Assessment of early tracheostomy in trauma patients: a systematic review and meta-analysis

Dunham C M, Ransom K J

CRD summary
This review concluded that early tracheostomy in brain injured patients is associated with a reduction in the time spent on a ventilator or in an intensive care unit, but that there was no advantage regarding mortality, pneumonia or laryngotracheal pathology. Limitations in the review methods affect the reliability of these conclusions.

Authors' objectives
To assess the benefits of early tracheostomy (ET) in trauma patients.

Searching
PubMed and databases from the Eastern and American Association for the Surgery of Trauma were searched; the search terms were reported. The bibliographies of retrieved articles were also checked. Only English language papers were considered.

Study selection
Study designs of evaluations included in the review
Retrospective studies and randomised controlled trials (RCTs) were eligible for inclusion if their outcomes related to the timing of tracheostomy.

Specific interventions included in the review
Studies comparing ET with late tracheostomy (LT) or with no ET were eligible for inclusion. The timing for ET ranged from 3 to 8 days, and for LT from 7 to more than 28 days.

Participants included in the review
Studies of trauma patients were eligible for inclusion. One study assessed burn patients, three assessed brain injured patients and the rest involved brain injured and non-brain injured patients.

Outcomes assessed in the review
Eligible outcomes were rates of mortality, pneumonia and laryngotracheal pathology, the number of days spent on a ventilator and the number of days spent in an intensive care unit (ICU). A variable representing length of ventilator or ICU stay was derived from the number of either ventilator or ICU days, depending on which was available.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

For dichotomous outcomes, the proportions of participants with each outcome of interest together with p-values for the difference between treatment groups were presented. Relative risks (RRs) and corresponding 95% confidence intervals (CIs) were calculated for data from RCTs. For continuous outcomes, means and standard deviations together with p-values for the difference were presented. Standardised mean differences were calculated for data from RCTs.
Methods of synthesis

How were the studies combined?

The results from all studies were presented narratively in the text and tables according to outcome measure. The results from RCTs were pooled using a fixed-effect meta-analysis.

How were differences between studies investigated?

The heterogeneity of results from RCTs was assessed using a statistical test of heterogeneity (heterogeneity considered to be present if $p<0.05$). Studies responsible for the heterogeneity were identified. Subgroup analysis was used to examine the effect of patient characteristics (brain injured versus non-brain injured).

Results of the review

Six RCTs (n=446) and 7 retrospective studies (n=545 from 5 studies; the sample size was not reported in the other 2 studies) were included.

Mortality (4 RCTs and 5 retrospective studies).

There were no statistically significant differences in mortality rates between ET and no ET (3 RCTs) or between ET and LT (1 RCT and 5 retrospective studies). There was no evidence of any survival benefit for ET in the meta-analysis of 4 RCTs (RR 1.12, 95% CI: 0.74, 1.70; no evidence of heterogeneity, $p=0.36$).

Pneumonia (6 RCTs and 3 retrospective studies). Pneumonia rates were statistically significantly lower in 1 RCT and 2 retrospective studies comparing ET with LT. The meta-analysis of 6 RCTs found no evidence of any benefit for ET (RR 0.94, 95% CI: 0.85, 1.05). There was statistically significant heterogeneity between the studies ($p=0.02$) which disappeared when the trial of ET versus LT was removed from the analysis (the other studies compared ET with no ET), but the overall conclusion remained the same.

Ventilator and ICU days (5 RCTs and 6 retrospective studies). One RCT and 6 retrospective studies reported statistically significant reductions in the number of ventilator or ICU days for ET compared with LT. The meta-analysis of 5 RCTs showed a benefit for ET ($p=0.0002$) although there was significant heterogeneity ($p=0.0008$) between the study results. The heterogeneity was no longer significant when the only trial of ET versus LT was removed from the analysis ($p=0.63$), although there was no longer any evidence of a benefit for ET from the meta-analysis results when excluding this study ($p=0.27$).

The subgroup analysis found that ET was associated with a non-statistically significant reduction in ventilator or ICU days compared with no ET in brain injured patients ($p=0.06$; based on 2 RCTs, n=129), but there was no difference between ET and no ET in non-brain-injured patients ($p=0.79$; based on 3 RCTs).

Laryngotracheal pathology.

Five studies (3 RCTs of ET versus no ET and 2 retrospective studies of ET versus LT) reported laryngotracheal pathology rates, with the retrospective studies finding no tracheal stenosis in any patients and the RCTs finding no significant differences in pathology rates.

Authors’ conclusions

ET is associated with a decrease in the number of ventilator or ICU days in patients with severe brain injuries, but has no influence on mortality rates, pneumonia rates or laryngotracheal pathology. Further research is needed.

CRD commentary

This review had a limited search which was restricted to studies published in English, thus increasing the chance that some relevant studies might have been missed. Inclusion criteria were stated with regard to the outcomes and study design. There was no quality assessment of the included studies and the study selection and data extraction do not appear to have been performed in duplicate, which increases the possibility of introducing errors and bias into the
review process.

The results from RCTs were pooled in meta-analyses, and sources of heterogeneity relating to the timing of tracheostomy were investigated and discussed. Only minimal details about the included studies and patients were provided, for example some studies were just described as retrospective with no further information provided. Evidence about brain injured patients was based on a subgroup analysis which may have been post hoc and which showed no significant difference between treatments. This, in combination with the limited search and reporting of this review, mean that the conclusions should be viewed cautiously.

Implications of the review for practice and research
Practice: The authors stated that ET should be strongly considered for patients with severe brain injury.

Research: The authors stated that additional research was needed but did not provide any recommendations for future research.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.