Leukapheresis for hyperleukocytosis in the pediatric leukemic population

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Introduction

- Hyperleukocytosis is defined as leukemia with an initial WBC > 100K.

- Patients with hyperleukocytosis are at risk for:
  - Early death
  - Neurological complications
  - Pulmonary leukostasis syndrome
  - Profound metabolic abnormalities
  - Tumor lysis syndrome

- Leukapheresis is recommended as a standard therapy
  - Category I indication, AML with WBC > 100K
  - Category III indication, ALL with WBC > 400K
What is known in pediatrics?

• Evaluated 178 ALL pediatric patients (median age 7.1 years) with WBC >200K.

• Degree of hyperleukocytosis > 400K was associated with:
  – Neurological complications (p=0.006)
  – Respiratory complications (p=0.014)

• The majority of complications existed at initial presentation

• 94 with median WBC >400K had cytoreduction
  – Decreased WBC (p=0.013)
  – However, delay in induction chemotherapy was common

• Conclusion: cytoreduction may be considered for WBC >400K or for patients with complications at presentation

Pediatr Blood Cancer 2005;45:10–15
Where the literature is lacking...

- Safety in the pediatric population?
  - Incidence of procedure related complications?

- Is cytoreductive effect the same for all leukemias?

- Does cytoreduction have an effect on outcome?
  - Mortality?
    - Early vs. late
  - Relapse rates?
Research Questions

1. What is the procedure related complication rate for pediatric leukapheresis?
   • Hypothesis: Leukapheresis has a low procedure complication rate in the pediatric population.

2. Would leukapheresis for hyperleukocytosis in pediatric acute leukemias decrease the early mortality rate, late mortality rate, and late relapse rates?
   • Hypothesis: Leukapheresis will significantly decrease the early mortality rate, late mortality rate, and late relapse rate.
Materials & Methods

• 5 year (2007-2011) retrospective review of children <19 years old presenting with WBC >100K

• Parameters examined:
  ➢ Clinical demographics
  ➢ Type of leukemia (AML, ALL, CML, etc.)
  ➢ Laboratory values
  ➢ Complications
    ➢ Neurological, respiratory, nephrogenic, coagulopathic
  ➢ Early (within 1 week) and late (at 6 months) mortality
  ➢ Relapse rate at 6 months
  ➢ Procedure details
    ➢ Number/timing of procedures, procedure related complications
Results

- 65 patients identified with WBC > 100K

- Evaluated patients by therapy received:
  - No leukapheresis
  - Leukapheresis
## Results - Demographics

<table>
<thead>
<tr>
<th></th>
<th>Leukapheresis (N=37)</th>
<th>No Leukapheresis (N=28)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age (years)</td>
<td>9</td>
<td>11</td>
<td>0.42</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>ALL</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>AML</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>CML</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Median Initial WBC count (x10⁹/L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td>480</td>
<td>140</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>AML</td>
<td>162</td>
<td>121</td>
<td>0.0532</td>
</tr>
<tr>
<td>CML</td>
<td>383</td>
<td>167</td>
<td>0.0182</td>
</tr>
<tr>
<td></td>
<td>ALL (N=20)</td>
<td>AML (N=9)</td>
<td>CML (N=8)</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
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<td>-----------</td>
</tr>
<tr>
<td>% WBC Decreased After First Reduction</td>
<td>50%</td>
<td>61%</td>
<td>17%</td>
</tr>
<tr>
<td>% Final WBC Decrease</td>
<td>70%</td>
<td>61%</td>
<td>54%</td>
</tr>
<tr>
<td>Mean Number of Leukapheresis Procedures</td>
<td>1.8</td>
<td>1.1</td>
<td>7</td>
</tr>
</tbody>
</table>

- ALL (N=20)
- AML (N=9)
- CML (N=8)
# Results - Complications

<table>
<thead>
<tr>
<th>Clinical Complications</th>
<th>Leukapheresis (N=37)</th>
<th>No Leukapheresis (N=28)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>32%</td>
<td>32%</td>
<td>0.8</td>
</tr>
<tr>
<td>Neurologic</td>
<td>27%</td>
<td>25%</td>
<td>0.88</td>
</tr>
<tr>
<td>Nephrologic</td>
<td>14%</td>
<td>29%</td>
<td>0.22</td>
</tr>
<tr>
<td>Coagulopathic</td>
<td>51%</td>
<td>46%</td>
<td>0.69</td>
</tr>
</tbody>
</table>

**Procedural Complications**: 0
Results: Mortality

- Early (within 1 week) deaths was statistically different between the two groups
  - Leukapheresis – 0 deaths
  - No leukapheresis – 3 deaths, p=0.047
Results: Mortality

- Late (at 6 months) deaths and relapse was not different
  - Leukapheresis – 5 deaths/relapses
  - No leukapheresis – 1 death/relapse, p=0.19
Conclusions

• This 5 year, single center, retrospective review noted:

  ➢ A lack of procedure related complications suggesting that leukapheresis can be performed safely in the pediatric population.

  ➢ Leukapheresis is effective in reducing WBC count in all types of leukemia, however, it is least efficient for CML patients.

  ➢ No difference in end organ complications was seen between those who received leukapheresis and those who did not.

  ➢ In this small single center review, there is no difference in late survival or relapse rate.
Thank you.