Autologous transfusion techniques: a systematic review of their efficacy

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CRD summary
This review evaluated the effects of techniques that involve the re-infusion of a patient's blood on the need for peri-operative allogeneic red blood cell transfusion and on clinical outcomes. The authors concluded that evidence of benefit of these techniques comes from poor-quality studies with inadequate clinical outcomes. These conclusions appear appropriate given the data presented.

Authors' objectives
To examine the effects of techniques that involve the re-infusion of a patient's blood on the need for peri-operative allogeneic red blood cell transfusion and on clinical outcomes.

Searching
MEDLINE, EMBASE, Current Contents and the Cochrane Controlled Trials Register were searched from inception to July 2002; the search terms were reported. Attempts were made to identify further relevant studies through contact with experts and searches of bibliographies. The searches were not restricted by language.

Study selection
Study designs of evaluations included in the review
Randomised controlled parallel-group trials (RCTs), or observational cohort studies with concurrent or non-concurrent control groups, were eligible for inclusion in the review.

Specific interventions included in the review
Studies were eligible for inclusion if they evaluated pre-operative autologous blood deposit (PAD), acute normovolaemic haemodilution (ANH) or cell salvage (CS) in the context of elective surgery. Studies that combined any of the above techniques with another blood-sparing intervention were excluded.

Participants included in the review
Studies of patients undergoing elective surgery were eligible for inclusion. Studies of children (under 18 years) or women in labour were excluded. Many of the included studies used patients who were undergoing cardiovascular or orthopaedic surgery.

Outcomes assessed in the review
Studies measuring the number of participants who received allogeneic blood transfusions or the amount of allogeneic blood received by participants were eligible for inclusion. The following outcome measures were reported in the review: number of patients receiving allogeneic and/or autologous red blood cell transfusions; the amount of blood transfused; haemoglobin levels; rates of infection, thrombosis, stroke, myocardial infarction and mortality; and hospital length of stay (LOS).

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
Validity was assessed using four criteria (Schultz et al.) relating to double-blinding, allocation concealment, participant inclusion and exclusion, and randomisation methods. Two reviewers assessed validity independently, with any disagreements resolved by consensus. One reviewer assessed non-English papers.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.
Continuous data outcomes were excluded if the standard deviation or standard errors were not reported, or could not be calculated from the raw data. Data expressed in millilitres of blood transfused were converted to units by dividing by 300.

Methods of synthesis
How were the studies combined?
The outcomes were expressed as relative risks (RRs), risk differences or weighted mean differences (WMDs) (for continuous variables) and pooled using a random-effects model.

How were differences between studies investigated?
Heterogeneity was assessed using the Q statistic, with a p-value of 0.1 or less used to define statistically significant heterogeneity. Subgroup analyses were performed using the following predetermined factors: type of surgery, use of transfusion protocols, type of salvaged blood re-transfused (washed or unwashed), timing of CS and methodological quality of the trials.

Results of the review
A total of 68 RCTs (n=4,539) and 75 cohort studies (n=30,326) were included in the review.

PAD.
Eight RCTs (n=1,191) were identified; their methodological quality was generally poor. PAD reduced the probability of receiving an allogeneic blood transfusion by 63% (8 RCTs; RR 0.37, 95% confidence interval, CI: 0.26, 0.54; Q statistic, p=0.002), but increased the probability of any transfusion by 29% (7 RCTs; RR 1.29, 95% CI: 1.12, 1.48; Q statistic, p=0.005). PAD did not appear to influence the probability of infection (3 RCTs; RR 0.70, 95% CI: 0.34, 1.43) or thrombosis (2 RCTs; RR 0.82, 95% CI: 0.21, 3.13).

Forty-two cohort studies (n=24,473) were identified. PAD reduced the probability of receiving an allogeneic blood transfusion by 69% (42 cohort studies; RR 0.31, 95% CI: 0.27, 0.35; Q statistic, p<0.001), but increased the probability of any transfusion by 91% (35 cohort studies; RR 1.29, 95% CI: 1.60, 2.28; Q statistic, p<0.001). PAD did not appear to influence LOS (6 cohort studies; WMD -0.74, 95% CI: -1.86, 0.39) or infection rates (2 cohort studies; RR 2.87, 95% CI: 0.72, 11.46).

ANH.
Thirty RCTs (n=1,295) were identified; their methodological quality was poor. ANH reduced the probability of receiving an allogeneic blood transfusion by 31% (25 RCTs; RR 0.69, 95% CI: 0.56, 0.84; Q statistic, p<0.001) and reduced the volume of allogeneic blood used per person by 1.9 units (17 RCTs; WMD 1.9, 95% CI: 1.1, 2.7). ANH did not appear to influence LOS (3 RCTs; WMD 0.21, 95% CI: -1.26, 1.68), mortality (8 RCTs; RR 1.16, 95% CI: 0.19, 7.15), infection (2 RCTs; RR 4.94, 95% CI: 0.61, 40.19) or nonfatal myocardial infarction (3 RCTs; RR 3.43, 95% CI: 0.15, 19.74).

Seven cohort studies (n=355) were identified. ANH reduced the probability of receiving an allogeneic blood transfusion by 55% (7 cohort studies; RR 0.45, 95% CI: 0.29, 0.70) and reduced the volume of allogeneic blood used per person by 2.8 units (7 cohort studies; WMD 2.8, 95% CI: 1.7, 4.0).

CS.
Thirty RCTs (n=2,125) were identified; their methodological quality was poor. CS reduced the probability of receiving an allogeneic blood transfusion by 42% (26 RCTs; RR 0.58, 95% CI: 0.47, 0.73; Q statistic, p<0.001) and reduced the volume of allogeneic blood used per person by 0.91 units (17 RCTs; WMD 0.91, 95% CI: 0.51, 1.31; Q statistic, p<0.001). CS did not appear to influence LOS (5 RCTs; WMD -1.28, 95% CI: -2.65, 0.08), mortality (11 RCTs; RR 1.53, 95% CI: 0.65, 3.61), infection (9 RCTs; RR 0.75, 95% CI: 0.41, 1.37) or nonfatal myocardial infarction (5 RCTs; RR 0.58, 95% CI: 0.28, 1.19).
Twenty-six cohort studies were identified. CS reduced the probability of receiving an allogeneic blood transfusion by 43% (26 cohort studies; RR 0.57, 95% CI: 0.46, 0.69) and reduced the volume of allogeneic blood used per person by 0.96 units (15 RCTs; WMD 0.96, 95% CI: 0.47, 1.461).

Other outcomes were reported in the paper.

Authors' conclusions
The evidence of benefit of autologous transfusion techniques comes from studies of poor methodological quality with inadequate clinical outcomes. The true clinical benefits, in terms of allogeneic blood savings and other outcomes, are unclear and probably quite small. These may even be offset by potential adverse effects.

CRD commentary
The research question underpinning this review was well defined in terms of the participants, interventions, outcomes and study designs. Attempts were made to identify all the relevant published literature, regardless of language of publication, from multiple sources. It was not clear whether attempts were made to minimise errors and bias at the study selection stage through the use of multiple reviewers. However, validity was assessed using established criteria and attempts were made to minimise error and bias in the assessment process.

Details of the individual studies were limited, which seems reasonable given the large number of studies included. The synthesis was undertaken using appropriate methods, and heterogeneity was properly assessed and investigated in predefined subgroup analyses. The review was generally well conducted and the authors' conclusions appear appropriate given the data presented.

Implications of the review for practice and research
Practice: The authors stated that techniques designed to reduce blood loss, such as antifibrinolytic drugs, and conservative transfusion thresholds used within well-constructed protocols are preferable to autologous transfusion techniques.

Research: The authors stated further research would only be warranted if it focused on large well-conducted trials comparing autologous transfusion techniques with other blood-sparing technologies, using clinically relevant outcomes.

Funding
National Health and Medical Research Council of Australia; Hunter Area Pathology Service, Australia.

Bibliographic details

PubMedID
15113377

DOI
10.1111/j.0958-7578.2004.0489.x

Indexing Status
Subject indexing assigned by NLM

MeSH
Blood Transfusion, Autologous /adverse effects /methods /statistics & numerical data; Controlled Clinical Trials as Topic /statistics & numerical data; Databases, Factual; Hemoglobins /analysis; Humans; Perioperative Care; Treatment Outcome
AccessionNumber
12004009642

Date bibliographic record published
19/10/2005

Date abstract record published
09/08/2008

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.