

Division of Blood Transfusion Services

Ministry of Health and Family Welfare



Apheresis



Apheresis

- Greek word meaning to remove.
- Apheresis is used for :

Harvesting the desired blood component

OR

Removing unwanted component

Principle of Apheresis

- Collection and anticoagulation of blood withdrawn from a donor or patient.
- Separation using Centrifugal or Membrane based technology.
- Retention of a desired component or a combination of components from donor or patient.
- Return of remaining constituents to the donor or patient.

Modalities

- Continuous flow
- Intermittent flow

Continuous flow

- Whole blood withdrawn and processed.
- Blood elements separate by density.
- Component to be removed is diverted.
- Remaining blood components are mixed with replacement fluid and returned to the patient.

Intermittent flow

- Whole blood is first withdrawn,
- Blood withdrawal is then stopped.
- Extracorporeal blood is processed.
- The remainder is returned to the patient.

Apheresis

Single or Combinations of the following constituents of blood can be separated by apheresis technique.

- Platelets
- Red blood cells
- Granulocytes
- Plasma
- Peripheral blood stem cells

Apheresis Platelets



Apheresis Platelet Donors

- Voluntary donors
- Family members
- HLA matched donors
- Platelet –antigen-compatible donors.



Platelet Donor selection and Monitoring

- Plateletpheresis donors should meet the same qualifications as blood donors.
- The interval between donations should be at least two days.
- Donor should not undergo plateletpheresis more than twice in a week or more than 24 times in a year.



Platelet Donor selection and Monitoring

- If the donor donates a unit of whole blood, or if it becomes impossible to return the donor's red cells during platelet pheresis, at least eight weeks should elapse before a subsequent platelet pheresis procedure.
- Donors who have taken antiplatelet medications are deferred for specific intervals. Aspirin – 48 hours, clopidogrel – 14 days, ticlopidine – 14 days.
- Donor's platelet count should be above 150,000/microliter.

Testing of Apheresis Platelets

- ABO group
- Rh type
- Unexpected alloantibodies
- TTI markers.

Apheresis Platelets

- Apheresis platelet component should contain at least 3×10^{11} platelets in 90% of sampled units.

Apheresis Plasma

Apheresis device can be used to collect plasma as

- Transfusable Fresh Frozen Plasma
- Source Plasma for subsequent manufacturing.

Granulocytes

- The granulocyte yield of Apheresis Granulocytes should be \geq to 1×10^{10}
- This can be achieved if the donor has been pretreated with steroids, granulocyte colony-stimulating factor or both.
- Lower- yield components are adequate for transfusion to neonates, who are the major recipients of granulocytes.

Granulocytes Storage

- Granulocytes should not be agitated during storage.
- Should be stored at 20⁰ to 24⁰ C.
- Should never be stored in a refrigerator.
- Should be transfused as soon as possible.

Apheresis Red blood cells

- Red blood cells can be obtained as a double unit of RBCs using apheresis.

Therapeutic Apheresis

- It encompasses the treatment of diseases through removal of blood components or specific blood substances.

Therapeutic Apheresis

- It is the process in which whole blood is withdrawn from a person's circulation.
- A pathologic component is separated out and retained.
- The remainder is returned to the patient.

Cytapheresis

To remove excessive or pathogenic cells:

- **Leukocytes:** acute leukemia with high blast counts.
- **Platelets:** essential thrombocythemia.
- **Red cells:** sickle cell anemia (with acute chest syndrome/stroke), severe malaria, babesiosis.

Cytapheresis (contd...)

- If red cells are removed and replaced with donor Red blood Cells, it is called red cell exchange.

Therapeutic Plasma Exchange (TPE)

- Separation and removal of plasma from whole blood.
- Replacement by a colloid solution (e.g. albumin or plasma) or a combination of crystalloid/colloid solution.

Therapeutic Plasma Exchange (TPE)

- It is usually limited to 1 or 1.5 plasma volumes, or approximately 40 to 60 ml plasma exchanged per kg of body weight.
- Larger volume exchanges can increase the risk of coagulopathy, citrate toxicity, or electrolyte imbalance, depending on the replacement fluid.

Therapeutic Plasma Exchange

TPE is done to remove a pathogenic substance :

- **Autoantibody** e.g. antiglomerular basement membrane antibody disease, myasthenia gravis.
- **Alloantibody** e.g. renal transplantation with presensitization, antibody-mediated organ transplant rejection.
- **Myeloma:** to remove excessive paraprotein.

Therapeutic Plasma Exchange

TPE is also used to provide a deficient normal substance, e.g. an enzyme or coagulation factor.

Replacement fluids

Replacement fluids used for TPE :

- Crystalloids
- Albumin
- Plasma
- Cryo-reduced plasma

Adverse reactions to Apheresis

- Paresthesia
- Hypotension
- Urticaria
- Nausea
- Shivering
- Flushing

Filtration devices

- Anticoagulated whole blood is passed through a filter.
- It allows plasma to pass and retains blood cells.
- The separated plasma is diverted into a waste bag.
- In selective adsorption, plasma is further processed and returned to the patient.

Selective Adsorption

Plasma is passed through a medium with high affinity for a specific component :

- IgG – refractory ITP, Rheumatoid arthritis
- LDL - Familial hypercholesterolemia

Photopheresis

- Buffy coat layer is treated with 8-methoxypsoralen and ultraviolet light & reinfused into the patient.
- This treatment causes cross linking of leukocyte DNA, which prevents replication and induces apoptosis.
- **Indications for photopheresis:** Prophylaxis of Cardiac allograft rejection, Cutaneous T- cell lymphoma,