A meta-analysis of prospective trials comparing percutaneous and surgical tracheostomy in critically ill patients

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Authors' objectives
To perform a meta-analysis of available prospective controlled studies comparing percutaneous dilational tracheostomy and surgical tracheostomy in critically ill patients to more fully understand the relative benefits and risks of these two procedures in this population.

Searching
MEDLINE, Current Contents, Best Evidence, Cochrane and HealthSTAR databases from 1985 onwards were searched using the search term 'percutaneous tracheostomy'. No language restrictions were used.

Study selection
Study designs of evaluations included in the review
Prospective controlled studies directly comparing the two interventions.

Specific interventions included in the review
Percutaneous dilational tracheostomy (PDT) compared to conventional surgical tracheostomy (SCT).

Participants included in the review
Critically ill patients requiring prolonged mechanical ventilation.

Outcomes assessed in the review
The following eight clinical end points were measured where available: procedure time, days intubated prior to tracheostomy, operative complications (all), operative bleeding, postoperative complications (all), postoperative bleeding, sternal infections, and death.

How were decisions on the relevance of primary studies made?
Two authors independently reviewed all of the articles to assess their relevance.

Assessment of study quality
The studies were judged in terms of Sackett's criteria (see Other Publications of Related Interest no.1), e.g. small randomised trials with a moderate risk of either false-negative or false-positive results. Aspects of validity, which are discussed, include method of randomisation, use of a power calculation, adequate description of techniques used and verification of seriousness of patients illness. The authors do not state how the papers were assessed for validity, or how many of the reviewers performed the validity assessment.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction. Data tables reported in the articles include the following types of information: bibliographic details, number of participants, and outcome data.

Methods of synthesis
How were the studies combined?
Odds ratios (OR) (with 95% confidence intervals) were pooled for discrete outcomes using a Mantel-Haenszel fixed-effect model (see Other Publications of Related Interest no.2). For continuous variables the difference in mean values
was used.

How were differences between studies investigated?
Heterogeneity was assessed using the Q statistic.

**Results of the review**
Five studies including three RCTs, one quasi-RCT and one study whose method of treatment allocation was unknown were included (236 patients in total, 115 PDT and 121 SCT).

- All operative complications (n=3 studies) OR=0.73 (95% CI: 0.06, 9.73).
- Operative bleeding (n=3 studies) OR=0.15 (95% CI: 0.02, 0.39) in favour of PDT.
- All postoperative complications (n=5 studies) OR=0.15 (95% CI: 0.07, 0.29) in favour of PDT.
- Postoperative bleeding (n=5 studies) OR=0.39 (95% CI: 0.18, 0.88) in favour of PDT.
- Stomal infections (n=5 studies) OR=0.02 (95% CI: 0.01, 0.07) in favour of PDT.
- Death (n=5 studies) OR=0.63 (95% CI: 0.18, 2.20).

- Overall procedure-related complications (n=3 studies) OR=0.73 (95% CI: 0.06, 9.37).
- Days intubated prior to tracheostomy (n=5 studies) absolute difference=0.16 days (95% CI: -0.9, 1.22) in favour of SCT.
- Operative time (n=4 studies) absolute difference=9.84mins (95% CI: 7.83, 11.85) in favour of PDT.

The studies were homogeneous. Four stated the method of randomisation used, none included a power calculation and only three of the studies verified the seriousness of the patients’ illness. All of the studies used the same dilational technique described by Ciaglia and standard methods of creating a surgical tracheostomy.

**Authors’ conclusions**
Despite its popularity, there are currently only a limited number of small studies prospectively evaluating PDT and surgical tracheostomy. Our meta-analysis of these studies suggests potential advantages of PDT relative to surgical tracheostomy, including ease of performance, and lower incidence of peristomal bleeding and postoperative infection. If confirmed by additional, adequately powered prospective trials, these findings support PDT as the procedure of choice for the establishment of elective tracheostomy in the appropriately selected critically ill patient.

**CRD commentary**
This is a reasonably well-conducted review based on clear inclusion criteria. The authors searched a range of electronic databases. No language restrictions were applied to the search, but no specific attempts were made to locate unpublished data so there is a risk of publication bias. The relevance of the studies was judged independently by two reviewers, but no details were provided about how many reviewers assessed the quality of the studies and extracted the data. The study quality was summarised in a narrative.

The studies were combined appropriately using a fixed-effect model, and the level of heterogeneity between the studies was assessed using a statistical test. The studies were found to be homogeneous although given the small numbers of studies involved, the statistical test may have lacked the power to detect differences between the studies. Overall, in view of the data presented the reviewers' conclusions and implications would appear to be reasonable, although the aforementioned inadequacies of the study should be borne in mind.
Implications of the review for practice and research

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

Research: The authors identify a need to conduct adequately powered prospective studies in order to confirm the findings of this meta-analysis. In addition they state that 'any advantage of PDT compared to SCT with respect to either long-term complications or cost requires further study'.

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