A cost-effectiveness analysis of neonatal ECMO using existing evidence
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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
Neonatal extracorporeal membrane oxygenation (ECMO) as a method of giving temporary life support for cases of severe respiratory failure.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Mature neonates with acute and potentially reversible respiratory failure.

Setting
Hospital. The economic study was conducted in the UK.

Dates to which data relate
The effectiveness data was obtained from studies published between 1989 and 1994. The price year used for cost data was 1994.

Source of effectiveness data
Effectiveness data were derived from a review of previously completed studies.

Modelling
Decision analysis was used as a tool for cost-effectiveness analysis. This involved the following steps: identifying alternative paths of care and their outcomes, placing probabilities on outcomes, identifying, measuring and valuing costs, estimating the cost-effectiveness ratio, and sensitivity analysis.

Outcomes assessed in the review
The primary health outcomes assessed were survival after transport to ECMO centre and morbidity at one year of age.

Study designs and other criteria for inclusion in the review
The studies were of widely different methodologies, ranging from randomised controlled trials to prospective studies. Those studies were selected which measured one or more of the following: survival after transport to ECMO centre, morbidity at 1 year of age, number of days on ECMO, number of days ventilated, and number of days in hospital not on
a ventilator.

**Sources searched to identify primary studies**
A systematic search for trials and other studies was carried out using methods advocated by Oxman (1994) and Schultz (1995). This involved a search of MEDLINE for papers from 1989-1994, papers referenced in articles found in MEDLINE, studies identified by the trial team, and from the National Perinatal Epidemiology Unit.

**Criteria used to ensure the validity of primary studies**
Studies were classified according to the strength of evidence hierarchy suggested by Guyatt (1991).

**Methods used to judge relevance and validity, and for extracting data**
Not stated.

**Number of primary studies included**
24 studies were found which provided data that could be used in the decision analysis.

**Methods of combining primary studies**
Where possible, data were extracted from the primary studies and pooled to obtain average probabilities for each stage of care. The statistical method used for data pooling was not specified.

**Investigation of differences between primary studies**
Not stated.

**Results of the review**
Short term outcomes:

the probability of surviving transport to ECMO centre, 0.88;

the probability of receiving ECMO treatment, 0.55;

the probability of survival following ECMO treatment, 0.81;

the probability of survival if ECMO treatment withheld at ECMO centre, 0.87;

the probability of survival following conventional treatment, 0.68.

Long term outcomes (morbidity at 1 year of age):

the probability of death before discharge: ECMO given, 0.09;

ECMO withheld, 0.05;

conventional treatment, 0.32.

Probability of survival without severe disability:

ECMO given, 0.32;

ECMO withheld, 0.28; conventional treatment, 0.55.
Probability of survival with severe disability:

ECMO given, 0.05;
ECMO withheld, 0.07;
conventional treatment, 0.05.

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

Short term benefit was assessed in terms of the number of extra babies surviving on discharge from the neonatal unit.

Long term benefit was measured by the number of extra babies surviving at one year without severe disability.

**Direct costs**

Only health service costs were identified in this study. In the short-term these costs included costs of care in the ECMO centres and neonatal units during the initial stay in hospital, and in the long-term, costs of follow-up care such as costs of readmissions and outpatient visits. Information on length of stay was extracted from the primary studies. The daily cost of care was taken from a single UK study (1992) and the cost of follow-up care from another UK study (1988). The cost of transport to, and cost of care at, the ECMO centre used data from the accounting departments of two centres. All costs were reported in 1994 prices.

**Currency**

UK pounds sterling (£).

**Sensitivity analysis**

Assumptions about probabilities, lengths of stay, costs of transport, costs of neonatal care, and costs of follow-up care were varied to establish the relative long-term cost-effectiveness of ECMO in a 'best' and 'worst' scenario. Probabilities were altered to their extreme values as found from individual studies.

**Estimated benefits used in the economic analysis**

Outcome at discharge from neonatal care: 6 additional ECMO survivors per 100 babies treated. Outcome at 1 year of age: 3 additional ECMO survivors without severe disability per 100 babies treated.

**Cost results**

Outcome at discharge from neonatal care: additional ECMO cost per 100 babies treated was £1,067,865. Outcome at 1 year of age: additional ECMO cost per 100 babies treated was £1,071,576.

**Synthesis of costs and benefits**

Outcome at discharge from neonatal care: additional cost per additional ECMO survivor was £177,978. Outcome at 1 year of age: additional cost per additional ECMO survivor without severe disability was £357,192.

**Authors’ conclusions**

Current evidence on the cost-effectiveness of ECMO is inadequate for decision makers. Firstly, it is not clear whether there are additional benefits with ECMO and, secondly, even if there are additional benefits it is not clear whether these outweigh the additional costs. Thus, there is no conclusive evidence as yet to suggest that neonatal ECMO should be available.

Note: subsequent to the paper reviewed in this abstract a number of studies have reported economic evaluations.
alongside the UK newborn ECMO trial. For further details of these, the reader is referred to items 4 to 8 in the Other Publications section.

**CRD COMMENTARY - Selection of comparators**
The comparator selected for the review appears to be suitable. ECMO is a relatively new intervention whose effectiveness is unclear, and therefore the comparison with conventional treatment is entirely appropriate.

**Validity of estimate of measure of effectiveness**
The method used to estimate effectiveness appears to be appropriate. A fairly systematic literature search was used to identify relevant literature, and the resulting papers were ranked according to study design, although limited information was provided regarding the actual studies included and the method used to pool their results. Nevertheless, as the authors themselves noted, the available evidence was of poor quality, and, despite the sensitivity analyses used, it is not clear to what extent the results of the model can be relied upon.

**Validity of estimate of costs**
Relatively limited detail was provided regarding the source of the costs used. However quantities and average costs were reported separately, and all important costs appear to have been considered.

**Other issues**
Given the limitations of the available data the author's conclusions are entirely justified.

**Source of funding**
The UK Collaborative ECMO trial was funded by the English Department of Health and the Scottish Office Home and Health Department. The economic evaluation work was funded by the English Department of Health.

**Bibliographic details**

**PubMedID**
8690565

**Other publications of related interest**


6. UK Collaborative ECMO Trial Group. UK collaborative randomised controlled trial of neonatal extra corporeal membrane oxygenation. Lancet 1996;384:75-82

7. UK Collaborative ECMO Trial Group. UK collaborative randomised controlled trial of neonatal extra corporeal membrane oxygenation: follow up to one year of age. Pediatrics 1998;101(E1). (Electronic version)

8. Roberts T,ECMO Economics Working Group (on behalf of the ECMO Trial Steering Group. Economic evaluation...
alongside the UK collaborative ECMO trial. BMJ 1998;317:911-914

Indexing Status
Subject indexing assigned by NLM

MeSH
Cost-Benefit Analysis; Decision Support Techniques; England; Extracorporeal Membrane Oxygenation /economics; Health Planning; Humans; Infant, Newborn; Intensive Care, Neonatal; Respiratory Insufficiency /economics /mortality /therapy; Scotland; Technology Assessment, Biomedical; Treatment Outcome

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