Cost/benefit analysis of open tracheotomy, in the OR and at the bedside, with percutaneous tracheotomy

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Three alternative ways of performing tracheotomy were evaluated:

open tracheotomy in the operating room (OT/OR), performed by several services (otolaryngology, cardiothoracic, neurosurgery and general surgery) under varying circumstances;

open tracheotomy at the bedside (OT/BS), performed by the otolaryngology service at the intensive care unit (ICU) assisted by an anaesthesiology service and a surgical nurse; and

percutaneous dilational tracheotomy (PDT), performed by the general trauma centre in the surgical ICU.

Type of intervention
Treatment and palliative care.

Economic study type
Cost-effectiveness analysis.

Study population
Adult patients requiring an elective or emergent tracheotomy at the Hershey Medical Centre were considered. Attending surgeons or residents performed the procedures. The physician in charge chose the method to be used.

Setting
The setting was tertiary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness and resource use data were derived from those patients requiring a tracheotomy between September 1996 and July 1997. The price year was not specifically stated.

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was carried out retrospectively on the same patient sample as that used in the effectiveness analysis. Patient-specific costs were not analysed as the overall charge was, in many cases, not itemised.
Study sample
Power calculations were not reported in the paper. A convenience sample was selected for inclusion. The sample appears to have been appropriate for the clinical study question. Seventy-one consecutive patients were included. There were 29 in the OT/OR group, 14 in the OT/BS group, and 28 in the PDT group.

Study design
This was a retrospective cohort study where the medical records and billing data from a single centre in Pennsylvania (USA) were reviewed. The attending physician chose the intervention. Charts were reviewed for complications up to 10 days after the procedure. A single reviewer evaluated the medical records. It was not reported whether the reviewer was blinded.

Analysis of effectiveness
The analysis in this observational study was performed on the basis of all included patients. The primary health outcomes were not specifically reported, but they included mainly major and minor complications. Differences among the groups (e.g. gender, age, number of days intubated before the tracheotomy) were not adjusted for in the analysis.

Effectiveness results
There were 3 complications (9%; 2 major) in the OT/OR group (n=29), 0 (0%) in the OT/BS group (n=14), and 8 (28%, contradictory report between text and table; 5 major) in the PDT group (n=28).

There was no statistically significant association between tracheotomy type or surgeon speciality and complications. There was a borderline association between complication rate and the number of days of intubation before the tracheotomy, (p=0.082).

There was no instance of loss of airway in any of the groups.

Four patients in the OT/OR group and one in the OT/BS died, although death was not attributed to tracheotomy complications.

Clinical conclusions
The authors concluded that the data from this study suggest that OT/OR, OT/BS and PDT are equally safe and effective procedures.

Measure of benefits used in the economic analysis
There was no summary measure of benefit. This was, in effect, a cost-consequences analysis.

Direct costs
Discounting was not performed, which was appropriate due to the short time horizon. Some quantities (e.g. procedure duration) were analysed for the OT groups, but most of the costs were calculated as an itemised charge per procedure, derived from the corresponding billing codes over two years. The costs items included surgeon fee, anaesthesia, bronchoscopy, equipment and OR cost/staff. Individual patient-specific charges were not included since the overall charge was frequently not itemised. An estimated deterministic cost per procedure was calculated. The price year was not specifically reported. The costs of complications were not included in the analysis.

Statistical analysis of costs
The costs were treated in deterministically. Therefore, statistical tests to compare the group results were not performed.
Indirect Costs
The indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was carried out. A scenario analysis was mentioned in the discussion. This reported that if "outside" anaesthesia were not routinely used, OT/BS would result in a cost of $1,541.90.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
The total costs were $2,071.70 for OT/OR, $1,997.90 for OT/BS and $1,632.30 for PDT.

The OT groups had an anaesthesia fee, operating room costs as well as higher equipment costs. PDT had the bronchoscopy fee that reduced the total cost differences.

The costs of complications were not included. These may have influenced the results.

Synthesis of costs and benefits
The costs and benefits were not combined.

Authors' conclusions
This report confirmed the results of several studies. It demonstrated that percutaneous dilational tracheotomy (PDT), open tracheotomy in the operating room (OT/OR) and open tracheotomy at the bedside (OT/BS) are equally safe. PDT appears to have been the most cost-effective strategy.

CRD COMMENTARY - Selection of comparators
The authors justified their selection of the comparators and provided possible advantages and drawbacks of the compared techniques.

Validity of estimate of measure of effectiveness
The authors stated that this retrospective cohort study will not resolve the arguments over which technique is truly better. The sample consisted mainly of patients who had been intubated and the patient groups (and numbers) were not balanced at baseline. The physicians chose the intervention, and the specialities of the physicians performing each procedure were different. Confounding factors were not accounted for in the analysis, probably because of the small sample size. A seemingly unblinded reviewer evaluated the outcomes, which may also add a potential information bias. As the authors acknowledged, the study had a short follow-up, which may have led to the underestimation of the true complication rate. Although statistical comparisons were made and reported to be non significant, confidence intervals, which would have permitted an estimation of the uncertainty of the results, were not given.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of benefit. The study was, in effect, a cost-consequences analysis.
Validity of estimate of costs
The authors stated that the reliance on costs estimated on the basis of what was required for each procedure and not on individual patient data represents the "Achilles heel" of the study in terms of validity. For this reason, a statistical analysis of the costs could not be performed and the costs were reported deterministically, without any range being given. The price year was not specifically stated, which limits translation exercises to other time dates. In addition, billing charges were used as a proxy for costs. The costs and the quantities were not reported separately. The costs of complications were not included in the analysis. These may significantly alter the study results, as PDT was the strategy with the most complications.

Other issues
The authors made some comparisons of their results with other studies. The generalisability to other settings was reported to be limited due to the study design and costing methodology. Although the authors stated that the three alternative types of tracheotomy are equally safe and effective, they acknowledged that the limitations of the study design meant that it was difficult to draw definite conclusions.

Implications of the study
This observational study suggested that PDT appears to be the most cost-effective tracheotomy alternative for non-emergency situations in patients who had been intubated. The analysis, however, revealed several options for decreasing the costs of OT/BS to allow this procedure to be even more cost-effective than PDT. A prospective, randomised trial with better controls and longer follow-up is needed to arrive at a definitive answer on the safety, effectiveness and costs of the various types of tracheotomy.

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