Shed mediastinal blood transfusion after cardiac operations: a cost-effectiveness analysis

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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 autologous blood transfusion (autotransfusion) in patients undergoing coronary artery bypass grafting, valve replacement or repair, and cardiac transplantation.

Type of intervention
Treatment and secondary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
Patients undergoing coronary artery bypass grafting, valve replacement or repair, and cardiac transplantation.

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

Dates to which data relate
Effectiveness data related to the period between October 1996 to June 1997. The effectiveness data relating to the risk of complications due to the use of allogeneic blood transfusion were obtained from studies published in 1994 and 1996. Resource utilization data were not systematically reported. The fiscal year was 1997.

Source of effectiveness data
Effectiveness data were derived from a single study and a review of the literature.

Link between effectiveness and cost data
Costing was partially performed on the same patient sample as that used in the effectiveness analysis. It was performed retrospectively.

Study sample
Power calculations were not used to determine the sample size. A total of 843 patients after cardiac operations were examined. The data relating to 221 patients were missing. The average (standard deviation) age of the study patients was 61.9 (12.7) years.

Study design
This was a retrospective cohort study, carried out in a single centre. The duration of the follow-up was until discharge.
No loss to follow up was reported.

**Analysis of effectiveness**
The principle (intention to treat or treatment completers only) used in the analysis of effectiveness was not explicitly specified. The health outcome measures were the probability of receiving allogeneic blood, the probability of haemoglobin (Hgb) less than or equal to 7.0 g/dL or chest tube drainage (CTD) greater than or equal to 250 mL, and the probability of Hgb less than or equal to 7.0 g/dL or CTD greater than or equal to 500 mL. Bootstrapping method was used to estimate means and 95% confidence intervals (CI).

**Effectiveness results**
The probabilities were (sample means, bootstrap means, and CIs):

- Receiving allogeneic blood, 0.305, 0.304, 0.276-0.337;
- Haemoglobin (Hgb) <= 7.0 g/dL or chest tube drainage (CTD) >= 250 mL, 0.819, 0.807, and 0.779-0.836;
- Hgb <= 7.0 g/dL or CTD >= 500 mL, 0.661, 0.661, and 0.628-0.697.

**Clinical conclusions**
"The principal putative beneficiaries of autotransfusion are patients with significant bleeding. This means that studies must be very large to detect significant differences in allogeneic blood use."

**Modelling**
Two decision trees were used to calculate the costs and effects of alternative modalities (tiered chi-square analyses generated the probabilities for the models).

**Outcomes assessed in the review**
The outcomes assessed in the review were the risk of serious adverse transfusion sequelae including HIV, hepatitis B, hepatitis C and transfusion reactions such as anaphylactic, hemolytic, febrile, and other.

**Study designs and other criteria for inclusion in the review**
Not reported.

**Sources searched to identify primary studies**
Not reported.

**Criteria used to ensure the validity of primary studies**
Not reported.

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

**Number of primary studies included**
Two studies were included in the review.
Methods of combining primary studies
Not reported.

Investigation of differences between primary studies
Not reported.

Results of the review
The estimated risk per unit (range) was:

HIV, 1/493,000 (1/(202,000 to 2,778,000));

hepatitis B, 1/63,000 (1/(31,000 to 147,000));

hepatitis C, 1/103,000 (1/(28,000 to 288,000)).

The estimated risk per unit for anaphylactic, hemolytic, febrile, and other reactions were 0.00011, 0.00016, and 0.00200, and 0.00162, respectively.

Measure of benefits used in the economic analysis
The benefit measure was the reduction of the need for allogeneic transfusions, and expected value of allogeneic units used with and without autotransfusion.

Direct costs
Costs were not required to be discounted due to the short time frame of the study. Resource use data were not systematically reported. The cost items were reported separately. The cost analysis covered the costs of unit packed red blood cells, laboratory handling, administration, handling and washing unused units, cost of treating complications (infections and transfusion reactions), and the costs of equipment and disposables (specific to autotransfusion). The marginal costs for allogeneic units were estimated. The perspective adopted in the cost analysis was that of a health care provider and payer. The sources of cost data were the study institution, and studies published in 1993 and 1995. The price data was 1997. The costs associated with initial typing and screening, fixed costs, the costs of blood bank administration, and the costs arising from prolongation of hospital stays because of infections related to transfusion-induced immunosuppression were not included in the cost analysis.

Indirect Costs
Not considered.

Currency
US dollars ($).

Sensitivity analysis
One-way sensitivity analyses were performed on the probability of receiving allogeneic blood in the absence of available autotransfusion, the cost of a unit of banked blood, and potential effect of capturing social costs.

Estimated benefits used in the economic analysis
The reduction of the need for allogeneic transfusions was estimated to be roughly 54%. The expected value of allogeneic units used with and without autotransfusion was 1.7 and 3.1 units, respectively.
Cost results
The cost of one unit of transfused allogeneic blood was $107.70 (range: $105.77-$113.27). The savings due to the use of autotransfusion after operation were reported to be $55 per case.

Synthesis of costs and benefits
Costs and benefits were not combined since the use of autotransfusion was associated with both risk reduction and cost saving.

Authors' conclusions
The use of autologous blood has the potential significantly to reduce the costs and risks associated with transfusing allogeneic blood after cardiac operations.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear.

Validity of estimate of measure of benefit
The internal validity of the estimates of benefits may be weakened by the absence of the following: a randomised design, a comprehensive literature review, and a quality assessment of the primary studies included in the review.

Validity of estimate of costs
Quantities were not systematically reported separately from the costs. However, adequate details of methods of cost estimation were given. The study lacked a comprehensive, and prospective cost analysis. As acknowledged by the authors, a broader societal perspective could have been adopted.

Other issues
In view of the absence of randomisation, a comprehensive 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 systematically addressed.

Implications of the study
As the authors noted, a prospectively randomised study would yield more convincing results.

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