Welcome to eSessions

Presented by CaridianBCT
WBC Depletion Procedures

COBE Spectra® Apheresis System
Presentation Overview

- Indication for a WBC depletion procedure
- Symptoms of leukocytosis
- Diseases treated
- Procedure goal
- Modification considerations
Presentation Objectives

Participants will be able to

• Name the indication and goal of a WBC depletion procedure.
• Identify two reasons for choosing an MNC procedure over a PMN procedure.
• Explain why processing 2 x TBV is more effective than processing 1 x TBV.
• Name the two factors to consider when choosing the correct collect flow rate.
Participants will be able to

- Explain how to calculate the fluid balance for a WBC depletion procedure and how to maintain isovolemia during the procedure.
- Identify three factors that affect procedure efficiency.
Important Note

• The information presented about symptoms of leukocystosis and diseases treated is educational and not intended for diagnostic purposes.
• The references used are listed at the end of the presentation.
Symptomatic leukocytosis

- WBC concentration of >100 x 10^3/µL
  - Range reported of 50 x 10^3/µL (AML) to 300 x 10^3/µL (CLL)*.

*“Leukemic cell’s ability to respond to cytokines and its expression of specific adhesion molecules are probably more important in determining whether leukostasis will develop than the number of circulating blasts.”

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Leukocytosis

Hyperviscosity due to large numbers of circulating cells may lead to:

• Leukostasis
• Vascular occlusion
• Perivascular leukemic cell infiltration
• Vascular damage
• Diminished blood flow
Symptoms of Leukocytosis

Symptoms are caused by hyperviscosity of the blood, increased rate of metabolism, and cell death. They can include, but are not limited to:

• Dizziness
• Headache
• Fainting
• Altered sensorium
• Intracranial hemorrhage
• Pulmonary insufficiency and hemorrhage
• Metabolic imbalances (e.g., hypocalcemia)
Diseases Treated

• Acute disorders
  • Acute myelogenous leukemia (AML)*
  • Acute myelomonocytic leukemia (AMML)*
  • Acute monocytic leukemia (AMOL)*
  • Blast crisis phase of chronic myelogenous leukemia (CML)*
  • Acute lymphoblastic leukemia (ALL)

*Patients with these disorders are at greatest risk for leukostasis.
Diseases Treated (cont)

• Chronic disorders*
  • Chronic myelogenous leukemia (CML)
  • Chronic myelomonocytic leukemia (CMML)
  • Chronic lymphocytic leukemia (CLL)

*For patients with these disorders, WBC depletion procedures can play an adjunctive role when symptoms related to leukocytosis appear.
Questions?
Procedure Goal

Rapid removal of greatly elevated numbers of WBCs to reduce patient’s morbidity and/or mortality

NOTE: Cytopheresis procedures provide only supportive therapy; chemotherapy controls the underlying disease.
Modification Considerations

- Procedure selection
- Blood volume processed
- Interface control
- Collect flow rate
- Fluid balance
- Procedure efficiency
MNC or PMN procedure

- What is the patient’s diagnosis?
- What cell type is increased?
  - Monocytes, lymphocytes, and blasts ⇒ select MNC
  - Mature granulocytes ⇒ select PMN
- Is the physician willing to use a sedimenting agent if PMN is the procedure of choice, and is a sedimenting agent and/or trisodium citrate available?
  - No ⇒ select MNC
The amount of blood volume processed is one of the major factors that contributes to the quantity of cells removed during a WBC depletion procedure. “The most consistent success has been achieved using continuous-flow procedures in which large volumes of patient blood are processed.”²
Interface Control

During Quick Start:
• Do not change the collect flow rate.

After Quick Start:
1. Change the collect flow rate.
2. Monitor the collect line exiting the centrifuge.
3. Adjust the plasma flow rate to achieve and maintain the desired collect line color.
   - MNC procedure: 3% to 4% Hct
   - PMN procedure: About 7.5% Hct
Collect Flow Rate

Default collect flow rate:
• MNC procedure: 1 mL/min
• PMN procedure: 3 mL/min

The number of WBCs and the possible recruitment of sequestered cells make it necessary to increase the collect flow rate to achieve a more effective reduction of circulating WBCs.
Collect Flow Rate: Adults

Table applies to
Adult patient (TBV 3-7L)
WBC count up to 500,000

<table>
<thead>
<tr>
<th>WBC precount (000)/µL</th>
<th>100</th>
<th>200</th>
<th>Collect (mL/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>8</td>
<td>11</td>
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<td>21</td>
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<td></td>
<td>13</td>
<td>20</td>
<td>27</td>
</tr>
</tbody>
</table>

| Inlet (mL/min) | 40 | 60 | 80 |

Note: The recommended collect flow rate should be adjusted to accommodate specific patient conditions.
Collect Flow Rate: Children

Based on documented procedures, we suggest determining a minimum collect flow rate*, ** as follows:

Collect flow rate = 0.0003*** x Inlet flow rate x WBC pre-count

Example:

Inlet flow rate = 10 mL/min  
WBC pre-count = 600 x 10^9/L  
Collect flow rate = 0.0003 x 10 x 600 = 1.8 mL/min

*The physician makes the final decision about how to determine the rate!  
**Using a collect flow rate below 0.8 mL/min is not recommended.  
***The constant is based on an inlet:AC ratio of 12:1.
In very small children (3.3 to 6.4 kg) with high WBC counts, the removal efficiency is about 40% when adequate collect flow rates are used.

The table below shows how much inlet volume to process to achieve the noted reductions.

<table>
<thead>
<tr>
<th>% Reduction</th>
<th>TBV Processed</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1.9</td>
</tr>
<tr>
<td>60</td>
<td>2.5</td>
</tr>
<tr>
<td>70</td>
<td>3.7</td>
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</tbody>
</table>
Fluid Balance

• **Ins:**
  - AC volume used
  - Net saline returned: 263 mL
    (Rinseback volume – Prime saline divert volume)

• **Outs:**
  - Volume collected*

• **Surplus or deficit:**
  - Difference between Ins and Outs

*To reduce volume collected, decrease the collect flow rate by 40% midway through a 2 x TBV run.
Example:

- AC volume: 600 mL
- Net saline: 263 mL
- Collect volume: 1500 mL

<table>
<thead>
<tr>
<th>INS</th>
<th>OUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 mL AC</td>
<td>1500 mL Collect</td>
</tr>
<tr>
<td>+263 mL Saline</td>
<td>- 1500 mL</td>
</tr>
<tr>
<td>863 mL</td>
<td>- 673 mL</td>
</tr>
</tbody>
</table>

**Deficit** of 673 ml.

NOTE: When using HES (PMN procedure) consider volume expansion.
Post-procedure WBC count is not always a good indicator of the procedure efficiency because of the possible recruitment of sequestered cells.

Consider obtaining the total WBC count on the collected waste product and comparing it to the patient’s starting total WBC count.
Checklist for Success

✓ Choose the appropriate procedure.
✓ Enter the actual patient Hct to speed up interface establishment.
✓ Choose the appropriate collect flow rate.
✓ Calculate the fluid balance and give replacement fluid as necessary throughout the procedure.
✓ Achieve and maintain interface stability in order to collect from the correct cell layer at all times.
✓ Monitor the collect line Hct.
✓ Provide enough anticoagulant to prevent platelet aggregation, which can interfere with the stability of the interface.
In these patients, the underlying disease can cause metabolic imbalances, including hypocalcemia, hyperkalemia, hyperphosphatemia, hyperuricemia, that might need treatment and careful attention during the WBC depletion procedure to prevent adverse effects.
WBC Depletion References


3. COBE Spectra(R) Apheresis System Helpful Hints for WBC Depletions (*WBC Depletion Workbook*), CaridianBCT, Inc., Lakewood, CO