Plateletpheresis

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KIMS
Brief structure of platelet
Platelet components available
Advantages and disadvantages (SDP vs RDP)
Donor selection criteria
Plateletpheresis
Indications and contraindications of platelet transfusion
Platelets

- Platelets are anucleate blood cells that form a platelet plug by adhesion and aggregation, thereby contributing to hemostasis.

Normal count - (150 - 450 \times 10^3/\mu l)
Platelet Components Available

RDP – Random Donor platelets

SDP – Single Donor Platelets

Methods of preparation

RDP – platelet rich plasma method
- Buffy coat method

SDP – Apheresis
Advantages and disadvantages (SDP vs RDP)

- One apheresis unit = one adult dose
- Decreases donor exposure
- Leukodepleted product
- Expensive
- Time taking procedure
- Post transfusion raise in platelet count: $5 \times 10^{11}/l$

- 6 RDP units = one adult dose
- Multiple donor exposure
- Poorly leukodepleted
- Cost effective
- Easy to prepare
- Post transfusion raise in platelet count after 1 RDP: $40 – 70 \times 10^9/l$
<table>
<thead>
<tr>
<th></th>
<th><strong>SDP</strong></th>
<th></th>
<th><strong>RDP</strong></th>
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<tbody>
<tr>
<td>Volume</td>
<td>200 – 300 ml</td>
<td>Volume</td>
<td>50 – 60 ml</td>
</tr>
<tr>
<td>Platelets</td>
<td>≥3-7 x 10^{11}/unit</td>
<td>Platelets</td>
<td>5 x 10^9 / unit</td>
</tr>
<tr>
<td>Leukocytes</td>
<td>&lt;5x10^6 / unit</td>
<td>Leukocytes</td>
<td>&lt;1 x10^8 / unit</td>
</tr>
<tr>
<td>pH</td>
<td>&gt;6</td>
<td>pH</td>
<td>&gt; 6</td>
</tr>
<tr>
<td>Red Cell</td>
<td>&lt;0.5mL</td>
<td>Red Cell</td>
<td>2 ml</td>
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Donor Selection and Monitoring

- Plateletpheresis donors may donate more frequently than whole blood donors but must meet all other donor criteria.
- The interval between donations should be at least 2 days.
- Frequency limits for plateletpheresis – two collections per week with at least 48 hr interval and maximum of 24 collections per year.
- Total volume limits (excluding anticoagulant) –
  - 500 ml if 50 – 80 kg
  - 600 ml if > 80 kg
• Platelet components are prepared from whole-blood donation or apheresis collection
• 6 – 8 RDP = 1 plateletpheresis unit = Therapeutic dose
• A routine plateletpheresis procedure typically takes 45 to 90 minutes.
• If the donor donates a unit of whole blood, or if it becomes impossible to return the donor’s red cells during plateletpheresis, at least 3 months should elapse before a subsequent plateletpheresis procedure unless the extracorporeal red cell volume is less than 100 mL.
Donors who have taken antiplatelet medications that irreversibly inhibit platelet function are deferred for specific intervals before donation:

- aspirin/aspirin-containing medications - 48 hours;
- Feldene - 48 hours;
- Plavix/clopidogrel - 14 days;
- Ticlid/ticlopidine - 14 days;
Drugs that inhibit platelet function

- ADP receptor antagonists – clopidogrel, prasugrel, ticlopidine
- Antibiotics- cephalosporin, nitrofurantoin, penicillin
- Anti Gp IIb/IIIa – abciximab, eptifibatide, tirofiban
- Cardiac drugs- nitroglycerine, nitroprusside
- Cyclooxygenase inhibitors- aspirin, NSAIDs
- Heparin- unfractionated, low molecular weight
- Miscellaneous- dextran, hydroxyethyl starch
- Phosphodiesterase inhibitors- cilostazol, dipyridamole
LABORATORY TESTING:
- ABO GROUP
- RH TYPE
- Antibody Screening for alloantibodies
- Markers for Transfusion Transmitted Diseases (should be repeated only at 30 day interval)
- If red cells are visible, the hematocrit should be determined.
- If component contains more than 2 ml of red cells, the red cells must be ABO compatible with recipient plasma and be cross-matched.
Informed Consent

• Information sheet – understandable language
  - description of the procedure
  - time
  - associated risks
  - frequency of donation
  - number of units collected
INTRODUCTION

• Apheresis is the process of collecting blood components such as plasma, platelets, red blood cells, and granulocytes from donor blood.

• The term “apheresis” is derived from the Latin word “aphaeresis”, which means “withdrawal”.

• Apheresis is accomplished using an apheresis instrument termed a cell separator. Whole blood from the donor is separated by the device through centrifugation, based on the specific gravity and/or filtration parameters.

• The selected component of the blood is retained, while remaining blood components are returned to the donor through automated circulation.

• The processing time is approximately 1-2 hr.
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<th>COMPONENT REMOVED</th>
<th>APPLICATION</th>
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<td>Plasmapheresis</td>
<td>Plasma</td>
<td>Donor and patient</td>
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<td><strong>Plateletpheresis</strong></td>
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<td>Leukapheresis</td>
<td>White blood cells</td>
<td>Donor and patient</td>
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<td>Red Blood cells</td>
<td>Donor and patient</td>
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<td>HPC apheresis</td>
<td>Hematopoietic progenitor cells (HPC)</td>
<td>Donor and patient</td>
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Plateletpheresis

**DONOR COLLECTION**
- Efficient removal of most specific elements without causing sufficient depletion to harm the donor

**THERAPEUTIC**
- Treatment goal is to deplete the circulating cells or substance responsible for disease process
METHODOLOGY

• 1. Centrifugation
• 2. Membrane filtration

• Centrifugation – Two types
  1. Intermittent flow centrifugation: In an intermittent flow centrifugation (IFC) procedure, blood is processed in batches or cycles, hence the term intermittent. The cycles are repeated until the desired quantity of product is obtained. A plateletpheresis procedure usually takes six to eight cycles to collect a therapeutic dose.
2. Continuous flow centrifugation: In a continuous flow centrifugation (CFC) procedure, the processes of blood withdrawal, processing, and reinfusion are performed simultaneously in an ongoing manner. This is in contrast to IFC procedures, which complete a cycle before beginning the next one.

- Membrane filtration: Membrane separators are typically composed of bundles of hollow fibers or flat plate membranes with specific pore sizes. As whole blood flows over the fibers or membrane, plasma passes through the pores and is collected, while the remainder of the cellular components is returned to the donor.
INTERMITTENT FLOW

- Blood processed in batches
- The container must be emptied before the next batch is processed

CONTINUOUS FLOW

- Ongoing process
- The separation container need not be emptied until the end of the procedure
PROCEDURE

• Donor's whole-blood is anticoagulated as it is passed through the instrument.
• Microprocessor controls blood flow rate.
• It is centrifuged and the blood is separated into red cells, plasma and a leukocyte platelet fraction.

• Then the derived fraction or component is removed and remainder of the blood is recombined and returned to the donor.
Apheresis Machine - Hemonetics MCS +
Quality Assurance and Monitoring

- SOP: collection, processing, compatibility testing, storage
- Equipment: standardized, calibrated
- Collection Efficiency (%) = \( \frac{\text{platelet yield per SDP} \times 100}{\frac{\text{Pre count} + \text{Post Count}}{2}} \times [\text{processed volume} - \text{AC volume}] \)
- Operator training
- Donor Monitoring
- Component testing, Record Keeping
- Quality control: plt. Count, WBC, pH, RBC count, volume...
Adverse Donor Reactions

Local Reactions
- Vascular injury
- Hematoma
- Paravasation
- Nerve injury

Systemic Reactions
- Citrate toxicity
- Vagal reaction
- Device related
- Hypotension

Immediate Reactions
- Hypotension
- Vagal reaction
- Citrate toxicity
- Machine related

Delayed Reactions
- Hematoma
- Nerve injury
Citrate Reactions in the donor/patient includes Numbness and twitching of mouth and lips, chills, bradycardia, tetany.

**Factors influencing:**
- Type of anticoagulant: ACD A or ACD B
- Rate of infusion
- Amount of citrate infused
- Donors serum albumin level
- Intermittent flow or continuous flow technique

**Management:**
- Reduce the flow rate
- Increase blood: ACD ratio
- Oral calcium: 2g calcium carbonate
- IV calcium infusion...
Indications for Platelet Transfusion

• Prophylactic platelet transfusions in patients with non-immune thrombocytopenia due to bone marrow disease or chemotherapy, or following haematopoietic stem cell transplant

• Platelet transfusions in bleeding patients with thrombocytopenia or platelet function defects

• Platelet transfusions in disseminated intravascular coagulation (DIC)

• Platelet transfusions in patients with long-term non-immune thrombocytopenia, unlikely to remit

• Platelet transfusions in patients with autoimmune thrombocytopenia
Indications for Platelet Transfusion

• Platelet transfusions in patients with acquired platelet function abnormalities
• Platelet transfusions in patients with congenital platelet disorders
• Platelet transfusions in massive haemorrhage
• Platelet transfusion in children, and infants under 4 months – additional considerations
• Platelet transfusion following thrombolysis for acute stroke
Contraindications for Platelet Transfusion

- Thrombotic thrombocytopenic purpura
- Heparin-induced thrombocytopenia
- Congenital IgA deficiency
• REFERENCES:
  
  • Principles Of Transfusion Medicine by ROSSI 2nd edition 1996.
  
  
Thank You