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PHARMACEUTICAL BIOTECHNOLOGY

UNIT 3

TOPIC :

- g) Blood products and Plasma Substitutes



Blood Products

Blood products are therapeutic components obtained from whole blood by separation and processing.

They are used to correct specific deficiencies of blood components such as:

- Red blood cells (RBCs)
- Platelets
- Plasma proteins
- Coagulation factors

Types of Blood Products

1. Whole Blood

Whole blood contains all blood components:

- RBCs
- WBCs
- Platelets
- Plasma

Composition

- Cellular components
- Plasma proteins
- Clotting factors
- Electrolytes

Uses

- Acute hemorrhage
- Massive blood loss
- Severe trauma

Disadvantages

- Risk of circulatory overload
- Increased transfusion reactions
- Limited use due to availability of specific blood components

2. Packed Red Blood Cells (PRBCs)

- PRBCs are concentrated erythrocytes obtained after removal of most plasma from whole blood.

Characteristics

- High concentration of RBCs
- Reduced plasma content
- Increased oxygen-carrying capacity

Uses

- Severe anemia
- Acute blood loss
- Surgical blood replacement

Advantages

- Efficient oxygen delivery
- Lower risk of fluid overload
- Reduced plasma-related reactions

3. Fresh Frozen Plasma (FFP)

- Fresh Frozen Plasma is plasma separated from whole blood and frozen within a few hours of collection.

Contents

- Coagulation factors
- Albumin
- Immunoglobulins
- Plasma proteins

Uses

- Coagulation disorders
- Liver disease
- Massive blood transfusion
- Deficiency of clotting factors

Advantages

- Replaces clotting factors
- Corrects bleeding disorders

Plasma Derivatives

- Plasma derivatives are products obtained from plasma by fractionation and purification processes.

Types of Plasma Derivatives

1. Albumin

Albumin is the major plasma protein responsible for maintaining colloidal osmotic pressure.

Functions

- Maintains fluid balance
- Prevents edema
- Expands plasma volume

Uses

- Burns
- Hypovolemic shock
- Severe hypoalbuminemia

2. Immunoglobulins

Immunoglobulins are antibody preparations obtained from plasma.

Functions

- Provide passive immunity
- Neutralize pathogens

Uses

- Immunodeficiency disorders
- Viral infections
- Post-exposure prophylaxis

3. Clotting Factor Concentrates

Purified coagulation factors obtained from plasma.

Uses

Hemophilia A

- Factor VIII concentrate

Hemophilia B

- Factor IX concentrate

Other Bleeding Disorders

- Coagulation factor replacement

Advantages of Blood Components Over Whole Blood

- Targeted therapy
- Better utilization of donated blood
- Reduced transfusion complications
- Lower risk of circulatory overload
- Improved patient safety

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Plasma Substitutes

- Plasma substitutes are solutions used to restore circulating blood volume in cases of hypovolemia.
- They do not contain blood cells and cannot transport oxygen.
- They are also called plasma expanders.

Functions of Plasma Substitutes

- Increase blood volume
- Maintain blood pressure
- Improve circulation
- Restore tissue perfusion

Characteristics of Ideal Plasma Substitutes

An ideal plasma substitute should:

Safety

- Non-toxic
- Non-antigenic
- Non-pyrogenic
- Free from pathogens

Effectiveness

- Maintain colloidal osmotic pressure
- Expand plasma volume efficiently
- Produce rapid action

Stability

- Long shelf life
- Easy storage
- Easy availability

Compatibility

- Should not interfere with blood grouping
- Should not affect coagulation

Elimination

- Adequate duration of action
- No harmful accumulation
- Easy excretion

Types of Plasma Substitutes

A. Natural Plasma Expanders

Human Albumin

Albumin obtained from human plasma acts as a natural plasma expander.

Mechanism

Maintains colloidal osmotic pressure and draws fluid into blood vessels.

Uses

- Burns
- Shock
- Hypovolemia
- Plasma loss

B. Synthetic Plasma Expanders

1. Dextran

Dextran is a polysaccharide solution used as a plasma volume expander.

Mechanism

Retains water within blood vessels and increases plasma volume.

Uses

- Hypovolemic shock
- Surgical blood loss
- Trauma

Advantages

- Rapid plasma expansion
- Improves circulation

2. Hydroxyethyl Starch (HES)

HES is a synthetic starch polymer used for plasma volume expansion.

Characteristics

- Longer duration of action
- Effective plasma volume replacement

Uses

- Fluid resuscitation
- Hypovolemia
- Surgical procedures

3. Gelatin Solutions

Examples

- Haemaccel
- Gelofusine

Characteristics

- Short-term plasma expansion
- Rapid action

Uses

- Mild blood loss
- Moderate blood loss
- Temporary volume replacement

4. Crystalloid Solutions

Examples

- Normal Saline (0.9% NaCl)
- Ringer Lactate Solution

Characteristics

- Replace body fluids
- Short duration of action
- Widely available

Uses

- Dehydration
- Fluid replacement
- Initial shock management