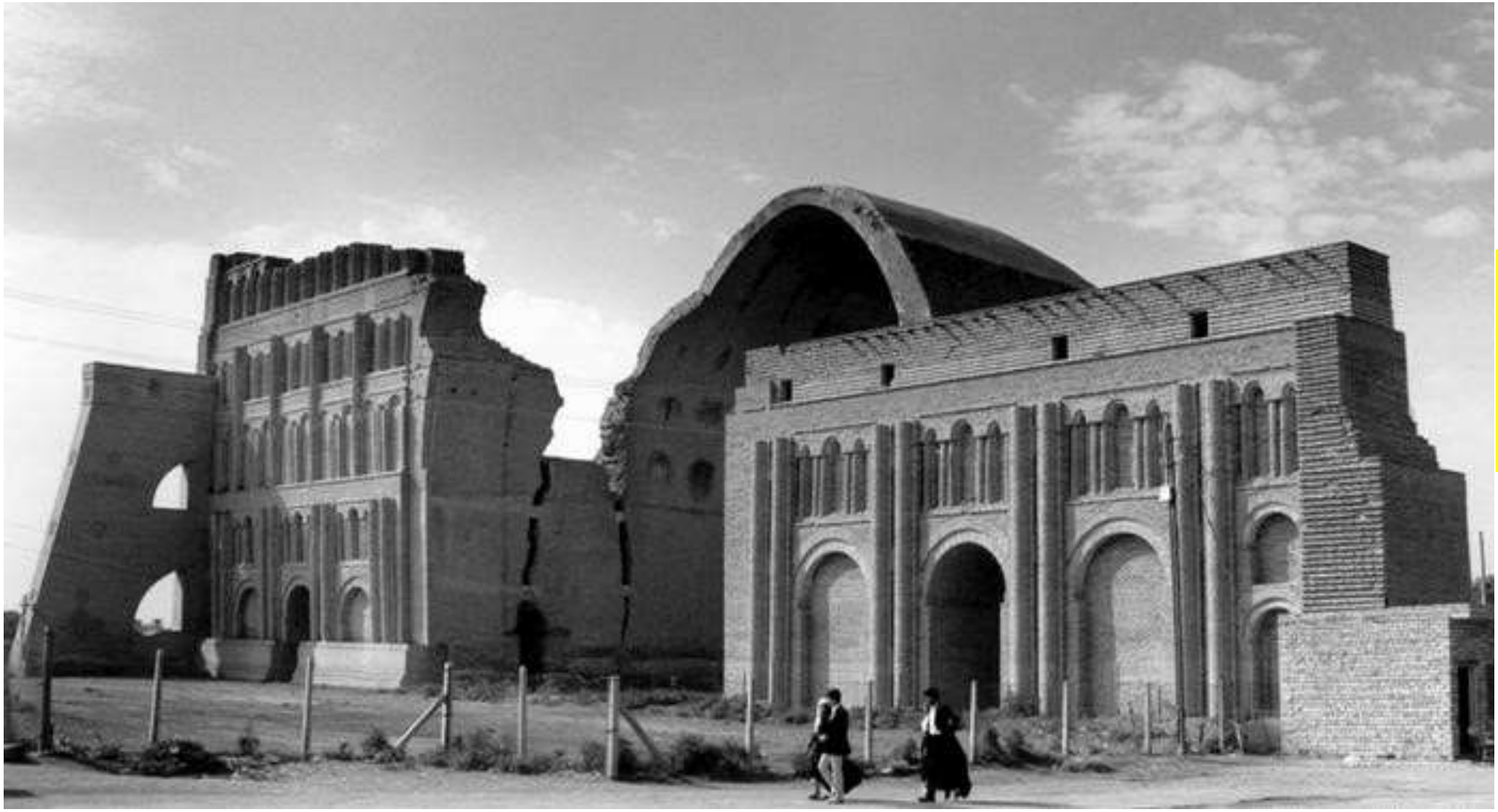

BT part 2B

University of Baghdad
College of Medicine
2023-2024

Title: BLOOD TRANSFUSION – Part 2B

Grade: 4

Module: PATHOLOGY (Hematology)

Speaker: Professor Dr. Haithem Ahmed Al-Rubaie

MBChB (1985)

FICMS-Hematopathology (1998)

DEPARTMENT OF PATHOLOGY AND FORENSIC MEDICINE

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Blood Transfusion (Part 2B)

Learning Objectives: at the end of this lecture, the student will be able to:

1. Prevent bacterial contamination.
2. Avoid circulatory overload in susceptible individuals.
3. Prescribe iron chelation agents for patients with transfusion-dependent anemias.
4. Consider physical or chemical destruction of blood.
5. Deal with complications of massive transfusion
6. Understand the risk of transfusion-transmitted infections and how to prevent them.

CONTENTS:

Non-Immunological Complications of blood transfusion:

- Reactions due to Bacterial Pyrogens or Bacteria
- Circulatory Overload
- Thrombophlebitis
- Air Embolism
- Hemosiderosis
- Non-Immune Hemolysis
- Complications of massive transfusion
- Transmission of Infection

Complications of Blood transfusion

Non-Immunological Complications

1. Reaction due to bacterial pyrogens or bacteria

- It has a very high mortality rate.
- Characterized by sudden onset of high fever, shock, and bleeding due to DIC.
- Blood may be contaminated by cold-growing organisms (pseudomonas or colon-aerogenes group).
- These microorganisms utilize citrate as the primary source of carbon, which leads to citrate depletion and hence clotting of blood.

- Visual inspection of the blood units may reveal clots and indicate the presence of contamination.
- The reaction may start after 30 minutes or more from the beginning of the infusion.
- As little as 10 ml of blood may contain sufficient microorganisms to produce the reaction.

Skin contaminants are sometimes present in freshly donated blood but many (e.g. **staphylococcus epidermidis**) do not survive storage at 4°C but grow profusely in platelet concentrates.

Dirt, soil, and feces contaminants: A number of Gram-negative, **endotoxin-producing** (**pseudomonads, coliforms**) may very rarely enter a unit and grow readily under the storage conditions of blood (and even more rapidly at RT).

Healthy individuals who are bacteremic at the time of donation: the majority are due to transmission of ***Yersinia enterocolitica***, which grows well in red cell components due to its dependence on citrate and iron.

Most cases of septic shock are caused by gram-positive bacteria.

Followed by endotoxin-producing gram-negative bacteria.

The infusion of a large number of ***gram-negative microorganisms*** results in a serious reaction manifested with fever, shaking chills, marked hypotension, pain, vomiting, and the development of profound **ENDOTOXIC SHOCK**.

Fungal infections are an increasingly prevalent cause of septic shock.

Management:

- Do a direct examination and culture of the blood from the patient & the blood unit.
- Give antibiotic IV.

Prevention:

1. Ensuring aseptic technique in the preparation of blood packs and anticoagulants.
2. Aseptic condition in blood donation.

3. Blood packs should not be opened for sampling and the unit should be transfused within 24 hours if any open method has been used.

4. Blood should be kept in an accurately controlled refrigerator at 2-6 °C.

5. Avoid leaving blood at room temp.

6. Inspect all blood units for signs of contamination as clotting or hemolysis.

2. Transfusion-Related Circulatory Overload (TACO)

- Transfusion generally increases blood volume except in those who have active bleeding.

- This increase in blood volume may be dangerous in:
  - Elderly with a compromised cardiovascular function,
  - Pregnancy and
  - Severe anemia.

Comparison	TRALI	TACO
Type of component	Plasma or platelets	Any
Blood Pressure	Hypotension	Hypertension
Onset	Up to six hours post transfusion, usually within 2hrs of transfusion	Defined as occurring within 6hrs of transfusion
Chest X-Ray	Bilateral pulmonary infiltrates, normal heart	Bilateral pulmonary infiltrates, enlarged heart
BNP	<250pg/mL	>250pg/mL
TNI	Normal	Elevated
Echo findings	Normal	Abnormal
Pulmonary wedge pressure	Low	Raised
FBC	Fall in neutrophils and monocytes followed by neutrophil leucocytosis	No specific changes
Response to fluid load	Improves	Worsens
Response to diuretics	Worsens	Improves
Oxygen Saturation	Reduced	Reduced

Prevention

- Blood should be given slowly over 4 hrs.
- Give diuretics at the start of transfusion.
- No more than 2 units should be given within 24 hrs.
- Blood should be given during the day-time and the patient should be followed carefully.

If sings & symptoms of circulatory overload & pulmonary edema occur:

1. Transfusion should be stopped.
2. Patient propped upright.
3. Give diuretics IV.

3. Thrombophlebitis

This is a complication of indwelling venous cannulae and is not specifically related to blood transfusion.

4. Air embolism

This is now a rare complication of transfusion therapy due to the introduction of plastic bags, which provide a closed system.

Only large volumes of air, and not the entry of a few bubbles, resulting in a clinically significant air embolism.

Symptoms include pain, cough, and sudden onset of dyspnoea.

The treatment includes **clumping off the administrating tube.**

5. Hemosiderosis

Each unit of blood contains approximately 200 mg of iron.

Repeated transfusions over many years, in the absence of blood loss, cause deposition of iron initially in the reticuloendothelial system (macrophages).

After 50 units in adults, and a lesser amount in children, the liver, myocardium, and endocrine glands are damaged.

This is a major problem in thalassemia major and other severe chronic refractory anemias, and this could be prevented by giving a **chelating agent.**

6. Non-immune hemolysis

Etiology: Physical or chemical destruction of blood (heating, freezing, hemolytic drug or solution added to blood)

Presentation: Hemoglobinuria, hemoglobinemia.

Diagnostic Testing: Rule out patient hemolysis (DAT, repeat patient ABO). Test the unit for hemolysis and inspect for hemoglobinemia.

Therapeutic/Prophylactic Approach: Identify and eliminate the cause.

7. Complications of massive transfusion

Massive transfusion is usually defined as the replacement of the total blood volume within 24 hours (for adults about 10 units/ 24 hours).

This could lead to:

A. Dilution of platelets
B. Dilution of coagulation factors
C. Metabolic changes
D. Hypothermia

A. Dilution of platelets:

- Blood stored more than 48 hr at room temp. has no functional platelets.
- Transfusion of 8 - 10 units of blood to an adult will lead to thrombocytopenia (low platelets).
- It follows that any patient receiving many blood units should be monitored through platelets count & judged on his clinical condition.
- **Some** give one platelets unit for every 4 blood units. **Others** give platelets transfusion if platelets count becomes less than 100,000 /µL *if there is bleeding or surgical intervention*.

B. Dilution of coagulation factors:

- This occurs if blood stored for more than 14 days is given.
- Blood stored less than 14 days has an adequate level of most of the coagulation factors except factors V & VIII, as they are the most labile factors.

C. Metabolic changes:

- ***Citrate toxicity:*** This is not a problem except in a very rapid transfusion (1 unit every 5 minutes).

- ***Hyperkalemia and hypocalcemia:*** These are usually transient & rapidly corrected.

D. Hypothermia: Cardiac irregularities, in particular ventricular fibrillation, may result from the transfusion of **large quantities of cold blood**.

8. Transfusion Transmitted Infections (TTI)

Diseases transmitted by blood could be classified as follows:

1. Bacterial:

- Syphilis
- Brucellosis

2. Protozoal:

- Malaria

3. Viral:

- HIV
- Hepatitis viruses

Bacterial diseases

1. Syphilis:

- The agent is ***Treponema pallidum*.**
- **Donor is infective during the early spirochetemia phase** i.e. before the development of the antibodies.
- **Blood products implicated: fresh blood & components.**
- **Viability in blood: the bacteria are unlikely to survive more than 3 days at 4 -6 °C,** so transmission of syphilis by blood is a rare complication.

- It is more likely to be transmitted by platelets concentrate because of its storage at room temp and its short shelf-life.

Prevention:

1. Mandatory screening of all donor units by TPHA
2. Exclusion of high-risk group.

2. Brucellosis:

- The agent is *Brucella abortus*.
- Viability in stored blood: months.
- Incubation period: 6 days - 4 months.
- Reports of transfusion-related brucellosis: mainly in children, splenectomized or immunocompromized.

Prevention: defer permanently infected patients from blood donation.

Protozoal diseases

Malaria:

- The agent is *Plasmodia Species* (*vivax, ovale, malariae, falciparum*).
- Viability: parasites are stable in plasma and whole blood for at least 18 days when stored at +4˚C and for extended periods in a frozen state.
- Blood product implicated: products containing red cells.
- Incubation period: *P. vivax* & *P. falciparum:* 1 week-1month; *P. malariae:* months.

Prevention

- In endemic areas: prophylactic treatment of donors with **chloroquine** 48 hrs before donation or single dose of chloroquine to the recipient 24 hrs before transfusion.

Viral diseases

1. AIDS (Acquired immune deficiency syndrome):

- The agent is *Human immunodeficiency virus* HIV type 1 & 2.
- Blood product implicated: whole blood (cellular & plasma blood components).
- Incubation period: mean incubation period is 4.5 yrs.

Prevention

1. Education through the media.
2. Self-exclusion of the high-risk group.
3. Screening all donors for HIV antibodies.

2. Hepatitis :

Post-transfusion hepatitis could be caused by the following viruses:

1. Hepatitis viruses (A, B, C).
2. Cytomegalovirus (CMV).
3. Epstein-Bar virus (EBV).

Prevention

- Tests to screen for Hepatitis B (HBs Ag).
- Tests to screen for HCV Abs.
- Exclusion of high-risk groups.

College of Medicine Feb 2024

Thank You..

End of BT Lectures