pneumonia and procedure failure).

Most of the included studies were conducted in the United States and were based on data collected from 1985 to 2004. Where reported, studies were in adults, children or mixed age groups (the median age ranged from one to 59 years); just under half of the studies were in children. Where reported, the median or mean Abbreviated Injury Score of the head region ranged from 2.7 to 5.1, Glasgow Coma Scale scores ranged from 3 to more than 9, and the mean or median Injury Severity Score (ISS) ranged from 18 to 39.8. Four studies reported use of bag-valve-mask ventilation or spontaneous breathing; in the other studies control interventions were not clear.

Two reviewers independently selected studies.

Assessment of study quality
Reviewers independently classified each study according to the grading system described by the Brain Trauma Foundation: class 2 (ii) evidence from moderate quality randomised controlled trial or good quality cohort or case-control study; class 3 (iii) evidence from poor quality RCTs, moderate or poor quality cohort or case-control study, case series, database or registry study. No class 1 (i) studies (good quality RCTs) were included in the review. Disagreements were resolved by discussion with a third reviewer. In addition, the authors discussed other aspects of quality, including differences between treatment and control groups, adjustment for confounding and adequacy of reporting.

Data extraction
Dichotomous data were extracted for the latest time period as reported in papers. Unadjusted odds ratios and absolute risk differences, with 95% confidence intervals (CI), were calculated.

Two reviewers extracted data. This was checked by another two reviewers and disagreements were resolved by consensus.
Methods of synthesis
The studies were combined in a narrative synthesis. Forest and L’Abbe plots were used to assess heterogeneity.

Results of the review
A total of 17 studies (n=15,335 patients) were included. These included one controlled trial (n=61 patients), one case-control study (n=670 patients), three cohort studies (n=375 patients) and 12 retrospective analyses of databases (n=14,229 patients). For study quality, three were class 2 studies and 14 were class 3 studies. Methodological flaws included the following: lack of randomisation; statistical adjustment for important confounding factors; description of control intervention and harms outcomes and information on drop-outs; historical control groups; and short-term outcomes. The maximum duration of follow-up was up to six months or hospital discharge.

In-hospital mortality (15 studies): Unadjusted odds ratios for in-hospital mortality ranged from 0.17 (95% CI 0.10 to 0.31) favouring control interventions to 2.43 (95% CI 1.78 to 3.33) favouring pre-hospital intubation); the absolute difference ranged from -21.8% to 38.2%; adjusted odds ratios (seven studies) ranged from 0.24 (95% CI 0.11 to 0.49) to 1.42 (95% CI 0.13 to 1.78).

Functional outcomes (five studies): Results were mixed. Three of five studies, assessing outcome by post-hospital destination, reported improved outcomes in control groups; one favoured pre-hospital intubation; and one small study findings were inconclusive. Two of six studies, assessing functional outcomes using various scoring systems, reported improved outcomes in pre-hospital intubation groups; two studies favoured control groups; and two studies findings were inconclusive.

Harms (seven studies): Pre-hospital intubation failure rates or complications ranged from 2.1% to 41.1% (five studies).

Pneumonia (three studies): All three studies reporting this outcome reported a higher risk of pneumonia in pre-hospital intubation groups.

Authors’ conclusions
Available evidence did not provide support for any benefit from pre-hospital intubation and mechanical ventilation in patients with traumatic brain injury.

CRD commentary
The review question was clearly stated and inclusion criteria appropriately defined. Criteria for study design were appropriately broad. Several relevant sources were searched, but no attempts were made to minimise publication bias and it was not clear if attempts were made to reduce language bias. Appropriate methods were used to minimise reviewer error and bias during the review process.

Although the validity assessment was based on grading studies according to a hierarchy of study design, some relevant limitations of the included studies were discussed. In view of the differences between studies, a narrative synthesis was appropriate.

Overall, the review was well-conducted and clearly reported. The authors’ conclusions reflected the limited evidence from poor quality studies and are likely to be reliable.

Implications of the review for practice and research
Practice: The authors stated that decisions about pre-hospital intubation should take account of organisation of emergency services, skills of staff, risk of failure and anticipated transport times.

Research: The authors stated that well-designed randomised and non-randomised studies are required to evaluate the harms and benefits of pre-hospital intubation. Future studies should do the following: report the severity of traumatic brain injury and other injuries using standard classification systems; clearly describe control interventions; report intubation training; describe organisational aspects of personnel and hospital; report the volume of patients; adhere to acceptable standards of reporting; collect data on physiological parameters; note any delays in patient management; use validated outcome measures; and report losses to follow-up.
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