Platelet Activation Status and Its Impact on Clinical Outcomes
Why are platelets kept at room temperature with agitation in breathable containers for only 5-7 days?

To minimize platelet activation & improve efficacy for prophylactic use.

Platelet activation status

Non-activated

Activated
Activated or Non-activated?

Activated or Non-activated?
Platelet activation in US supply

Platelet Activation Rate - National Average (> 12,000 tested)

Non-Activated Platelets

64%

Activated Platelets

36%

Multi-center study (Cedars-Sinai, BUMC, KUMC, Dallas Children’s Hospital, UCHealth Denver, Duke) publication in preparation
Activation – Daily variation

Dallas Children’s Hospital, publication in preparation
Where do activated platelets come from?
Determine activation of supply to increase efficacy

Non-activated platelet → stress → Activated platelet and microparticle (MP) fragments

Cancer

Surgery/Trauma
Does platelet supply match the demand?
Supply & demand

Transfusions

Demand

Donations

CPX-351
Activated platelet transfusions affect clinical outcome

**Current practice:**
Platelet activation status unknown

**QI practice:**
Platelet activation status known
88-day pragmatic study at KUMC

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<tr>
<th>Baseline</th>
<th>Platelet management</th>
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<tbody>
<tr>
<td>112 Patients</td>
<td>116 Patients</td>
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<tr>
<td>592 Transfusions</td>
<td>554 Transfusions</td>
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Random bags to blood cancer patients

**Complex case:**
5/10 transfusions in any 30-day window

**Non-compliance:**
1 activated platelet transfusion

Exclusive to blood cancer patients
Benefit of non-activated platelet transfusions at KUMC

Before activated
- 103 Patients
- 304 Transfusions
- Mean 18hr Count Increment (10^9/L): 22.9
- 22% Reduction
- 1-sided p-value = 0.002

After activated
- 37 Patients
- 250 Transfusions
- Mean 18hr Count Increment (10^9/L): 18

Mean Time btw. Tx (days)
- Before activated: 4.0
- 35% Reduction
- 1-sided p-value = 0.002
- After activated: 2.6

Kansas University Medical Center, publication in preparation
Data analysis performed by Emmes Canada.
100-day pragmatic study at UCHealth Denver

Baseline

111 Patients
1208 Transfusions

Oct 2017  Nov 2017  Dec 2017  Jan 2018

Platelet management

122 Patients
1296 Transfusions

May 2018  Jun 2018  Jul 2018  Aug 2018

Complex case:
5/10 transfusions in any 30-day window

Non-compliance:
1 activated platelet transfusion

Random bags to blood cancer patients

Exclusive to blood cancer patients

Non-Activated

Activated
Benefit of non-activated platelet transfusions at UCHealth

**Before activated**
- 49 Patients
- 149 Transfusions

**After activated**
- 21 Patients
- 126 Transfusions

**Mean 1hr Count Increment (10⁹/L)**

- Before activated: 25.1
- After activated: 19.7

21.5% Reduction

2-sided p-value = 0.003

**Mean Time btw. Tx (hours)**

- Before activated: 37.7
- After activated: 28.8

30.9% Reduction

2-sided p-value = 0.04

UCHealth Denver, publication in preparation
Data analysis performed by Emmes Canada.
4-Month pragmatic study at Dallas Children’s

Baseline

101 Patients
682 Transfusions

Dec 2016 Jan 2017 Feb 2017 Mar 2017

Platelet management

112 Patients
508 Transfusions

Feb 2018 Mar 2018 Apr 2018 May 2018

Complex case:
10 transfusions in any 30-day window

Non-compliance:
3 consecutive activated platelet transfusions

Random bags to blood cancer patients

Severity of cases in Baseline and Study Period were the same.
Improvements in pediatric hospital

Baseline
101 Patients
682 Transfusions

ThromboLUX
112 Patients
508 Transfusions

Mean Transfusions Per Patient

Baseline: 6.8
ThromboLUX: 4.4

32% Reduction

1-sided p-value = 0.059

% Complex Cases

Baseline: 14%
ThromboLUX: 6%

55% Reduction

1-sided p-value = 0.035

Dallas Children’s Hospital, publication in preparation
Data analysis performed by Emmes Canada.
Benefit of activated platelet transfusions


Comparison of the Hemostatic Effects of Fresh Whole Blood, Stored Whole Blood, and Components After Open Heart Surgery in Children

Group II. Twenty-four- to 48-hour-old blood was whole blood collected 24 to 48 hours before transfusion and was stored at 4 to 6°C until used.

f fresh blood from directed, family donors. Our current practice is to use screened, refrigerated 24- to 48-hour-old whole blood for early blood replacement requirements following complex OHS with CPB in children. Another approach to decreasing blood loss after OHS suggested by the results of this study might include finding ways to improve the function of the platelets in stored platelet concentrates.

Dr. Stubbs and colleagues are to be commended for their tireless efforts to advance platelet transfusion therapy for bleeding patients, which they richly document in the current issue of TRANSFUSION. Some centers maintained dual platelet inventories until the early 1980s—one stored at room temperature for prophylactic transfusions and the other stored refrigerated for bleeding patients. Since the abandonment of this practice, we have applied a "one-size-fits-all" approach to platelet transfusion, although the primary intended function for a platelet transfusion is substantially different based on its indication. Patients with acute hemorrhage as a result of gross vascular disruption require maximal hemostatic function provided by platelets. In contrast, the primary function of platelets in the prevention of bleeding is to remain in the circulation and repair the subtle damage to endothelium that may occur in the setting of thrombocytopenia.

Murphy, Gardner, Becker, Acker, Valeri, and Slakter, to name just a few of the great pioneers of platelet transfusion, toiled over the challenges of storing these cells, trying to achieve an elusive balance between hemostatic function that can respond to hemorrhage and the need for prolonged circulation in the setting of prophylactic transfusion. Unfortunately, to date, this balance has been impossible to achieve. Room temperature storage results in loss of platelet hemostatic function with preservation of circulation time, whereas cold storage leads to desialylation and early clearing (over 1-2 days) but preservation of hemostatic function. Platelet transfusions continue to be a treatment of choice for the management of bleeding in the setting of trauma.

Supply & demand solution

CPX-351

Personalized platelet transfusions close the gap
Personalized platelet transfusions

Cancer

Surgery/Trauma
Email: emaurer@mail.ubc.ca
Call: 1-604-734-3548
Follow me on Twitter @dr_emaurer
Activated platelets – non-immune refractoriness

New drugs prolong thrombocytopenia

HLA mismatch – immune refractoriness