Percutaneous tracheostomy: one center's experience with a new modality

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
The study examined the use of percutaneous tracheostomy (PT), compared with open tracheostomy (OT), as performed or supervised by a trauma or critical care faculty member.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The population comprised surgical and trauma patients who received elective PT or OT at the study hospital.

Setting
The setting was tertiary care, specifically an American College of Surgeons-verified Level 1 trauma centre/teaching hospital. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness evidence and cost data related to patients treated at the hospital between January 1998 and May 2004. The price year was not stated.

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

Link between effectiveness and cost data
The costing was conducted retrospectively on the same sample of patients as that used in the effectiveness study.

Study sample
Power calculations were not conducted. The sample was a convenience sample and patients were identified as those treated at the study centre between set dates. A total of 383 surgical airways were performed. Fifteen emergent cricothyroidotomies were excluded from the study. Of the remaining 368 elective tracheostomies, 190 OT and 178 PT were performed and included in the study.

Study design
This was a single centre, retrospective comparative study. The decision to perform OT or PT was based on the
preference of the attending surgeon. No surgeon had previous experience of PT. Standard contraindications for PT for all surgeons included the presence of coagulopathy, an unstable cervical spine, as well as surgeon's definition of difficult anatomy. Thus, the two groups were not similar prior to the intervention being studied. Data for the period of hospitalisation were collected. There was no blinding prior to the assessment of the outcomes.

**Analysis of effectiveness**
The analysis of the clinical study was based on the treatment received. The effectiveness outcomes included complications, mortality, and injury severity score for trauma patients. Both length of stay in the intensive care unit (ICU) and hospital appear to have been used as a proxy effectiveness measure, although the authors did not explicitly state so. The baseline comparability of the study groups was not discussed and no adjustments for confounding factors were made. Males accounted for 68% of the study sample (63% of the OT group and 73% of the PT group, p=0.043). The mean age was 51.8 years (55.7 in the OT group and 47.9 in the PT group, p=0.0002). A p-value of less than 0.05 was considered significant.

**Effectiveness results**
The mortality for those undergoing tracheostomy was 12% (12.1% OT and 11.8% PT; p non significant). There were no deaths attributable to tracheostomy.

The mean injury severity score in trauma patients was 29.5 (28.9 in the OT group and 30.1 in the PT group; p non significant).

The mean overall time from endotracheal intubation to tracheostomy (TTT) was 14.2 days. There was no statistical difference between the two groups.

The TTT for PT significantly decreased from 12.7 days in 1998 to 7.4 days in 2004, (p=0.001). Over the same time period, TTT for OT remained relatively stable, with a mean of 14.0 days.

The rate of OT and PT changed significantly, (p=0.03) from a more prevalent use of PT in 1998 (OT 42%, PT 58%) to a more prevalent use of OT in 2004 (OT 68%, PT 32%).

There was no significant difference in the mean length of stay post tracheostomy placement or in ICU stay for the two groups.

The mean time from tracheostomy to discontinuation of mechanical ventilation was 15.5 days (OT 15.8, PT 15) after excluding 4 OT patients and 5 PT patients who were discharged to another facility still requiring mechanical ventilation.

The complication rate was 3.5% (1.5% OT, 5.1% PT; p=0.20).

**Clinical conclusions**
The TTT for PT in 2004 was 4.5 days less than for OT. This was attributed to difficulties in obtaining operation theatre time and other logistics associated with OT. The complication rate was comparable. There were no complications after a surgeon had performed 11 PT, and the authors stated that this suggests a steep learning curve. The study also implied that the initial enthusiasm for PT diminishes as improved patient selection skills are developed.

**Measure of benefits used in the economic analysis**
No summary measure was derived. In effect, a cost-consequences analysis was conducted.

**Direct costs**
The direct costs included for PT were endoscopy laboratory service charge, PT kit charge and pharmacy charge. The direct costs included for OT were operating room time and anaesthesia time. Hospital charges, not costs, were used in the cost analysis. The resource use data were evaluated retrospectively using the hospital's prospectively maintained NHS Economic Evaluation Database (NHS EED)
surgical database, which enabled the data of the sample of patients in the effectiveness study to be evaluated. Discounting was not relevant because the costs were incurred during a short time. Neither the unit costs nor the quantities of resources used were reported separately. The costing for each year was not based on the prices for the corresponding year and the price year was not specified.

**Statistical analysis of costs**
No statistical analysis of the costs was performed.

**Indirect Costs**
The indirect costs were not included in the economic evaluation.

**Currency**
US dollars ($).

**Sensitivity analysis**
No sensitivity analysis was conducted.

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

**Cost results**
The total charge was $458 for PT and $932 for OT (which included the costs of using an operation theatre for an average of 1 hour). Thus, a $444 charge difference exists between PT and OT.

No statistical analysis of the costs was carried out. The costs of adverse effects or knock-on costs were not taken into consideration.

**Synthesis of costs and benefits**
The costs and benefits were not combined since, in effect, a cost-consequences analysis was conducted.

**Authors' conclusions**
Open tracheostomy (OT) is a safe and effective method of performing tracheostomies. Although there is a steep learning curve for percutaneous tracheostomy (PT), the technique can be mastered quickly. PT resulted in a significant decrease in the average time to tracheostomy (TTT). Charges for PT are $444 lower than those for OT.

**CRD COMMENTARY - Selection of comparators**
The rationale for the choice of the comparator was clear. The two technologies were the two options for tracheostomy in the authors' institution. You should decide if the comparator represents current practice in your own setting.

**Validity of estimate of measure of effectiveness**
The analysis of effectiveness was based on a retrospective chart review. The treatment allocation was dependent on the attending surgeons' preference and their perception of the presence of contraindications. Given that the choice of procedure used (and therefore allocation to the groups) was dependent on the surgeon's discretion, it is conceivable that patient allocation to the groups might have been biased by the clinical situation and the surgeon's perception of the optimal method of treatment in that situation. This and the retrospective nature of the study represent limitations to the
internal validity of the analysis. In addition, the single-centred nature of the study can affect its external validity. These limitations imply that the effectiveness results should be treated with some caution.

**Validity of estimate of measure of benefit**
The authors did not derive a summary measure of health benefit. The comments in the ‘Validity of estimate of measure of effectiveness’ field (above) therefore apply.

**Validity of estimate of costs**
The perspective of the analysis was not reported. However, no productivity losses were included, which eliminates a societal perspective. The details of the analysis of resource usage and unit costs were not reported, which means that it would be difficult to replicate the study in other settings. Discounting was appropriately not carried out as the cost time horizon was short term. The price year was not reported, thus impeding any future reflation exercises. Charges were used to proxy costs. However, no cost-to-charge ratio was used for the conversion.

**Other issues**
The authors did not compare their findings with those from other studies, although they did make some comparison with complication rates and found these to be similar. The issue of generalisability to other situations was not addressed. However, it is likely, given the nature of the analysis of effectiveness and the use of hospital charges to proxy costs, that the results will be very specific to the authors’ setting.

**Implications of the study**
The study showed that initial enthusiasm to use the new modality diminished as improved patient selection skills were developed in the authors’ institution. The authors suggested that further prospective studies should compare the safety and costs of bedside PT with that of bedside OT.

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