Extending ventilator circuit change interval beyond 2 days reduces the likelihood of ventilator-associated pneumonia

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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
Using 7- or 30-day versus 2-day circuit change intervals in patients receiving mechanical ventilation.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients in RICU or MICU, who were receiving mechanical ventilation.

Setting
Hospital. The economic study was carried out in Chicago, USA.

Dates to which data relate
The data relating to 2-, 7-, and 30-day intervals were collected from January 1991 to January 1993, from January 1993 to January 1994, and from January 1994 to December 1994, respectively. The dates for the resources used were not specified. 1994 prices were used.

Source of effectiveness data
The evidence for the final outcomes was derived from a single study.

Link between effectiveness and cost data
The costing was not performed on the same patient sample as that used for the effectiveness study.

Study sample
Power calculations were not used to determine the sample size. The study sample consisted of 637 patients: 343 in the 2-day change group, 137 in the 7-day group and 157 patients in the 30 day change interval group.

Study design
The study was a nonrandomised trial with historical controls, performed in a single centre.
**Analysis of effectiveness**

It was not stated whether the analysis of the clinical study was based on intention to treat or treatment completers only. The health outcome measures consisted of the rate of ventilator-associated pneumonia (VAP) identified using 1988 CDC-defined criteria, average (SD) days to VAP, mortality rate, and risk of occurrence of VAP. A Cox proportional hazards model was performed using ventilator circuit change interval and hospital unit as the potential predictors. In the estimation of relative risk (RR), the adjustment was made for the type of hospital unit (MICU or RICU). The effect of a confounding variable (using heated wire circuit in 30-day change interval group) was investigated. The comparability of the characteristics of the study groups was not assessed.

**Effectiveness results**

The 2-day change interval group had a rate of 11.88 VAP per 1,000 ventilator days versus 3.34 and 6.28 for the 7- and 30-day circuit change interval groups, respectively (P= 0.266 for the difference between the 7- and 30-day circuit change interval groups). In terms of days to VAP, the 2-day change interval group had, on average, 12.03 (SD=9.07) days to VAP versus 17.25 (7.09) and 14.5 (7.31) for the 7- and 30-day circuit change interval group, respectively. The RICU and MICU patients had total mortality rates of 33% (range: 25 - 43%) and 40% (range: 32 - 47%), respectively. The risk of occurrence of VAP was significantly higher for the patients in the 2-day change interval group when compared to the 7-day group (RR=0.210, P= 0.003) and the 30-day group (RR= 0.407, P=0.013). The risk was higher for the patients in the 2-day group when compared with those in a group consisting of a combination of 7- and 30-day intervals (RR= 3.1; P= 0.0004; 95% CI: 1.662 - 5.812).

**Clinical conclusions**

The study revealed that extending ventilator circuit change intervals beyond 2 days was a more effective health policy in terms of both the rate and the risk of VAP in comparison with the 2-day change interval policy.

**Measure of benefits used in the economic analysis**

No summary benefit measure was identified in the economic analysis and only separate effectiveness outcomes were reported.

**Direct costs**

The quantities and cost items were not reported separately. The average cost per patient per year and per patient per circuit change consisted of the supply and labour costs. The point of view of the cost analysis was not stated. The actual cost for supplies was used. The time standards of labour were estimated using the American Association for Respiratory Care uniform reporting method. 1996 and 1994 price data were used.

**Indirect Costs**

Not reported.

**Currency**

US dollars ($).

**Sensitivity analysis**

No sensitivity analysis was carried out.

**Estimated benefits used in the economic analysis**

Not applicable.
Cost results
The average cost per patient per year for the 2-, 7-, and 30-day intervals was $23,460, $4,522, and $612, respectively. The average cost per patient per circuit change (in terms of 1994 prices) for the 2-, 7-, and 30-day intervals was $114, $27.60, and $3.38, respectively.

Synthesis of costs and benefits
No synthesis was performed by the authors since extending ventilator circuit change intervals beyond 2 days was the dominant strategy.

Authors' conclusions
The authors concluded that circuit change intervals of 7 and 30 days had lower risks for VAP than the 2-day intervals, yielding substantial reductions in morbidity as well as labour and supply costs.

CRD COMMENTARY - Selection of comparators
The justification for the choice of the comparator was implicit in that it accorded with the minimum circuit change interval recommended in the Centres for Disease Control (CDC) guidelines. You should consider whether this is applicable within your own setting.

Validity of estimate of measure of benefit
In the absence of randomisation, potential for bias exists and the internal validity of the estimate of effectiveness may have been affected.

Validity of estimate of costs
Resource quantities were not reported separately from the prices. Adequate details of the methods of cost estimation were not given.

Other issues
Given the lack of randomisation, sensitivity analysis, and statistical analysis of the costs, the results need to be treated with some caution. The issue of generalisability to other settings or countries was not addressed.

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Other publications of related interest
MeSH
Adult; Confidence Intervals; Cost Control; Costs and Cost Analysis; Critical Care /economics; Critical Illness; Cross Infection /prevention & control; Disposable Equipment /economics; Equipment Design; Hospitals, Veterans; Hot Temperature; Humans; Humidity; Pneumonia /prevention & control; Proportional Hazards Models; Prospective Studies; Respiration, Artificial /adverse effects /economics; Risk Factors; Survival Analysis; Time Factors; Ventilators, Mechanical /adverse effects /economics

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