An *In Vitro* Transfusion Model to Assess Cold-stored Platelets in Trauma

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Introduction

- Up to 40% of collected platelet concentrates expire before they are used for transfusion resulting in an annual platelet wastage cost of over 5 million dollars in Canada.
- Whereas room-temperature stored platelets (**RPs**) are limited to 7 days storage due to bacterial growth, cold-stored platelets (**CPs**) can limit this growth and extend storage time.
- CPs have superior hemostatic functions *in vitro* than RPs
- CPs could be more beneficial to actively bleeding patients.
- In this study, we use an in vitro transfusion model adapted from the Massive Transfusion Protocol to investigate the functions of cold-stored platelets in trauma.

Hypothesis/Objective

Using an in vitro transfusion model, we compared the effectiveness of cold-stored platelets to room-temperature stored platelets at restoring the hemostatic potential of whole blood in trauma.

In vitro Transfusion Model Methods

Platelets were samples on days 1, 7 and 14 to make transfusion packages.

- Transfusion packages made with room-temperature stored platelets are **warm package.**
- Transfusion packages made with cold-stored platelets are **cold package**.

Simulated Trauma Patient Whole blood (WB):

- Hemodilution (diluted to 20% Hct with saline)
- Hyperfibrinolysis (tissue plasminogen activator 8.8 µg/mL)

ROTEM analysis with INTEM (ellagic acid)

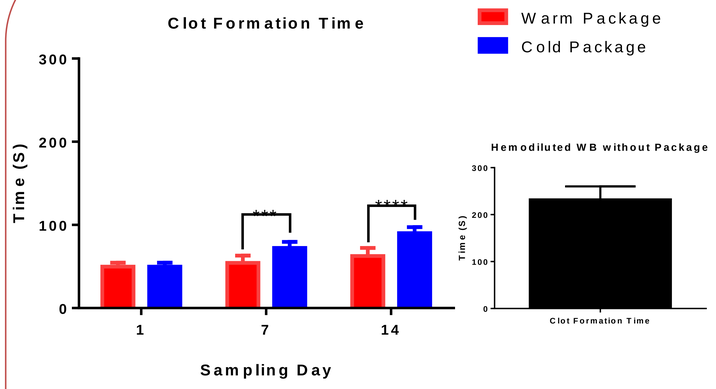
ROTEM Parameters:

- Clot Formation Time: The time between 2 mm amplitude and 20 mm amplitude.
- Maximum Clot Firmness: The maximum amplitude reached during the test
- Maximum Lysis: The percentage of lost clot stability at the end of the ROTEM reaction

Results and Discussion

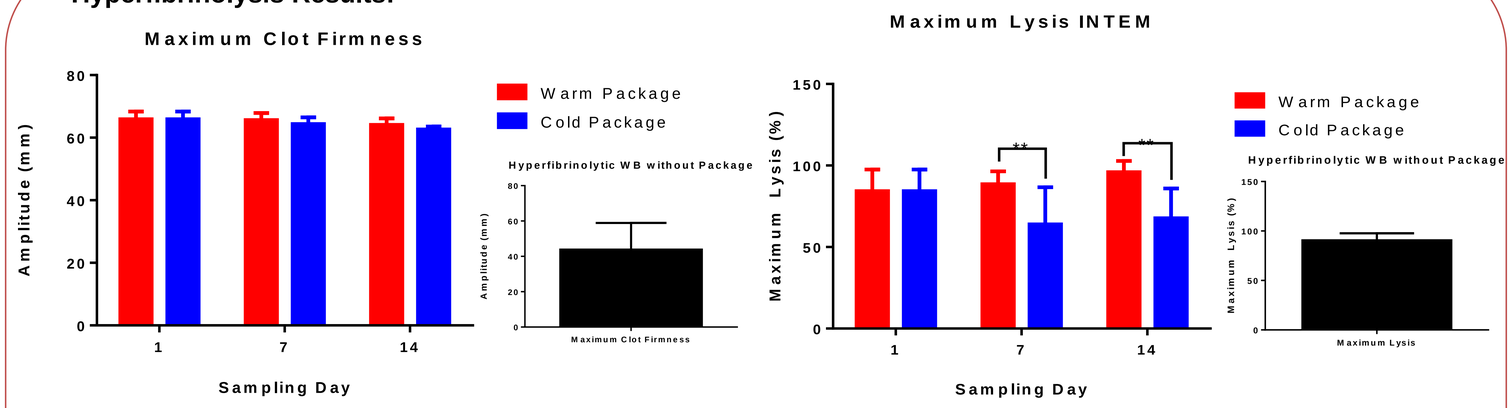
Results are shown as the mean ± 1SD of 6 independent experiments. Two-way ANOVA was used to compare difference between samples transfused with warm transfusion package and cold transfusion package. ** = P ≤ 0.01; *** = P ≤0.001; **** = P ≤ 0.0001. Statistical analysis was performed on GraphPad Prism 6.

Hemodilution Results:



Transfusion of both warm and cold packages rescued the ROTEM parameters of hemodiluted whole blood. However, transfusion with cold packages on day 7 and 14 had increased clot formation time and decreased maximum clot firmness. This could be attributed to the decreased platelet count in CPs compared to RPs during storage as shown in literature.

Hyperfibrinolysis Results:



Warm and cold transfusion packages both restored the ROTEM parameters of hyperfibrinolytic whole blood. Of note, on day 14, cold package (68±18%) but not warm package (96±7%) significantly reduced the maximum lysis of hyper-fibrinolytic whole blood (91±7%) (P<0.01).

Conclusions

Cold-stored platelets transfusion packages may be able to restore the blood hemostatic profile of trauma patients. In addition, transfusion packages made from CPs may provide additional benefit of resisting hyperfibrinolysis in bleeding patients. In trauma where post-transfusion platelet recovery is less of a concern, CPs are a viable option to restore hemostasis.

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