Subglottic secretion drainage for preventing ventilator-associated pneumonia: a meta-analysis

CRD summary
This review assessed the use of subglottic secretion drainage in the prevention of ventilator-associated pneumonia. The authors concluded that, compared with no drainage, drainage reduces the incidence of pneumonia by half in mechanically ventilated patients. The authors’ conclusions about the efficacy of subglottic secretion drainage appear to be supported by the evidence.

Authors’ objectives
To investigate the efficacy of subglottic secretion drainage in preventing ventilator-associated pneumonia (VAP).

Searching
MEDLINE, CINAHL, EMBASE, the Cochrane Library, Current Contents and Biological Abstracts were searched for relevant trials published in any language between January 1966 and May 2003; the search terms were listed. The bibliographies of all relevant articles were checked and the authors of included articles were contacted for details of unpublished studies.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) that evaluated the use of subglottic secretion drainage for preventing VAP were eligible for inclusion.

Specific interventions included in the review
The inclusion criteria specified studies that compared the use of some form of subglottic secretion drainage with no drainage (control group). The included trials implemented subglottic secretion drainage using hourly aspiration with syringe, continuous wall suction, and intermittent wall suction. All trials used some form of stress ulcer prophylaxis and systemic antimicrobial therapy, although the medications used varied between trials. One study also used semirecumbent patient positioning for the intervention and control patients.

Participants included in the review
Studies of mechanically ventilated patients were eligible for inclusion. The included patients were from medical and surgical intensive care units (ICUs). No further details of the participants included in the review were given.

Outcomes assessed in the review
Studies that reported the incidence of pneumonia in both the intervention and control groups were eligible for inclusion. The primary outcome was the risk and incidence rate of VAP, defined as new or progressive infiltrate on chest radiograph plus one other confirmatory finding. In the included trials, the other confirmatory finding included positive bronchoalveolar lavage, positive culture, histology or response to antibiotics.

Other outcomes included length of ICU stay, length of hospital stay, duration of mechanical ventilation and time from intubation to the diagnosis of pneumonia.

How were decisions on the relevance of primary studies made?
Two authors independently conducted the searches. However, the authors did not state how the papers were subsequently selected for the review, or how many reviewers performed the selection.

Assessment of study quality
Validity was assessed and scored using the Jadad scale, which considers the reporting and handling of randomisation, blinding and handling of withdrawals. The maximum possible score was 5 points. The assessment (using the Jadad scale) was performed in a non-blinded manner, but the authors did not state how many reviewers performed the validity assessment.

**Data extraction**

Two authors independently extracted data for the review using standardised forms. A third author resolved any disagreements. In addition to extracting information on the methodology and results, data were extracted on an intention-to-treat (ITT) basis where possible.

**Methods of synthesis**

How were the studies combined?

For dichotomous outcomes, a summary risk or rate ratio (RR) and 95% confidence interval (CI) were calculated using fixed-effect and random-effects models. For continuous outcomes, weighted mean differences between the treatment and control groups were calculated based on non-standardised mean differences weighted by the inverse of their variances.

How were differences between studies investigated?

Heterogeneity between the studies was tested using the chi-squared test. A P-value of less than or equal to 0.05 was considered indicative of statistical heterogeneity. Several sensitivity analyses were planned, one of which repeated the meta-analysis excluding one study that differed from the other studies (only included post-cardiac surgery patients with a shorter duration of mechanical ventilation). The sensitivity analyses used either only ITT data or only non-ITT data.

**Results of the review**

Five RCTs (n=896) were included.

Study quality was moderate (Jadad scores 2 to 4). Two studies reported appropriate randomisation methods. In only one study was the outcome assessor blinded to the intervention. Two of the included studies blinded the radiologists who read the chest X-rays.

Subglottic secretion drainage significantly reduced the risk of VAP (fixed-effect model, RR 0.51, 95% CI: 0.37, 0.71), and significantly reduced VAP (fixed-effect model, RR 0.57, 95% CI: 0.33, 0.97). For bacterial early-onset pneumonia, the RR was 0.38 (95% CI: 0.16, 0.88). No statistically significant heterogeneity was found (P>0.05).

There was significant statistical heterogeneity between the studies for the outcomes of duration of mechanical ventilation (P=0.004), length of ICU stay (P<0.001) and time to onset of pneumonia (P<0.001). Omitting one study, which was based on cardiothoracic surgery with patients having a shorter mean duration of mechanical ventilation than in the other studies, resulted in the heterogeneity disappearing (P>=0.04).

A meta-analysis based on the remaining four studies, in which all patients were expected to require ventilation for at least 72 hours, found that subglottic secretion drainage significantly reduced the risk of VAP (RR 0.50, 95% CI: 0.35, 0.71), significantly reduced the length of ICU stay by 3 days (95% CI: 2.1, 3.9) and reduced the duration of mechanical ventilation by 2 days (95% CI: 1.7, 2.3). These patients developed pneumonia 6.8 days later (95% CI: 5.5, 8.1).

Comparing ITT versus non-ITT data gave very similar results.

**Cost information**

Based on published cost data and the risk of pneumonia estimated in this review, the authors calculated that using subglottic secretion drainage would result in a saving of $3,535 per case of pneumonia.
Authors' conclusions
Subglottic secretion drainage was an effective means of preventing VAP, and shortening the duration of mechanical ventilation and the length of ICU stay, in patients who were expected to require more than 72 hours of mechanical ventilation.

CRD commentary
The review question was clear in terms of the study design, intervention and outcomes. The search strategy was comprehensive; several relevant sources were searched and the authors did not apply any language limitations. Some attempts were made to identify unpublished data, thus reducing the possibility of publication bias, although this was not assessed. Methods were used to minimise errors and bias when extracting the data, but it was unclear whether similar steps were taken when selecting studies since the methods used to select studies were not described in detail. Validity was assessed using established criteria. No basic demographic details of the patients in the included trials were given, making it hard to assess the external validity of the results. Appropriate statistical methods were used to combine the studies, statistical heterogeneity was assessed and sources of potential heterogeneity were examined. The authors' conclusions about the efficacy of subglottic secretion drainage appear to be supported by the evidence.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.
Research: The authors stated that a formal economic evaluation is required to confirm whether subglottic secretion drainage is cost-effective.

Bibliographic details

PubMedID
15639202

DOI
10.1016/j.amjmed.2004.07.051

Other publications of related interest

This additional published commentary may also be of interest. Blackwood B. Review: subglottic secretion drainage reduces ventilator associated pneumonia. Evid Based Nurs 2005;8:114.

Indexing Status
Subject indexing assigned by NLM

MeSH
Confidence Intervals; Drainage; Glottis; Humans; Intubation, Intratracheal /adverse effects; Odds Ratio; Pneumonia /etiology /prevention & control; Randomized Controlled Trials as Topic; Respiration, Artificial /adverse effects; Risk Assessment; Time Factors

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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.