CD34 Collection Efficiency (CE) in the Allogeneic PBSC Donor – Insights for Optimizing Collections

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May 6, 2016
Background

• PBSC collections for NMDP are 1-2 days for a total of 24 L WB processed (not including anticoagulant)

• Calculations on how much WB to process use historical CE2 based on donor Pre CD34+ count

• CE1 is based on average of donor Pre and Post CD34+ counts – cannot be calculated until the end of the collection

• Most studies about CE1 performed to date have focused on autologous collections
Background

\[
CE1 = \frac{\text{Total CD34+ Collected}}{\text{WB Volume Processed} \times \frac{\text{Pre CD34} + \text{Post CD34}}{2}}
\]

\[
CE2 = \frac{\text{Total CD34+ Collected}}{\text{WB Volume Processed} \times \text{Pre CD34}}
\]
Fig. 1. The absolute number of CD34+ cells × 10^3/ml blood during leukapheresis in nine patients.

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Objectives

• Analyze the difference between CD34+ CE1 and CE2 in the allogeneic donor setting
• Determine whether CE1 and CE2 correlate with donor Pre WBC and Pre CD34+
• Make recommendations about the use of CE2 for calculations for optimizing whole blood to process
Methods

• Prospective analysis of 35 collections
• Routinely scheduled PBSC donors for NMDP
• Routine Post-CBC sample used to determine Post CD34+ count
• No additional donor consent required per NMDP
• Analyzed only Day 1 collections
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Results

- N = 35
- Age range: 18-63
- Male to female ratio: 22/13
- Median requested CD34 dose (x10^6) = 431
  range = 178 - 1010
## Results

<table>
<thead>
<tr>
<th></th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB drawn (L)</td>
<td>21.5</td>
<td>12.8 – 25.1</td>
</tr>
<tr>
<td>TBVs Processed</td>
<td>4.2</td>
<td>1.9 – 6.5</td>
</tr>
<tr>
<td>Pre WBC (k/uL)</td>
<td>34.4</td>
<td>14.6 – 54.3</td>
</tr>
<tr>
<td>Pre CD34 (/uL)</td>
<td>91</td>
<td>19 – 235</td>
</tr>
</tbody>
</table>

![Pre CD34 Count](chart.png)
Results

n = 35

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<tr>
<td>Pre CD34 (/uL)</td>
<td>91</td>
<td>19 - 235</td>
</tr>
<tr>
<td>Post CD34 (/uL)</td>
<td>65</td>
<td>6 – 276</td>
</tr>
</tbody>
</table>

Paired t-test of pre vs post CD34 concentration - p = 0.004
Mean difference = 20 cells/ uL
# Results

<table>
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<tr>
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<th>Range</th>
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<tbody>
<tr>
<td><strong>n = 35</strong></td>
<td></td>
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</tr>
<tr>
<td>CD34 yield (x10^6)</td>
<td>765</td>
<td>212 – 1424</td>
</tr>
<tr>
<td>Actual/Requested CD34</td>
<td>1.5</td>
<td>0.5 – 3.4</td>
</tr>
<tr>
<td>yield</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD34 CE2 (%)</td>
<td>40</td>
<td>17 – 97</td>
</tr>
<tr>
<td>CD34 CE1 (%)</td>
<td>44</td>
<td>18 – 110</td>
</tr>
</tbody>
</table>

Paired t-test of CE1(%) vs CE2 (%), *p < 0.001*

Mean difference between CE2 and CE1 = -6%
Results

Wide range between -22% and 8%
Objectives

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No correlation between donor peripheral WBC count and CD34 CE1 (p = 0.536)
Pre WBC and CD34+ CE2

No correlation between donor peripheral WBC count and CD34 CE2 (p = 0.260)
Pre CD34+ and CD34+ CE1

Inverse correlation between donor pre CD34 count and CD34 CE1 ($p < 0.001$)
Inverse correlation between donor peripheral pre CD34 count and CD34 CE2 ($p < 0.001$)
Intra-procedure CD34 Mobilization

CD34 Cells Mobilized Intra-Procedure(%) = \( \frac{\text{Total # of CD34s in donor post procedure} + \text{CD34 yield in product}}{\text{Total # of CD34s in donor pre procedure}} \)

CD34 cells mobilized during collection (as a % of CD34 cells present in donor pre-collection) correlates inversely with pre CD34 count. (p < 0.001)

Higher CD34 pre count donors mobilize proportionally less CD34 cells intra-procedure
- May contribute to lower CE values observed in higher pre CD34 count donors
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Pre CD34+ and CD34+ CE2

Less conservative CE2 value = more under-collections in higher CD34 count donors

More conservative CE2 value = more over-collections in lower CD34 count donors (due to larger WB processed targets)
Using two different CE2 values (based on pre CD34 count) optimizes WB processed across a range of pre CD34 counts.
Conclusion

In the allogeneic donor setting, ~4 TBVs WB processed

• CE2 is a good surrogate for evaluating collection performance (mean difference of 6% compared to CE1)

• No correlation found between Pre WBC and CE1 or CE2

• Inverse correlation between Pre CD34+ and CE1 or CE2
  – May be due to lower intra-procedure mobilization in high pre-CD34+ donors

• Multiple CE2 values based on Pre CD34 count may be useful to ensure requested cell dose is collected across low and high Pre CD34 counts
Questions?