Adverse reactions of blood transfusion

Immunological reactions

Dr. Abdullah Aljedai

Reactions due to transfusion of red cells

- **Acute intravascular haemolysis:**
  - Considered as a medical emergency.
  - Incompatible blood transfusion (usually ABO) results in destruction of donor red cells by patient’s ABO system antibodies.
  - Red cell haemolysis $\rightarrow$ complement activation $\rightarrow$ release of Hb $\rightarrow$ DIC + acute renal failure.
  - This reaction is fatal in 10% of cases.
  - Can occur within minutes of transfusion.
  - Majority of ABO-incompatible transfusion are due to clerical errors.
Reactions due to transfusion of red cells

- **Allo-immunization to red cell antigens:**
  - The donor red cells are routinely matched with patient’s ABO and RhD type before first transfusion.
  - This means that the patient immune system may react and form antibodies against any other red cell antigens on donor red cells that he is lacking.
  - This is called allo-immunization.
  - It takes around 3 days to occur.
  - There will be a difficulty in subsequent blood transfusions.
  - Antibody screening and crossmatching should be done after 3 days post first transfusion in order to give the patient compatible blood in case he needs another transfusion.
  - Allo-immunization can be avoided by limiting blood transfusion to only necessary conditions and by the use of blood transfusion alternatives (iron, EPO, etc).

- **Delayed extra-vascular haemolysis:**
  - May be caused by antibodies to several different blood group systems.
  - Occurs within few days after transfusion.
  - Features include fever, general malaise, and low Hb.
  - Risk may be reduced before transfusion by cross-matching patient serum and donor red cells, and by antibody screening of patient serum for clinically significant Abs.
Iron overload:
- This risk occurs for those who receive regular red cell transfusions for months and years.
- Free iron in the body is very toxic and difficult to intoxicate by our body.
- Excess iron in the body can cause diverse tissue damage including heart and hepatic failure.
- This can be reduced by chelation therapy.

Reactions due to transfusion of red cells

1) None-haemolytic febrile transfusion reactions (NHFTR)
- Occurs mostly following transfusion of blood without leucodepletion.
- Caused by anti-leucocyte antibodies in the patient reacting against donor leucocytes and activation of complement.
- Cytokines and granules released from damaged donor WBC are responsible for symptoms associated with NHFTR.
- Symptoms include flushing, pyrexia, rigors, & hypotension.
- These risks can be minimised by leucodepletion of any red cell or platelets components prior to transfusion.
2) Allo-immunization
- WBC allo-immunization → Production of anti-HLA antibodies.
- These HLA antibodies not only destroy donor WBC (see NHFTR) but also can destroy any transfused platelets.
- Patient becomes refractory to platelets transfusions.
- In this case the patient would have to be transfused with HLA-matched platelets. (very difficult & time consuming).
- Prevention: leucodepletion of any red cell or platelets components.

3) Postransfusion pupora (PTP)
- Pupora: appearance of red or purple discolorations on the skin due to bleeding underneath the skin.
- Microaggregates in blood units contain platelets and WBC.
- Platelets alloantibodies are formed in the patient against donor platelets antigens and attack donor & patient’s platelets.
- This causes platelets destruction and sequestration in the spleen → thrombocytopenia.
- PTP is not very common and takes usually 5-10 days to develop.
- Pre-transfusion filtration of microaggregates form blood units may minimise the risk of PTP.
Reactions due to transfusion of WBC

4) Adult respiratory distress syndrome (ARDS)
   • CAUSE: microaggregates blockage of pulmonary blood vessels.
   • This can lead to damage of the lung and stiffness of alveoli due to accumulation of free radicals and lysozymes & compliment activation.
   • Prevention: pre-transfusion removal of microaggregates.

5) Graft-versus-host disease (GVHD)
   • Fatal condition caused by transfusion of donor WBC to an immuno-compromised patient.
   • The donor WBC (graft) proliferate in patient blood and reject the host (patient) tissues.
   • Prevention: gamma irradiation of red cell and platelets components prior to transfusion.
Reactions due to transfusion of platelets

1) Allo-immunization:
   - Allo-immunization to platelets Ags results in production of anti-platelets antibodies.
   - If platelets components are contaminated with RBC & WBC this will result in production of anti-red cell or HLA antibodies.
   - **Prevention:** give only RhD Neg components to RhD neg women + leuodepeltion.

2) PTP
   - Platelets antibodies in the patient to the introduced platelets antigens.
   - May be life threatening ➔ thrombocytopenia.
   - If occurs, give platelets from matched donors.

3) Release of histamine and serotonin
   - Released from donor’s damaged platelets.
   - Can cause hypotension, bronchospasm, and urticaria.
   - May be treated by anti-histamine.

4) Acute haemolysis
   - why?
   - Platelets from ABO-compatible donors.
1) Anaphylactic shock reactions
- A sudden, severe allergic reaction characterized by a sharp drop in blood pressure, urticaria, and breathing difficulties
- Rare but severe with high mortality.
- Caused by IgE anti IgA in the patient serum who is IgA deficient.
- Prevention: give those patients IgA deficient plasma or wash plasma products from red cells and platelets.

2) Transfusion Related Acute Lung Injury (TRALI)
- Very fatal condition.
- Caused by antibodies to PMN (granulocytes) in the donor plasma reacting against patient’s PMN.
- \( \Rightarrow \) compliment activation \( \Rightarrow \) destruction of PMN in pulmonary BV \( \Rightarrow \) oedema and infiltration of the lower lung.
- Prevention?
Reactions due to transfusion of plasma

3) Mild allergic reactions
- The patient develops allergy against allergens in the donor plasma.

4) Febrile reactions:
- Caused by cytokines released from damaged WBC in the plasma component.

5) Acute haemolysis:
- Caused by donor ABO antibodies in the plasma.

6) Allo-immunization to red cell antigens:
- Caused by the presence of small amount of red cells in FPP.