Effect of reusing suction catheters on the occurrence of pneumonia in children

Scoble M K, Copnell B, Taylor A, Kinney S, Shann F

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 use of ordinary disposable suction catheters for a 24-hour period, in children hospitalised in the paediatric intensive care unit (PICU).

Type of intervention
Other: device.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised children with an endotracheal tube in place, who were in a PICU. Children who had clinical and documented evidence of a lower respiratory tract infection before entry to the study, in other words a clinical diagnosis of croup, pneumonia or bronchiolitis, were excluded. Children were also excluded if they had been intubated for more than 24 hours before admission, or for less than 24 hours, had been entered into the study previously, or required extracorporeal membrane oxygenation.

Setting
The setting was a tertiary paediatric centre. The economic study was carried out at the Royal Children's Hospital in Melbourne, Australia.

Dates to which data relate
The effectiveness and resource use data were gathered from July 1995 to May 1998. No price year was reported.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was carried out prospectively on a subsample of the patients assessed in the effectiveness analysis.

Study sample
Power calculations indicated that 240 patients for each group would result in an 80% power to detect an increase from 5 to 11% in the incidence of pneumonia (alpha=0.05, one-tailed test). An initial sample of 1,199 children was entered into the study. Of the 713 children excluded, 595 did not meet the inclusion criteria and 118 were excluded because of errors in the randomisation or study procedures. The final sample comprised 486 patients, 245 in the control group and 241 in the study group. The median age in the control group was 2.89 months (range: 0 - 19 years). The median age in
the study group was 3.32 months (range: 0 - 16 years).

**Study design**
This was a randomised controlled trial, which was carried out in a single centre (the Royal Children's Hospital in Melbourne). Equal numbers in the groups were ensured by using block randomisation, with a block size of 4 patients. The group allocation was placed in a sequentially numbered, sealed opaque envelope, which was opened when the patient was entered into the study. The patients remained in the study until pneumonia developed, they were extubated for any reason, or they underwent a tracheostomy. The loss to follow-up was not reported. A radiologist, who was unaware of the group to which the patient was assigned, assessed the presence of pneumonia.

**Analysis of effectiveness**
The basis for the clinical analysis (intention to treat or treatment completers only) was not stated, although no losses to follow-up were reported and the primary outcome was measured by intention to treat. The primary health outcome measure was the development of pneumonia more than 24 hours after intubation and within 24 hours of extubation. Pneumonia was defined using the age-specific World Health Organization recommendations (co-presence of three criteria). The secondary outcome measures were the relative risk, the absolute risk reduction, time to infection, and antibiotic use in uninfected children. The time to infection was calculated from the time of randomisation to the date when pneumonia occurred. The comparability of the study groups was not explicitly reported. The impact of the duration of intubation on the estimated outcome measures was assessed through logistic regression.

**Effectiveness results**
Pneumonia developed in 14 children (5.71%) in the control group and 12 children (4.98%) in the study group. This difference did not reach statistical significance at the 5% level.

The relative risk was 0.87 (95% confidence interval, CI: 0.41 - 1.85).

The absolute risk reduction was 0.74% (95% CI: -3.26 - 4.73; p=0.84).

The duration of intubation did not affect the study results.

The time to infection was 3.26 days (95% CI: 0.34 - 31.63) in the control group and 3.76 days (95% CI: 0.63 - 22.51) in the study group. This difference was not statistically significant at the 5% level.

Antibiotic use in uninfected children was 21% in the control group and 27% in the study group. This difference was not statistically significant at the 5% level.

**Clinical conclusions**
The effectiveness analysis showed that there was no statistically significant difference in terms of any of the outcome measures assessed. Thus, the use of suction catheters for a 24-hour period proved to be a safe choice.

**Measure of benefits used in the economic analysis**
The authors did not use a summary benefit measure. A cost-consequences analysis was therefore carried out.

**Direct costs**
Discounting was not carried out since the costs per patient were incurred over a short period of time. The unit costs and the quantities of resources were reported separately for the unique cost item, the suction catheter, included in the analysis. The cost/resource boundary adopted appears to have been that of the hospital. The source of the cost data was not reported. The quantities of resources were derived from the trial, and were measured from July 1995 to May 1998. The price year was not reported.
Statistical analysis of costs
No statistical analysis of the costs was carried out.

Indirect Costs
The indirect costs were not included in the analysis.

Currency
Australian dollars (Aus$).

Sensitivity analysis
Sensitivity analyses were not performed.

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

Cost results
The cost per patient day was Aus$0.81 in the intervention group and Aus$4.95 in the control group. Thus, the use of suction catheters for a 24-hour period resulted in cost-savings of Aus$4.14 per patient day, and an 84% reduction in the cost.

Synthesis of costs and benefits
Not relevant.

Authors' conclusions
The use of suction catheters for a 24-hour period was both safe and cost-effective when compared with the use of a new catheter for each suctioning episode.

CRD COMMENTARY - Selection of comparators
The rationale for the selection of the comparator was clear. The use of a new catheter for each suctioning episode represented the routine intervention for the treatment of children with an endotracheal tube in place. You should assess whether it represents a currently used procedure in your own setting.

Validity of estimate of measure of effectiveness
The effectiveness analysis used a randomised controlled trial. The methods of randomisation and assessment were reported clearly, thus helping to avoid selection bias. Appropriate statistical analyses were also conducted to take into account possible bias and confounding factors. The outcome assessment was also blinded to the treatment group. Power calculations were performed in the planning phase of the study, thus enhancing the internal validity of the analysis. The baseline characteristics were presented to check whether the study sample was representative of the study population.

Validity of estimate of measure of benefit
No summary benefit measure was used in the economic analysis. In fact, it might be argued that a demonstration of equal effectiveness is sufficient not to require one. However, this depends on one's attitude to uncertainty and the value of the effectiveness measure.
Validity of estimate of costs
The suction catheter represented the only cost item included in the analysis. The unit cost and the quantities of catheters used were reported separately. The source of the cost was not reported. The costs were treated deterministically and the price year was not reported, thus making reflation exercises to other settings difficult. The costing was carried out on a subsample of patients included in the effectiveness analysis.

Other issues
The authors compared their findings with those from other studies. The authors stated that the generalisability of the study results to other settings could be limited, because the patients hospitalised at their institution may not be representative of all children with an endotracheal tube in place. Thus, caution should be required when generalising the study results to patients requiring long-term ventilation. The authors noted that a possible limitation of their study was the lack of control for the use of prophylactic antibiotics in cardiac patients. These could have prevented the occurrence of pneumonia in the patients included in the study.

Implications of the study
The authors highlighted the cost-effectiveness of suction catheters used for a 24-hour period. However, it was noted that the intervention was unpopular among nurses and there was a decrease in compliance over time. In addition, “one controversial aspect of the study relates to the ethical and legal concerns raised by reusing equipment that is labelled by the manufacturer as ‘single use’”. Further research into the relationship between nosocomial pneumonia and the suctioning technique should be carried out. The authors recommended the study be duplicated in other settings with different types of patients, especially to determine the appropriate length of time for which a suction catheter should be used.

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