

Cost-effectiveness of cell salvage and alternative methods of minimising perioperative allogeneic blood transfusion: a systematic review and economic model

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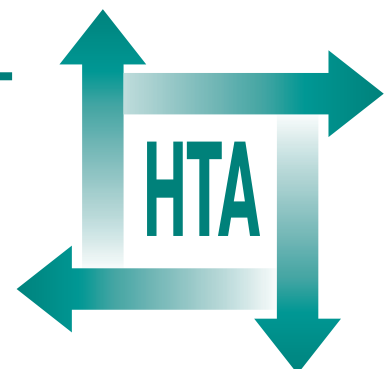
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Executive summary

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Executive summary

Background

When severe haemorrhage occurs due to surgery, blood transfusion can be life saving. Elective surgery accounts for over 40% of requests for stored blood to the National Health Service Blood Transfusion Authority (NHS BTA) (previously the National Blood Service).

Alternatives to allogeneic transfusion (blood from an unrelated donor) include autologous transfusion using the patient's own blood, interventions to reduce surgical blood loss and interventions to minimise the use of perioperative allogeneic blood.

All blood transfusions are associated with serious adverse events. The cost of allogeneic blood has risen and the NHS BTA faces difficulties in meeting demand for blood products.

Objectives

The principal objectives were to:

1. Assess the effectiveness of alternative transfusion strategies in terms of the relative risk of exposure to allogeneic and autologous blood transfusion, postoperative complications, reoperation due to bleeding, adverse transfusion reactions and mortality and the mean length of stay. Two Cochrane systematic reviews of cell salvage (published/last updated 2003) and preoperative autologous donation (PAD) (published/last updated 2001) were updated; existing systematic reviews were reviewed [acute normovolaemic haemodilution (ANH), erythropoietin, antifibrinolytic drugs and fibrin sealants]. The updates were submitted to the Cochrane Library.
2. Obtain data on health-related quality of life and utilities and the relative cost and cost-effectiveness of the transfusion strategies. This included a review of economic evidence.
3. Use a decision analytic model to determine the likely cost-effectiveness of cell salvage.

Methods

Data sources

Searches were conducted for the period 2002–4 (cell salvage) and 2001–4 (PAD) to update the two Cochrane systematic reviews. Search strategies for the original Cochrane systematic reviews were adapted to identify new trials. Data for the updates were obtained from electronic searches of the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, ISI Web of Science and International Network of Agencies of Health Technology Assessment (INAHTA). The searches for the review of systematic reviews covered the period 1996–2004, using the Cochrane Database of Systematic Reviews and MEDLINE. The review of economic evidence covered the period 1994–2004, using MEDLINE, EMBASE, Econlit, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects and the NHS Economic Evaluation Database (National Electronic Library for Health, Issue 3, 2004).

Study selection

Only randomised controlled trials (RCTs) undergoing elective non-urgent surgery were included for the update of existing systematic reviews. The review of systematic reviews only included reviews with explicit search and selection criteria. The patient population was adults undergoing elective non-urgent surgery. Included interventions were allogeneic transfusion; cell-salvage; PAD; ANH; antifibrinolytic drugs; fibrin sealants; and recombinant human erythropoietin (EPO). Economic and cost studies were only included if they reported resource use or cost for allogeneic blood transfusion or included interventions for adult patients undergoing major elective surgery.

Data extraction

Two reviewers independently abstracted data for the updates to the cell salvage and PAD systematic reviews. One reviewer extracted data about the focus, inclusion criteria and number and methodological quality of the included studies in each systematic review. The systematic reviews were quality assessed using a form developed for the Critical Appraisal Skills

Programme. Any resource use or cost data were extracted for potential use in populating an economic model.

Data synthesis

Data for the updated systematic reviews were added to the original meta-analyses from the two original systematic reviews. Differences in outcomes were combined across studies using relative risks or weighted mean differences in random effects meta-analyses. Results of the meta-analyses for each systematic review were extracted into tables. Relative risks or weighted mean difference of each outcome for each intervention were assessed, taking into account the number of RCTs included in each outcome and intervention and the presence of any heterogeneity. This allowed indirect comparison of the relative effectiveness of each intervention when the intervention is compared with allogeneic blood transfusion.

Economic model

A decision analytic model synthesised clinical and economic data from several sources, to estimate the relative cost-effectiveness of cell salvage for people undergoing elective surgery with moderate to major expected blood loss. The perspective of the NHS and patients and a time horizon of 1 month were used. The economic model was developed from reviews of effectiveness and cost-effectiveness and clinical experts. Secondary analysis explored the robustness of the results to changes in the timing and costs of cell salvage equipment, surgical procedure, use of transfusion protocols and time horizon of analysis.

Results

Overall, 668 studies were identified electronically for the update of the two systematic reviews. Five RCTs were included (two cell salvage, three PAD). Five published systematic reviews were identified for antifibrinolytics, fibrin sealants and restrictive transfusion triggers, PAD plus erythropoietin, erythropoietin alone and ANH. Twelve published studies reported full economic evaluations.

All but two of the transfusion strategies significantly reduced exposure to allogeneic blood. The relative risk of exposure to allogeneic blood was 0.59 for the pooled trials of cell salvage (95% CI 0.48 to 0.73). This varied by the type and timing of cell salvage and type of surgical procedure. For cell salvage, the relative risk of

allogeneic blood transfusion was higher in cardiac surgery than in orthopaedic surgery.

Cell salvage had lower costs and slightly higher quality-adjusted life years compared with all of the alternative transfusion strategies except ANH. The likelihood that cell salvage is cost-effective compared with strategies other than ANH is over 50%. Most of the secondary analyses indicated similar results to the primary analysis. However, the primary and secondary analyses indicated that ANH may be more cost-effective than cell salvage.

Conclusions

Implications for healthcare

The available evidence indicates that cell salvage may be a cost-effective method to reduce exposure to allogeneic blood transfusion. However, ANH may be more cost-effective than cell salvage. The results of this analysis are subject to the low quality and reliability of the data used and the use of indirect comparisons. This may affect the reliability and robustness of the clinical and economic results.

Recommendations for research

There is a need for further research that includes:

1. Adequately powered high-quality RCTs to compare directly various blood transfusion strategies. These should include measures of health status, health-related quality of life and patient preferences for alternative transfusion strategies.
2. Observational and tracking studies to estimate reliably the incidence of adverse events and infections transmitted during blood transfusion.
3. Observational studies to identify the lifetime consequences of the serious hazards of transfusion on mortality, health status and health-related quality of life.

Publication

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NHS R&D HTA Programme

The research findings from the NHS R&D Health Technology Assessment (HTA) Programme directly influence key decision-making bodies such as the National Institute for Health and Clinical Excellence (NICE) and the National Screening Committee (NSC) who rely on HTA outputs to help raise standards of care. HTA findings also help to improve the quality of the service in the NHS indirectly in that they form a key component of the 'National Knowledge Service' that is being developed to improve the evidence of clinical practice throughout the NHS.

The HTA Programme was set up in 1993. Its role is to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined to include all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care, rather than settings of care.

The HTA Programme commissions research only on topics where it has identified key gaps in the evidence needed by the NHS. Suggestions for topics are actively sought from people working in the NHS, the public, service-users groups and professional bodies such as Royal Colleges and NHS Trusts. Research suggestions are carefully considered by panels of independent experts (including service users) whose advice results in a ranked list of recommended research priorities. The HTA Programme then commissions the research team best suited to undertake the work, in the manner most appropriate to find the relevant answers. Some projects may take only months, others need several years to answer the research questions adequately. They may involve synthesising existing evidence or conducting a trial to produce new evidence where none currently exists.

Additionally, through its Technology Assessment Report (TAR) call-off contract, the HTA Programme is able to commission bespoke reports, principally for NICE, but also for other policy customers, such as a National Clinical Director. TARs bring together evidence on key aspects of the use of specific technologies and usually have to be completed within a short time period.

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Reports are published in the HTA monograph series if (1) they have resulted from work commissioned for the HTA Programme, and (2) they are of a sufficiently high scientific quality as assessed by the referees and editors.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

The research reported in this monograph was commissioned by the HTA Programme as project number 02/36/01. The contractual start date was in September 2003. The draft report began editorial review in February 2005 and was accepted for publication in April 2006. As the funder, by devising a commissioning brief, the HTA Programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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