Plateletpheresis

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Brief structure of platelet

Platelet components available

Advantages and disadvantages (SDP vs RDP)

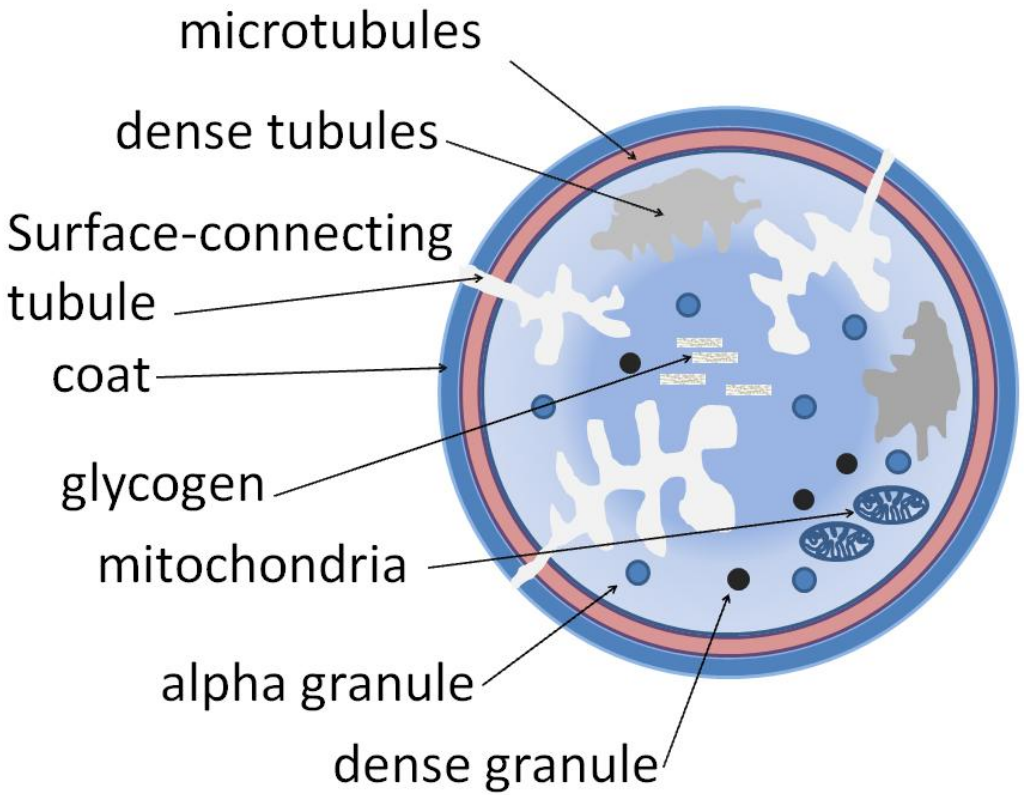
Donor selection criteria

Plateletpheresis

Indications and contraindications of platelet transfusion

Platelets

- Platelets are anucleate blood cells that form a platelet plug by adhesion and aggregation, there by contributing to h



Normal count - (150 - 450×10 $^{3/\mu l}$)

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 x 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 x 10^{9}/ l

SDP

- Volume 200 – 300 ml
- Platelets ≥3-7 x 10^{11}/unit
- Leukocytes <5x10^{6} / unit
- pH >6
- Red Cell <0.5mL

RDP

- Volume 50 – 60 ml
- Platelets 5x 10^{9} / unit
- Leukocytes <1 x10^{8} / unit
- pH > 6
- Red Cell 2 ml

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 llb/llla – 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 .

PROCEDURE	COMPONENT REMOVED	APPLICATION
Plasmapheresis	Plasma	Donor and patient
Plateletpheresis	Platelets	Donor and patient
Leukapheresis	White blood cells	Donor and patient
Erythrocytapheresis	Red Blood cells	Donor and patient
HPC apheresis	Hematopoietic progenitor cells (HPC)	Donor and patient

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 .

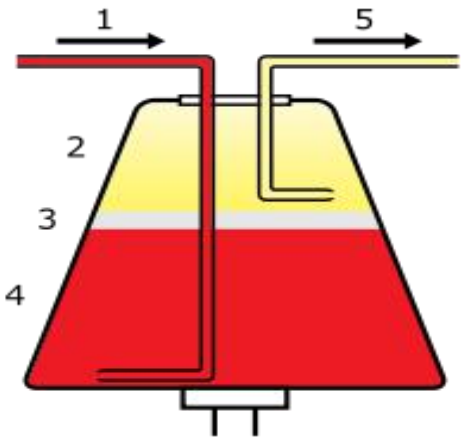
A plateletpheresis procedure usually takes six to eight cycles to collect a therapeutic dose.

2. Continuous flow centrifugation : In a continuous flow centrifugation (CFC) procedure, the processes of blood withdrawal, processing, and reinfusion are performed simultaneously in a 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 in to 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
- Operator trainin
- Donor Monitorir
- Component testing, Record Keeping
- Quality control : plt. Count, WBC, pH, RBC count, volume…

Collection Efficiency (%)

$$\frac{\text{platelet yield per SDP } x100}{\left[\frac{Pre\ count + Post\ Count}{2}\right] x\ [processed\ volume - AC\ volume]}$$

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.
- Modern Blood Banking And Transfusion Practices by Denise M Harmening 6th edition 2012.
- AABB update of guidelines for platelet transfusion – WHO manual , 2014.

Thank You