Platelet-rich plasmapheresis in cardiac surgery: a meta-analysis of the effect on transfusion requirements

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Authors' objectives
To determine whether intra operative platelet-rich plasmapheresis in cardiac surgery is effective in reducing the proportion of patients exposed to allogenic red cell transfusions.

Searching
MEDLINE (1966 to July 1997), HealthSTAR (1995 to July 1997), Current Contents (week 1 to week 29, 1997), Biological Abstracts (1990 to March 1997) and EMBASE/Excerpta Medica (1980 to 1997) were searched. Medtronic Inc of Canada were asked to contribute all articles or reports on this subject from their records. Bibliographies of all identified articles and reviews were handsearched. No restrictions were applied on language or medium of publication.

Study selection
Study designs of evaluations included in the review
Prospective randomised controlled trials (RCTs) that compared intra operative platelet-rich plasmapheresis to an appropriate control group were included. Duplicate publications and trials in which patients were pseudo-randomised were excluded.

Specific interventions included in the review
Platelet-rich plasmapheresis defined as the process of preparation of autologous platelets from whole blood by means of centrifugation was studied. Various devices were used to collect the platelet-rich plasma

Participants included in the review
Adults undergoing primary or redo coronary artery bypass graft (CABG) or valve replacement procedures (either alone or in combination) were included. Children were not included.

Outcomes assessed in the review
The primary outcome was the proportion of patients exposed to allogenic red cells in the peri-operative period. Secondary outcomes included the number of allogenic red cells transfused and the amount of blood lost during the first 24 hours post-operatively.

How were decisions on the relevance of primary studies made?
All titles and abstracts of identified articles were reviewed by two investigators.

Assessment of study quality
Validity was assessed using the Jadad scale which included assessment of subject and investigator blinding, method of randomisation, and reporting of subject withdrawals (see Other Publications of Related Interest). Trials scoring 3 or more were considered good quality and trials scoring less than 3 considered poor quality. Methods used to assess validity were not specified.

Data extraction
Data were extracted independently onto study data forms by two individuals with disagreement being resolved by consensus. Non-English language trials were abstracted by one investigator with the assistance of a translator. Where necessary, authors were contacted for clarification of results or to provide missing data.
Methods of synthesis

How were the studies combined?

The odds ratio (OR) and 95% confidence interval (CI) of receiving a transfusion were calculated using the random-effects model of DerSimonian and Laird. Continuous data such as the total number of units transfused and mean blood loss in first 24 hours were analysed using the fixed-effect model provided by RevMan 1.04b with summary results being expressed as weighted mean differences (WMD) with 95% CI.

How were differences between studies investigated?

Tests for heterogeneity were performed for each meta-analysis. If positive, studies that appeared to be major contributors to the heterogeneity were evaluated. The following subgroup analysis were proposed a priori: type of surgery (primary vs repeat vs either primary or repeat); volume of platelet plasma withdrawn before the operation (300 to 350 ml vs 650 to 800 ml vs 850 to 1050 ml); transfusion protocol (threshold 60 to 80 Hgb vs 80 to 90 Hgb vs 90 to 100 Hgb); and pre-treatment with aspirin (some patients on aspirin vs no patients on aspirin). Other sub- groups analysed included type of surgery (CABG vs CABG or valve); and study quality (low vs high).

Results of the review

Seventeen RCTs were included (N = 1369 patients).

Four trials were considered to be good quality and 13 trials were graded as poor quality.

Exposure to at least one unit of allogenic red cells for platelet-rich plasmapheresis treatment: OR = 0.44 (95% CI: 0.27, 0.72; P = 0.0012). Heterogeneity chi-squared = 47.1: P < 0.001 indicating marked heterogeneity.

Number of units of allogenic red cells transfused (15 RCTs): WMD (platelet-rich plasmapheresis minus control) = -0.33 units (95% CI: -0.43, -0.23). Heterogeneity chi-squared = 33.0; P < 0.001 indicating marked heterogeneity.

Volume of blood loss in first 24 hours (12 RCTs): WMD (platelet-rich plasmapheresis minus control) = -102 mL (95% CI: -148, -55; P = 0.00002). Heterogeneity chi-squared = 61.2; P < 0.001 indicating marked heterogeneity.

No difference noted in efficacy among sub-groups in the proportion of patients receiving a transfusion of allogenic red cells. No significant differences in sub-group analysis noted for mean units transfused or blood loss in first 24 hours.

Authors' conclusions

Although platelet-rich plasmapheresis appeared effective in decreasing the proportion of patients receiving transfusions after cardiac operations, the quality of most of the supporting trials was low and the benefit was small in trials of good quality. Further clinical trials should be completed.

CRD commentary

Aims and inclusion criteria were clearly stated. Several databases were searched to identify relevant studies. Methods used to select primary studies and extract data were described. Attempts were made to obtain missing data from the original authors. Validity and heterogeneity were assessed and considerable investigation of heterogeneity undertaken. The discussion included consideration of the following factors limiting the meta-analysis: small sample sizes; large amount of heterogeneity not explained by subgroup analysis; and lack of reporting of both the primary and secondary outcomes and adverse reactions in all studies.

Fuller details of the literature search such as keywords used would have been helpful.

As the author acknowledge the significant unexplained heterogeneity among trials requires that caution be exercised in commenting on the results of the review. The authors conclusions were supported by the evidence presented.

Implications of the review for practice and research

Practice: The authors consider that the unexplained heterogeneity requires that caution be exercised in recommending
this technology without large scale trials that clearly demonstrate benefit.

Research: The authors consider that a large, double-blind randomised controlled clinical trial is required to delineate the role of intra operative platelet-rich plasmapheresis in cardiac surgery and that uniform and comprehensive standards are needed when reporting results of trial of blood conservation technology.

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Bibliographic details

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Other publications of related interest

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Subject indexing assigned by NLM

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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.