Massive Blood Transfusion AND SICKLE CELL ANEMIA

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Definition OF MASSIVE BLOOD TRANSFUSION

- Transfusion of half of the blood volume within 3 hr (i.e. for adults ~ 5 units = 2.5 L).
- (or) Transfusion of an amount equal to or more than one blood volume within 24 hr.
- (or) Transfusion of blood at a rate of 150 ml/min.

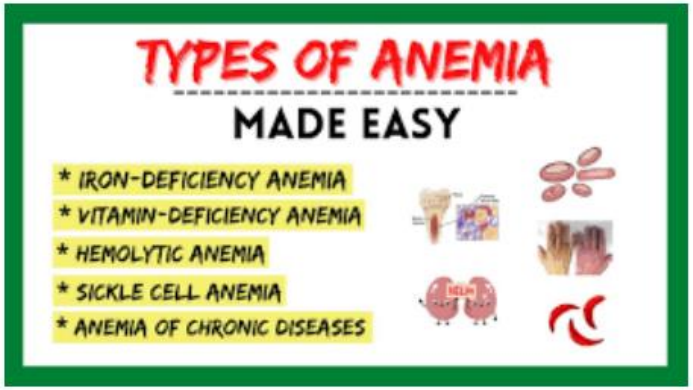
Complications of massive transfusion "

1. ***Dilution of platelet:*** Stored blood has no functional platelets after 48 hours.
2. ***Dilution of coagulation factors:*** Stored Whole blood < 14 days has adequate levels of most coagulation factors for hemostasis, Stored blood of > 14 days may require replacement of coagulation factors with FFP (fresh frozen plasma).
3. ***Hypothermia.***
4. ***Excess Citrate and hypocalcemia.***
5. ***Acid-base disturbances:*** Citrate and lactic acid metabolized to bicarbonate leading to metabolic acidosis.
6. ***Hyperkalemia:*** This can be caused by the loss of intracellular potassium from RBC during storage.
7. ***Fluid overload.***
8. ***Thrombosis and air embolism.***
9. ***High oxygen affinity blood (tissue hypoxia).***

Strategies to Reduce Transfusion-Related Complications	
Complication	**Strategies to Reduce Complication**
Hypothermia	Warm the room Surface warm the pt with heating blankets, heating lamps Heat & humidify inspired gases for ventilators Warm all IV fluids & blood products administered
Coagulopathy	Transfuse RBC: FFP in 1:1 ratio Check coagulation testing, including fibrinogen Transfuse cryoprecipitate if fibrinogen concentration low
Thrombocytopenia	Transfuse platelets to keep platelet count >100,000 (100 × 109/l) to form stable clot
Electrolyte abnormalities	Measure blood potassium, calcium, & magnesium concentrations Replete electrolytes to normal values as indicated
Acid–base disorders	Sodium bicarbonate or THAM for severe met acidosis with hemodynamic instability or renal failure
TRALI	Use restrictive transfusion strategy once hemorrhage controlled Use FFP from men or nulliparous women
TACO	Discontinue crystalloid fluid resuscitation Consider IV diuretic use

Sickle Cell Anemia & Anesthesia

Anaemia: Reduced haemoglobin concentration; usually defined as less than 13 g/dl for males, 12 g/dl for females. In children, the figure varies 18 g/dl (1–2 weeks of age); 11 g/dl (6 months–6 years); 12 g/dl (6–12 years).



Caused by: "

I. reduced production:
1) deficiency of iron, vitamin B12, and folate.
2) chronic disease, e.g. malignancy, infection.
3) endocrine disease, e.g. hypothyroidism, adrenocortical insufficiency.
4) bone marrow infiltration, e.g. leukaemia, myelofibrosis.
5) aplastic anaemia, including drug-induced, e.g.chloramphenicol.
6) reduced erythropoietin secretion,e.g.renal failure.
7) Abnormal red cells/haemoglobin,e.g.sickle cell anaemia ,thalassaemia.

II. increased haemolysis.

III. haemorrhage: acute or chronic.

Effects: "

1. reduced O2-carrying capacity of blood: fatigue, dyspnoea on exertion, angina.
2. increased cardiac output, to maintain O2 flux: palpitations, tachycardia, systolic murmurs, cardiac failure.
3. Reduced viscosity increases flow but turbulence is more likely.
4. increased 2,3-DPG(2,3-Disphosphoglycerate).
5. maintenance of blood volume by haemodilution.

Sickle-cell disease

_is caused by inheriting sickling haemoglobinopathies either in the homozygous (HbSS; sickle-cell anemia) or heterozygous (HbAS; sickle-cell trait) state or in combination with another Hb β chain abnormality such as Hb C (HbSC disease), Hb D (HbSD disease) or β- thalassemia (HbS/β-thal).

SCD is endemic in parts of Africa, the Mediterranean, the Middle East and India. The highest incidence is from equatorial Africa; all patients from areas with a high prevalence should have a sickle test preoperatively.

Pathology: "

Deoxygenated HbS polymerises and precipitates within red blood cells, with distortion and increased rigidity. Sickle-shaped red cells are characteristic. The distorted cells increase blood viscosity, impair blood flow and cause capillary and venous thrombosis and organ infarction.

Diagnosis:

is by detection of HbS in the blood. The Sickledex test involves the addition of reagent to blood, with observation for turbidity. It detects HbS but provides no information about other haemoglobins. Haemoglobin electrophoresis is the definitive method of determining the nature of haemoglobinopathy.

Anesthetic considerations:

1. preoperatively:

- All races at risk should be screened for HbS, ideally by electrophoresis. Sickledex testing is usual initially, with progression to electrophoresis if positive. In emergencies, if the Sickledex test is positive, diagnosis may be aided by blood counts and peripheral film. If the history does not suggest HbSS, and haemoglobin/reticulocyte count and peripheral film are normal with no red cell fragments, HbAS is likely, although HbSC and other heterozygous variants may still be present. Management

ultimately depends on the nature of the surgery and the availability of blood.

- Preoperative assessment is directed towards the above complications, especially pulmonary and renal function impairment. Preoperative folic acid has been suggested. Exchange transfusion is often used in HbSS patients before major surgery to reduce HbS concentrations to < 30%. A less aggressive transfusion strategy is to aim for a haematocrit of > 30%; both approaches have similar efficacy.
- Hypoxaemia, dehydration, hypothermia and acidosis should be prevented at all times perioperatively. Prophylactic antibiotics are often administered.

2. intraoperatively:

- standard techniques may be used, apart from tourniquets that cause tissue ischaemia. Heat loss should be prevented and cardiovascular stability maintained. Preoxygenation and FIO2 of 50% reduce the risk of hypoxaemia by increasing arterial PO2 and pulmonary O2 reserve. IV hydration should be maintained. Frequent analysis of acid-base status is required in HbSS patients. Prophylactic bicarbonate administration has been suggested, but administration according to acid-base analysis is usually preferred.
- intraoperative crises may present with changes in breathing pattern or BP, acidosis and hypoxaemia. Detection may be difficult.

3. postoperatively:

The precautions already instituted should continue, since complications may occur postoperatively. Patients are generally considered unsuitable for most day-case surgery. O2 administration for at least 24 h is usually advocated.