I. Hyperleukocytosis and Rationale for Leukopheresis

- Increased WBC count may be manifestations of various myeloproliferative disorders, leukemias, etc
- Hyperleukocytosis leads to leukostasis, which results in microvascular obstruction, ischemia, possible hemorrhage and organ dysfunction
- Disease control ultimately requires chemotherapy, immunotherapy, radiation, etc, but some time may be required before therapy is effective
- Goal of leukopheresis: Rapid reduction of peripheral WBC count could reduce morbidity and mortality for symptomatic patients or those at risk for life threatening events (Category I ASFA/AABB Indication)
- Leukopheresis often serves as a bridging therapy in the interval between diagnosis and initiation of definitive therapy
- Clinical sings and symptoms of leukostasis can be variable and nonspecific, onset could be acute or chronic
  - Cerebrovascular leukostasis presents with vascular insufficiency or intracerebral hemorrhage
  - Pulmonary leukostasis presents with SOB, tachypnea, hypoxemia, diffuse pulmonary infiltrates without laboratory or clinical evidence of pneumonia
  - Priapism may be seen in CML
- Risk greatest with AML, AMML, or AMoL (acute monocytic leukemia), and blast phase of CML
- Patients with chronic or accelerated phase of CML or CMML and increased immature myeloid cells are also at risk
- Leukopheresis often performed on the basis of elevated WBC count and/or symptoms, however WBC counts do not always correlate with clinical risks
- Better correlation with immature myeloid blast count. Leukostasis is
  - Present in most AML patients with WBC counts above 200,000/µL, or blast count > 100,000/µL
  - Uncommon in ALL unless WBC above 250,000/µL
  - Seen in CML patients with WBC counts above 300,000/µL to 500,000/µL
  - Rarely seen in CLL even with very high counts
- In the future, expression of adhesion molecules (hence ability of WBCs to infiltrate through blood vessels or form aggregates in the blood vessels) may become basis for performing leukopheresis procedures.
- Removal of tumor cells also decreases the risks of tumor lysis syndrome. This is frequently done but not yet an “official” AABB or ASFA indication. Currently the evidence for “prophylactic” procedures is weak
- Leukopheresis may also be adjunct or primary therapy for patients who are refractory to chemotherapy or have contraindications
  - E.g Pregnant woman with CML
II. Procedural Considerations for Leukopheresis

- Can be performed with most centrifugal apheresis instruments
- In emergent cases, peripheral venous access can be used instead of central venous catheter (and avoid the attendant risks of catheter placement)
- No standardized protocol established, but usually:
  - 8-10L of whole blood processed (~2 blood volumes)
  - 6% hydroxyethyl starch (HES) added to facilitate separation of WBCs and RBCs. HES causes RBCs to have rouleaux formations.
  - HES should always be used if cells to be removed are mature myeloid cells (heavier cells that sit right above the RBC layer during centrifugation). Lymphoid and monocytic cells may be removed efficiently without HES
- No guidelines on the absolute post-procedure WBC count or percentage of cell count reduction that should be accomplished
- Because of the large size of WBCs, the total cell volume removed often exceeds 0.5L, and 1.0L in many patients
- Volume loss may be offset to some extent by the volume expanding properties of HES, but replacement fluid may still be needed if loss exceeds 1L
- WBCs may also be mobilized from extramedullary sites into the intravascular space during procedure, thus the reduction in WBC may be less than expected
- Both the post-procedural WBC count and percentage of cell count reduction are unpredictable. Most procedures result in a 30-50% reduction of WBC count.
- Repeat procedures as necessary based on post-procedural assessments. For most AML patients <100,000/μL post procedure is adequate. Mid procedure count may be helpful.