

Physiological basis of Blood Transfusion

Indications for Transfusion:-

1. Acute Blood loss
2. Chronic Anemia
3. Bone marrow failure
 - leukemia
 - Aplastic Anemia
 - Bone marrow infiltration by neoplastic cells
4. Purpura
5. Clotting Factor deficiencies
6. preparation of surgery and during surgery
7. Burns

Procedure of Blood Transfusion

- (1) Selection of Appropriate Donor.
- (2) ABO and Rh typing.
- (3) Cross matching.
- (4) Antibody Screening of the Patient.

① SELECTION OF APPROPRIATE DONOR:

- Should select donors free from transfusion-transmissible diseases
- The age of the donor should be 18 yrs or above and preferable not above 60 yrs.
- Donor should be voluntarily donate the blood.
- Hemoglobin status should be 12g% in Females
13g% in males.
- Donor should not be having AIDS, hepatitis and protozoal organisms like malaria, filaria etc...

② ABO and Rh TYPING:

- ABO incompatibility ~~must be~~ causes intermediate reactions and may even kill persons
- Rh incompatibility causes delayed reactions

- The concept of Universal donor and recipient helps in this process.

Universal Donor:

- O^{-ve} because their red cells contain no antigens.
Hence it is given to any individual.

Universal recipient

- AB⁺ because their plasma has no antibodies. Hence do not ~~contain~~ cause agglutination reaction against any blood cells.

③ CROSSMATCHING

Addition to ABO and Rh system, there are many minor blood group systems. Hence cross matching is done to eliminate the possibilities of mismatching.

Major cross-matching:

- In this procedure, we are looking for antibodies in recipient against transfused red blood cell antigens from the donor.
- Therefore, we need serum from recipient and RBC from donor.

Minor cross-matching:

- In this procedure, we are looking for antibodies in the donor serum to the recipient RBC.
- Therefore, we need serum from the donor and RBC from recipient.

④ ANTIBODY SCREENING OF THE PATIENT

The recipient serum should be screened for various antibodies like autoantibodies that may react against the donor's cells and cause hemolysis.

Blood Collection-And Storage:

Collection of Blood:

Usually, 350 ml of blood is collected from a single donor.

- Then mixes 50 to 70 ml of anticoagulant

Anticoagulant = citrate + phosphate + dextrose (CPD)

- Donors are advised not to donate blood for at least next 3 months.

Storage of Blood:

Blood stored in blood bank at 4°C .

- This stored blood can be used within 2 weeks of storage.

Should not be used after 3 weeks due to gross haemolysis occurs during this period.

Red cell changes during storage:

- Reduction of metabolism of cells

- $\uparrow$ in sodium and $\downarrow$ in K^+

$\rightarrow$ decrease

Occurs due to

$\rightarrow \downarrow$ active transport of ions across the membrane

$\rightarrow \text{Na}^+ \text{K}^+$ pump activity grossly decreased

$\rightarrow$ Inhibition of $\text{Na}^+ \text{K}^+$ pump inc intracellular sodium conc that causes H_2O to enter the cell by Endosmosis

- Cells swell and become more spherocytic result in spontaneous haemolysis
- AP content in the cell $\downarrow$ and inorganic Phosphate conc $\uparrow$

Hazards of Blood Transfusion:

Mostly Transfusion reactions occurs due to human error.

1) Due to mismatched Transfusion:

When incompatible blood is transfused, the mismatched reaction occurs immediately

- Complications are
1. Shivering and fever
 2. Jaundice
 3. Acute renal failure
 4. Hemoglobinemia and hemoglobinuria
 5. Hyperkalemia.

② Due to Faulty Techniques of Giving blood:

- Wrong method of transfusion
- Complications are
 1. Thrombophlebitis → mostly occur in persons who receive repeated transfusions.
 2. Air Embolism → Air Enters in Venous circulation

③ Due to Massive Transfusion:

- Occurs when more than 10 units of blood is given within hours.
- leads to circulatory overload.

④ Febrile Reaction:

- occurs due to presence of pyrogens in the transfusion apparatus.

⑤ Allergic reactions:

- less frequent
- complications → itching, erythema, nausea, vomiting

⑥ Transmission of Diseases:

1. Hepatitis
2. AIDS
3. Malaria
4. Syphilis