Comparing the efficacy and safety of apheresis and whole blood-derived platelet transfusions: a systematic review

Heddle N M, Arnold D M, Boye D, Webert K E, Resz I, Dumont L J

CRD summary
The authors concluded that there was insufficient evidence from small diverse studies to draw definitive conclusions about clinical benefits of apheresis platelet concentrates compared with whole blood derived platelets. Further research was required. This was a well-conducted review. The authors’ conclusions reflected the limited evidence presented and are likely to be reliable.

Authors’ objectives
To compare the effects of apheresis platelet concentrates with whole blood derived platelets on clinical and laboratory outcomes.

Searching
MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, PapersFirst and ProceedingsFirst were searched from inception to January 2007. Search terms were reported. No language restrictions were applied. Abstracts from the American Society of Hematology and American Association of Blood Banks meetings (2000 to 2005) and reference lists of reviews and relevant articles were screened. Studies published as abstracts were eligible.

Study selection
Randomised controlled trials (RCTs) that compared the effects of apheresis platelet concentrates versus whole blood derived platelets (prepared from buffy coats or platelet-rich plasma) on clinical outcomes (bleeding adverse events, time to next transfusion, alloimmunisation or refractoriness) or laboratory outcomes were eligible for inclusion.

Products evaluated in the included studies differed with respect to leukoreduction (before and after storage) and age of product. Most studies were in patients with haematological malignancies and/or solid tumours who were receiving prophylactic and/or therapeutic transfusions; one study that evaluated radiolabelled platelet recovery and survival was in healthy volunteers. Studies used different definitions for acute transfusion reactions (ranging from all grades to severe reactions only), alloimmunisation and refractoriness. The duration of follow-up ranged from six days to eight weeks.

One reviewer performed the initial screening. Two reviewers then independently selected studies from those identified.

Assessment of study quality
Two reviewers independently assessed validity using the Jadad scale, which assesses randomisation, blinding and handling of withdrawals. Allocation concealment was also assessed. Disagreements were resolved by consensus. The maximum possible Jadad score was 5 points; studies scoring 2 or less were judged to be poor quality.

Data extraction
Three reviewers independently extracted data and resolved discrepancies by consensus. Outcomes were extracted as proportions for dichotomous data and means with standard deviations or medians with ranges for continuous data. Where possible, individual patient data were used in analysis.

Methods of synthesis
Pooled relative risks and 95% confidence intervals (CI) were calculated using the random-effects DerSimonian and Laird model. Pooled weighted mean differences (WMD) were calculated for continuous outcomes; studies were weighted by the variance. Heterogeneity was assessed using the I² statistic. For acute transfusion reactions, the influence of product type (leukoreduced or not leukoreduced) on reactions per patient and per transfusion was explored using logistic regression.

Results of the review
Ten RCTs were included (n= 1,137). Five studies were judged to be of poor quality. Methodological flaws included lack of reporting of methods of randomisation, allocation concealment and losses to follow-up.

The authors stated that platelet products were incomparable with respect to leukoreduction and age of product, so data were not pooled. However, the abstract reported that apheresis platelet concentrates were associated with a statistically significant reduction in the risk of acute transfusion reaction per patient than whole blood derived platelets (relative risk 0.65, 95% CI: 0.44, 0.98), but when controlled for leukoreduction for there were no significant differences between groups.

Whole blood derived platelet-rich plasma non-leukoreduced products were associated with a statistically significant higher risk of acute reactions per patient than apheresis platelet concentrate leukoreduced products (odds ratio 1.87, 95% CI: 1.12, 3.12), but there was no significant difference between whole blood derived and apheresis platelet concentrates that were leukoreduced. There was no statistically significant difference between treatments in acute transfusion reactions per transfusion.

Apheresis platelet concentrates were associated with statistically significant higher corrected count increment than whole blood derived platelets at one hour (weighted mean difference 2.49, 95% CI: 2.21, 2.77; five studies) and 18 to 24 hours (weighted mean difference 1.64, 95% CI: 0.60, 2.67; four studies; moderate heterogeneity, $I^2=50.5\%$).

For non-leukoreduced products there was no significant difference between apheresis platelet concentrates and whole blood derived platelets in alloimmunisation based on three studies with significant heterogeneity ($I^2=65.5\%$).

**Authors' conclusions**
Small diverse studies presented insufficient evidence to draw definitive conclusions about clinical benefits of apheresis platelet concentrates compared with whole blood derived platelets. High-quality RCTs were required.

**CRD commentary**
The review question was clearly stated. Several relevant sources were searched and attempts were made to minimise publication and language bias. Appropriate methods were used to minimise reviewer error and bias during the review process. Only RCTs were included, validity was assessed and results were reported. Summary data were presented in tables. Some data were pooled using meta-analyses, heterogeneity was examined and potential sources of differences among studies were explored and discussed. This was a well-conducted review. The authors' conclusions reflected the limitations of the evidence presented and are likely to be reliable.

**Implications of the review for practice and research**
Practice: The authors did not state any implications for practice.

Research: The authors stated that rigorous RCTs were required to compare apheresis platelet concentrates with whole blood derived platelets in different populations and evaluate their effects on the frequency and severity of transfusion reactions, bleeding and time to next transfusion. Studies should design and analyse studies to take account of differences between patients in their proneness to acute transfusion reactions, platelet age and ABO compatibility, and should report studies in a standardised manner. Studies should also examine the usefulness of corrected count increment as a surrogate outcome for bleeding.

**Funding**
Gambro BCT. One author developed the review proposal while an employee of Gambro BCT.

**Bibliographic details**
Heddle N M, Arnold D M, Boye D, Webert K E, Resz I, Dumont L J. Comparing the efficacy and safety of apheresis platelet concentrates compared with whole blood derived platelets in different populations and evaluate their effects on the frequency and severity of transfusion reactions, bleeding and time to next transfusion. Studies should design and analyse studies to take account of differences between patients in their proneness to acute transfusion reactions, platelet age and ABO compatibility, and should report studies in a standardised manner. Studies should also examine the usefulness of corrected count increment as a surrogate outcome for bleeding.

**PubMedID**
18482183
**DOI**
10.1111/j.1537-2995.2008.01731.x

**Original Paper URL**
http://onlinelibrary.wiley.com/journal/120121349/abstract

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Blood Component Removal / adverse effects / methods / statistics & numerical data; Humans; Platelet Transfusion / adverse effects / methods / statistics & numerical data; Randomized Controlled Trials as Topic

**AccessionNumber**
12008106115

**Date bibliographic record published**
03/02/2009

**Date abstract record published**
22/07/2009

**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.