**Chapter 24: "Blood Transfusion and Its Adverse Effects"**

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## Chapter 24: Blood Transfusion and Its Adverse Effects

### 🎯 Objective:

By the end of this chapter, students should know:

- The **adverse reactions** that can occur during or after a blood transfusion.
- The **components of blood**, their **preparation**, **storage**, and **uses**.

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### 💧 1. Introduction

- **Blood transfusion** means transferring blood or its components from a **donor** to a **recipient (patient)**.
- It is done to replace lost blood or to treat anemia or bleeding disorders.
- However, it can sometimes cause **serious reactions or infections** if not done carefully.

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### ⚠️ 2. Risks of Blood Transfusion

- In **tropical countries**, the risk of transmitting infections (like HIV, hepatitis, malaria, syphilis) is **high** if blood is **not screened** properly.
- Blood transfusion also carries the risk of **immune reactions** if the donor and recipient blood groups are **not compatible**.
- Therefore, **blood should only be given when necessary**, after checking the patient's **hemoglobin (Hb)** or **packed cell volume (PCV)**.

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### 🩸 3. Blood Components and Their Preparation

When a **whole blood donation** is taken, it is collected into plastic bags containing **anticoagulants** like:

- **CPD** = Citrate, Phosphate, Dextrose
- **CPDA** = Citrate, Phosphate, Dextrose, Adenine

🔹 The **citrate** prevents clotting by binding calcium in blood.

Then, the whole blood is **centrifuged (spun)** to separate it into 3 layers:

1. **Red Blood Cells (RBCs)**
2. **Buffy coat** (White Blood Cells + Platelets)

3. **Plasma (Fresh Frozen Plasma)**

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## 🩸 Blood Components and Their Uses

*1. Red Blood Cells (RBCs):*

- Stored at **4–6°C** for up to **35 days**.
- Used to treat **anemia** and **blood loss**.

*2. Granulocyte Concentrates:*

- Prepared from **healthy donors**.
- Used for **patients with severe neutropenia** (very low white blood cell count).

*3. Platelet Concentrates:*

- Made using **cell separators** or from individual donor units.
- Stored at **room temperature (22–24°C)**.
- Used for patients with:
    - **Thrombocytopenia** (low platelets)
    - **Platelet function disorders**
    - **Bleeding or risk of bleeding**

*4. Fresh Frozen Plasma (FFP):*

- Plasma rapidly frozen and stored at **below -30°C**.
- Contains **clotting factors** and is used to correct **bleeding disorders**.

*5. Cryoprecipitate:*

- Obtained by **thawing FFP at 4°C**.
- Contains **Factor VIII** and **Fibrinogen**.
- Used in **Hemophilia A** and **Fibrinogen deficiency**.

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## ⚠ 4. Adverse Effects of Blood Transfusion

### 1 Haemolytic Transfusion Reaction

- Occurs when **wrong blood group** is transfused (e.g., wrong ABO or Rh).
- Causes **breakdown of red blood cells** inside blood vessels (**intravascular haemolysis**).
- **Symptoms:** Fever, chills, back pain, dark urine, shock, kidney failure.
- **Prevention:** Crossmatching and checking blood group carefully.

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## 2 Febrile (Fever) Reactions

- Due to **antibodies against white blood cells (HLA antibodies)**.
- Common in people with **previous transfusions or pregnancy**.
- **Symptoms:** Fever, rigors (shivering), sometimes lung problems.
- **Prevention:** Use **leucocyte-depleted (filtered)** blood.

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## 3 Transfusion-Associated Circulatory Overload (TACO)

- When too much blood is transfused too fast.
- Causes **heart failure** (shortness of breath, raised blood pressure).
- **Prevention:** Slow transfusion, give **diuretics** (to remove extra fluid).

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## 4 Transfusion of Bacterially Contaminated Blood

- Rare but serious.
- Especially occurs in **platelet packs stored at 20–24°C** (favorable for bacterial growth).
- **Symptoms:** Shock, fever, low blood pressure, loss of consciousness.
- **Prevention:** Strict sterile collection and screening.

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## 5 Graft-versus-Host Disease (GVHD)

- Happens when **donor lymphocytes attack the patient's tissues**.
- Occurs in **immunocompromised patients (weak immune system)**.
- **Prevention:** Use **irradiated blood products**.
- **Note:** It is **fatal** if not prevented.

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## 6 Transfusion Related Acute Lung Injury (TRALI)

- Occurs within **6 hours** after transfusion.
- **Symptoms:** Cough, breathlessness, fever, chills.
- Due to donor antibodies reacting with patient's WBCs in lungs.

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## 7 Post-Transfusion Purpura

- Appears **7–10 days** after transfusion.
- Due to immune reaction against platelets → **severe thrombocytopenia** (very low platelets).
- **Symptoms:** Bleeding under skin (purpura).

## 8 Viral Transmission

- Blood can carry viruses like:
  - **Hepatitis (B, C)**
  - **Cytomegalovirus (CMV)**
  - **Epstein–Barr virus (EBV)**
  - **HIV**
  - **HTLV (Human T-cell leukemia virus)**
- **Prevention:** Routine **screening** of all blood donations.

## 9 Other Infections

- Some other diseases can also be transmitted by blood transfusion:
  - **Malaria**
  - **Syphilis**
  - **Toxoplasmosis**

## 10 Post-Transfusional Iron Overload

- Occurs in patients who get **many red cell transfusions over years** (like in **Thalassemia major**).
- Iron builds up in **liver, spleen, and other organs**.
- **Complication:** Organ damage.
- **Treatment:** Iron chelation therapy (to remove extra iron).

## Summary Table: Blood Transfusion Reactions

| Type | Cause | Main Symptoms | Prevention |
|---|---|---|---|
| Hemolytic reaction | Wrong blood group | Fever, back pain, dark urine | Crossmatching |
| Febrile reaction | WBC antibodies | Fever, chills | Filtered blood |
| TACO | Too rapid transfusion | Breathlessness | Slow transfusion, diuretics |
| Bacterial contamination | Infected blood | Shock, collapse | Sterile collection |
| GVHD | Lymphocyte attack | Fatal | Irradiated blood |
| TRALI | Donor antibodies | Lung injury | Careful donor screening |
| Post-transfusion purpura | Platelet antibodies | Bleeding | Avoid re-exposure |

| Type | Cause | Main Symptoms | Prevention |
|---|---|---|---|
| Viral infections | Unscreeened blood | Hepatitis, HIV | Screening |
| Iron overload | Repeated transfusion | Organ damage | Chelation therapy |

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## 10 Important Short Questions and Answers

1 **Q:** What is blood transfusion?
**A:** It is the transfer of blood or its components from a donor to a recipient.

2 **Q:** What anticoagulant is used in blood collection bags?
**A:** Citrate phosphate dextrose (CPD) or CPDA.

3 **Q:** Name the three main components obtained after centrifugation of blood.
**A:** Red cells, buffy coat (platelets + WBCs), and plasma.

4 **Q:** What is the storage temperature for red blood cells?
**A:** 4–6°C for up to 35 days.

5 **Q:** What is cryoprecipitate and what does it contain?
**A:** It is plasma thawed at 4°C; contains Factor VIII and fibrinogen.

6 **Q:** What causes hemolytic transfusion reactions?
**A:** Transfusing wrong blood group (ABO or Rh incompatibility).

7 **Q:** What is TRALI?
**A:** Transfusion Related Acute Lung Injury — causes cough, breathlessness, and fever within 6 hours after transfusion.

8 **Q:** Why are immunocompromised patients given irradiated blood?
**A:** To prevent graft-versus-host disease (GVHD).

9 **Q:** What infections can be transmitted through blood transfusion?
**A:** HIV, hepatitis B & C, malaria, syphilis, and toxoplasmosis.

10 **Q:** What is post-transfusional iron overload and who gets it?
**A:** Iron buildup in body due to repeated transfusions, seen in thalassemia major.

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