Beyond Mobilization: Factors Affecting Peripheral Blood CD34+ Cell Collection by Large Volume Leukapheresis

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Exodus of a Stem Cell

- Mobilization
- COLLECTION
- Transplant
Collection Efficiency

• Generally accepted equation:

\[
\text{CD34}^+ \text{ cell yield} = \frac{\text{Peripheral CD34}^+ \text{ cells/μL} \times \text{apheresis collection volume processed (μL)}}{
}

• Issues
  – Complicated and different algorithms
    • Lots of variable interactions
  – Non-linear correlations
  – Wide variability in collection efficiencies
Obtaining Stem Cells as a Static Phenomenon

Mobilization

Efficient ($\approx 0.95$)

Collection

CD34 conc. (%)

$t_0$

2 TBV  4 TBV
Obtaining Stem Cells as a Dynamic Phenomenon

Mobilization

Efficiency (> 1)

Collection

CD34 conc. (%)

$t_0$

2 TBV 4 TBV
Research Aim

• A new way of thinking about collection efficiency:

*Use pre-collection CD34+ cell count (pre-CD34) in a regression analysis to coin the term, **predictive power**, a different approach to predicting and determining an efficient collection.*
# Patient Characteristics

<table>
<thead>
<tr>
<th>Donor Classification</th>
<th>Number of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple myeloma</td>
<td>236</td>
</tr>
<tr>
<td>Non-Hodgkin’s lymphoma</td>
<td>118</td>
</tr>
<tr>
<td>Hodgkin’s disease</td>
<td>27</td>
</tr>
<tr>
<td>Acute leukemia</td>
<td>8</td>
</tr>
<tr>
<td>Amyloidosis</td>
<td>5</td>
</tr>
<tr>
<td>Germ cell tumor</td>
<td>1</td>
</tr>
<tr>
<td>Allogeneic</td>
<td>89</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>484</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mobilization Regimens</th>
<th>Number of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-CSF</td>
<td>227</td>
</tr>
<tr>
<td>Plerixafor</td>
<td>5</td>
</tr>
<tr>
<td>G-CSF + Plerixafor</td>
<td>353</td>
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<tr>
<td>G-CSF + Chemotherapy</td>
<td>66</td>
</tr>
<tr>
<td>G-CSF + Plerixafor + Chemotherapy</td>
<td>32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>683</strong></td>
</tr>
</tbody>
</table>

4 total blood volumes processed for all patients
Pre-CD34+ Correlates with Collection Yield

\[ y = 7.687x \]
\[ r = 0.948 \]
Predictive Power Correlates with Collection Efficiency

$PP = \frac{CY}{Pre-CY}$

$Pre-CY = 7.687 (pre-CD34)$

$r = 0.853$

$p < 0.001$
Predictive Power

- Range: 0.01 – 3.53
- 3 groups based on PP
  - PP < 0.7 (n = 113)
  - PP = 0.7 - 1.3 (n = 250)
  - PP > 1.3 (n = 81)
Diagnosis and Mobilization Effect on Predictive Power

***p < 0.001
BMI Effect on Predictive Power

*** $p < 0.001$
TBV Directly Associated with Predictive Power

*** $p < 0.001$
WBC Inversely Associated with PP

**p < 0.001**
PLT Inversely Associated with Predictive Power

**p < 0.01
***p < 0.001
Pre-CD34 Inversely Associated with PP

** $p < 0.01$

*** $p < 0.001$
Conclusion

• Predictive power is a reliable model for identifying significant trends in efficient collections.
• Patients mobilized with G-CSF and chemo may contribute to a dynamic efficiency of collection by pooling stem cells from sources outside the circulation (during collection).
• Plerixafor potentially reflects a static contribution to an efficient collection.
Future Research

• Use predictive power to maximize the efficiency of a stem cell collection.
  – *Especially for patients who fail to achieve collection goal and/or are poor mobilizers.*

• Use predictive power to make an educated guess on whether or not a collection will be successful.
Acknowledgements

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