

APHERESIS

Apheresis word emerged from a Greek verb a-fur-ee-sis "to take away" in early 20th century. The term apheresis generally refers to the separation of blood into its different components, removal of one component and the return of the remainder.

Apheresis procedure can be of two types.

- ▶ Donor procedure - Harvest a desired component from a healthy donor. Commonest procedure is Plateletpheresis.
- ▶ Therapeutic apheresis (For patients) - Remove an incriminating substance from a patient. Commonest procedure is the plasma Exchange, while Leukocytapheresis (WBC Removal) and Erythrocytapheresis (RBC Removal) are also performed sometimes.

PLATELETPHERESIS

Definition :

Plateletpheresis is the procedure in which we can harvest large number of Platelets from a donor, which would reduce the donor exposure for patient by six to eight times.

- ▶ Plateletpheresis is used to obtain platelets from volunteer donors, from patients' relatives or from donors with matched HLA phenotype.
- ▶ Because large number of platelets can be obtained from a single individual, collection by apheresis reduces number of donor exposures for patient.
- ▶ Product name - Platelets, Pheresis
Also called apheresis platelets or single-donor platelets (SDPs)

Donor Selection criteria :

Plateletpheresis donor may donate blood more frequently than whole blood donors.

The interval between donations should be at least 72 hours and the donors should not undergo plateletpheresis more than twice in a week or more than 24 times in a year.

Donor should not have taken aspirin-containing medication within 36 hours prior to donation.

Important usage of Apheresis Platelet in different specialty :

Hematology-

1. Aplastic or hypo plastic anemia
2. Immune Thrombocytopenic Purpura (ITP)
3. Disseminated Intravascular Coagulation (DIC)
4. Bone marrow suppression following chemotherapy after leukemia
5. Myelo Dysplastic syndrome (MDS)
6. Non-Hodgkin's Lymphoma (NHL)

General Medicine-

1. Any condition in which more than 4 units of random donor platelet is required
2. Refractory thrombocytopenia
3. Thrombocytopenia following ingestion of aspirin containing compounds
4. Thrombocytopenia following P. Falciparum infection
5. Thrombocytopenia due to septicemia
6. Dengue fever

Cardiology-

1. Thrombocytopenia following cardiopulmonary bypass surgery
2. Following vascular surgery

Gynecology-

1. Thrombocytopenia following APH or PPH
2. DIC due to retained product of conception, amniotic fluid embolism, eclampsia, retained dead fetus or abruptio placenta etc.

Surgery-

1. Hypersplenism
2. Thrombocytopenia following major operation

Oncology-

1. Thrombocytopenia following chemotherapy, hypoplasia

Nephrology-

1. Any condition leading to thrombocytopenia

Neurology-

1. Any condition leading to thrombocytopenia

Continuous flow Apheresis Procedures :

Continuous flow separation can be done by CS-3000 plus machine.

Adv : Smaller extracorporeal volume,

Shorter procedure

Disadv : Double arm procedure

Advantage of Apheresis platelet over random donor platelet unit

- ▶ 6 times less donor exposure
- ▶ Reduced exposure to potentially infectious diseases
- ▶ Fewer febrile nonhemolytic reactions
- ▶ Reduced HLA immunization (due to fewer donor exposures)
- ▶ Better response in "refractory" patients (those who don't respond well to random donor platelet concentrates Transfusion)

Storage And Shelf life :

Stored at 20-24° c. on shaking platform for 5 days.

Dosage And Administration :

- ▶ 1 unit of Platelet, Pheresis increases platelet count by 3×10^{11} platelets (30,000-60,000 in patients) i.e. equivalent to 6-8 units of random donor platelets.
- ▶ Preferably procedure should be done on an ABO matched donor. If red cells contamination is there the unit should be cross-matched before issue.

THERAPEUTIC APHERESIS

PLASMA EXCHANGE

Cells, plasma or plasma constituents may be removed from the circulation and replaced by normal plasma, crystalloids or colloids. The theoretical basis for therapeutic plasma exchange is to reduce the patient's load of a pathologic substance to levels that will allow improvement.

Indications :

1. Neurological conditions:

- Acute Guillian-Barre Syndrome
- Myasthenia Gravis
- Chronic Inflammatory Demyelinating Polyneuropathy (CIDP)

2. Hematological Conditions:

- TTP/HUS
- Paraproteinemia
- Hyperleucocytosis
- Thrombocythemia (>15 lakh/cu mm)
- Post transfusion Purpura
- Sickle cell disease

3. Others:

- Cryoglobulinemia
- Homozygous type II familial hypercholesterolemia

Volume Exchange :

1-1.5 plasma volume exchanged at every cycle for better results. (e.g.-if the weight of the patient is 70 kg, 1.5 exchange means processed 4200 ml of plasma)

Average number of procedures :

3-7 procedures depending on patient's clinical improvement

Frequency :

Usually 1 procedure on every alternate day

Efficacy :

About 65% of incriminating substance (eg. antibody) is removed after one plasma volume exchange.

Replacement fluid :

Albumin is preferred as a replacement fluid. Since albumin is expensive, so in lot of patients, plasma has to be used in place of albumin as the colloid solution. The ratio of colloid and crystalloid in the replacement fluid is usually 50:50.

Preprocedure lab investigation :

Hemoglobin, Serum protein, PT/APTT, Platelet count.

Preferably the procedure is done through the ante-cubital vein. Intra-venous catheter in subclavian/ internal jugular/ femoral vein is preferred for good venous access especially in pediatric age group/ critically ill patients.

LEUCOCYTAPHERESIS

Leucocytapheresis (Leukapheresis) is a term for "to take away leukocytes" (white blood cells).

- ▶ Leukapheresis is often used to treat the elevated white cell count that can occur in acute leukemia.
- ▶ Several different thresholds have been used.
 1. Fractional volume of leukocytes above 20%
 2. Total circulatory leukocytes above 1,00,000/ul.
 3. Circulatory blasts above 50,000/ul.
- ▶ Leukapheresis is sometime used to reduce the white cell count <1,00,000/ul before the start of chemotherapy, to reduce likelihood of tumor lysis syndrome.
- ▶ Factors such as erythrocyte concentration, leukemic cell type, rate at which the count is rising, potential obstructions to cerebral or pulmonary blood flow, the patient's coagulation status and general condition should be considered.

ERYTHROCYTAPHERESIS

Erythrocytapheresis is a term used to removal of infected/ abnormal red blood cells.

Indications :

1	Infectious agents targeting red cells	Malaria Babesiosis
2	Abnormality in Red cells	Sickle cell disease
3	Increase in RBC mass	Polycythemia vera
4	Due to abnormality in iron metabolism	Hereditary hemochromatosis Transfusion associated iron overload Methemoglobinemia

COMPLICATIONS OF APHERESIS

Generally they are very rare.

If at all, they are there then mainly Physical discomfort (vasovagal reaction or maintaining venous access), Citrate toxicity or Allergic complications can occur, sometimes.



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