Outline the adverse consequences of a blood transfusion. (75% of marks) Define massive blood transfusion and list the adverse consequences associated with a massive blood transfusion. (25% of marks)

General risks associated with blood transfusions can be divided into acute, delayed and storage lesions

1. **Acute (<24 hours)**
   a. **Immune-mediated**
      - Allergic reaction to plasma proteins – mild (urticarial) or severe (anaphylaxis)
      - Haemolytic transfusion reaction - incompatibility of donor and recipient blood leads to widespread haemolysis and circulatory collapse
      - Febrile non-hemolytic transfusion reaction (FNHTR) - due to stored cytokines and/or the presence of recipient alloantibodies
      - Tranfusion related acute lung injury (TRALI) - noncardiogenic pulmonary oedema caused by HLA antibodies in donor plasma directed against recipient leukocytes or bioactive lipids which accumulate during storage

   b. **Non-immune mediated**
      - Sepsis – bacterial infections are most common with platelets as they are stored at room temperature
      - Transfusion Related Circulatory overload (TACO) – fluid overload usually due to rapid or massive transfusion
      - Non-immune mediated haemolysis
      - Hypothermia
      - Dilutional coagulopathy

2. **Delayed (>24 hours)**
   a. **Immune-mediated**
      - Delayed haemolytic transfusion reaction
      - Transfusion-related immunomodulation (TRIM) – transient immunosuppression in blood recipients which may be due to release of cytokines from donor lymphocytes
      - Alloimmunisation – development of antibodies during exposure to blood products, resulting in an amplified reaction on subsequent exposure

   b. **Non-immune mediated**
      - Iron overload – most common in chronically transfused patients
      - Transfusion-related infection
         i. Viral – the risk of HIV, HTLV 1&2 and HCV is <1/1 million. The risk of contracting HBV is slightly higher at 1/500,000.
         ii. Other – malaria, vCJD, Dengue Fever, West Nile Virus

3. **Storage lesions**
   A storage lesion refers to the changes that occur to a sample of blood during storage. They include:
      - Reduction in the viability of RBCs due to shape changes and reduced deformability
      - Hyperkalaemia – plasma K can be >20 at 28 days in stored blood due to inactivation of the red cell Na/K ATPase pump.
      - High citrate load – can lead to hypocalcaemia and alkalosis
      - Reduction in 2,3-BPG – causes left shift of the oxygen/haemoglobin dissociation curve
      - Increase in free haemoglobin due to cell lysis may cause renal impairment
      - Formation of microaggregates

A **massive transfusion** is defined as transfusion of more than half the total blood volume (70ml/kg) within four hours or more than the entire blood volume within 24 hours. The criteria for children is more than 40ml of blood/kg. Associated adverse consequences include an exaggerated risk of those listed above, as well as hypothermia, haemostatic abnormalities due to dilutional coagulopathy, electrolyte disturbances, citrate toxicity, and air embolism.