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Platelet Activation Affects Transfusion Outcomes in Hematology-Oncology Patients: Meta-Analysis of Data from Four North American Hospitals.

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Abstract Text:

Background/Case Studies: Platelet concentrates (PC) are stored at room temperature with agitation in breathable containers and consequently for only 5-7 days. These requirements were implemented decades ago because of evidence for shortened survival of activated platelets after transfusion. Although these processes were developed to optimize transfusion outcomes for hematology-oncology patients, recent studies found that donor and apheresis factors are not addressed, leading to an average 36% of PC containing activated platelets. The objective of this analysis was to investigate the impact of an activated transfusion on count increment (CI) at different study sites.

Study Design/Methods: Apheresis PC were screened for activation status (ThromboLUX, LightIntegra Technology) in four hospital blood banks: Vancouver General Hospital, Children's Health Dallas, UCHealth Denver, and Kansas University Medical Center. Combined data were analyzed using a linear mixed model fit with CI as the outcome to provide accurate and robust estimates of the aggregate effect of activation status on CI. The model included an indicator for whether the corresponding transfusion was at or after first activated transfusion, and various fixed effects considered to be clinically relevant for predicting CI. Only patients who were platelet transfusion naïve (de novo) were included. P-values reported are from 2-sided Wald-tests using robust (sandwich) standard errors and 95% confidence intervals. All statistical modelling was conducted in SAS 9.4 using PROC MIXED.

Results/Findings: Data from a total of 432 patients and 2139 transfusions were analyzed. The mean CI in response to non-activated PCs compared to an activated and subsequent transfusions showed a statistically significant 17.1% decrease in 1-hr CI from 32.2 x 10^9/L to 26.7 x 10^9/L ($p < 0.0001$), and a statistically significant 24.3% decrease in 24-hr CI from 19.8 x 10^9/L to 15.0 x 10^9/L ($p = 0.0008$) after adjusting for within-patient trend by transfusion. Results from a sensitivity analysis supports that the observed reductions in CI at or after first activated transfusion can be attributed to the receipt of an activated transfusion rather than worsening CI over time ($p = 0.001$).

Conclusions: Despite significant efforts to minimize platelet activation in PC, donor and processing factors still lead to an average 36% of PC being activated. The result of this meta-analysis demonstrates that regardless of variability in PC supplies, patient populations, and hospital protocols, hematology-oncology patients receiving an activated platelet transfusion experience worse subsequent transfusion outcomes. Since clinical decisions are made based on post-transfusion CI, avoiding activated platelet transfusions may reduce PC requirements and cost of care for these patients.

Title:
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Preferred Presentation Format:
Oral or Poster

Keywords:
Inventory Distribution, New Innovations, New Techniques and New Technologies, Platelets and Testing and Assay Development

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