DEFINITION

- Haemorrhage means escape of blood outside its containing vessel.

CLASSIFICATION

A) Depending on nature of the vessel involved

B) Depending on the timing of hemorrhage

C) Depending on the duration of Haemorrhage

D) Depending on the nature of bleeding

E) Depending upon type of Intervention

A) SOURCE

1- ARTERIAL: Bright red, Emitted as spurting jet **(pulsatile).** Can lead to severe blood loss , Often hard to control

2- VENOUS: Darker red. Steady and copious flow , Color becomes further darker with oxygen desaturation , Usually easy to control

3- CAPILLARY : Bright red , Rapid and oozing , Blood loss becomes serious if continues for hours , Generally minor & easy to control

B) TIMING

1- PRIMARY: Occurs at the time of surgery , Cause is injury to vessels , May be arterial, venous or capillary , More common in surgery on malignancies

2- REACTIONARY : Bleeding within 24 hours (usually 4-6 hrs) of surgery , **Cause** is slipping of ligature, dislodgement of clot or cessation of reflex vasospasm , Bleed starts when there is a rise in the arterial or venous pressure

3- SECONDARY: Occurs after 7-14 days of surgery**, Cause** is sloughing of vessel due to infection, pressure necrosis or malignancy. , 1st a warning stain followed by a sudden severe bleed , Common after hemorrhoids surgery, GI surgery & amputations

C) DURATION

1- Acute Haemorrhage: occurs suddenly. e.g. Esophageal variceal bleeding due to portal HT.

2- Chronic Haemorrhage

D) NATURE / TYPE

1- External Haemorrhage or Revealed : External or visible bleed – Soft tissue injuries, bleeding from the limb vessels, wound, nose etc.

2- Internal Haemorrhage or Concealed : Internal or invisible bleed – Blunt or Penetrating trauma, May remain concealed as in ruptured spleen or liver, Concealed hemorrhage may become revealed as in **hematemesis or melena** in peptic ulcer bleed

Hematemesis (Coffee-ground appearance of vomitus) – **Melena** (black, tarry stools)- **Hemoptysis**(coughing up blood)

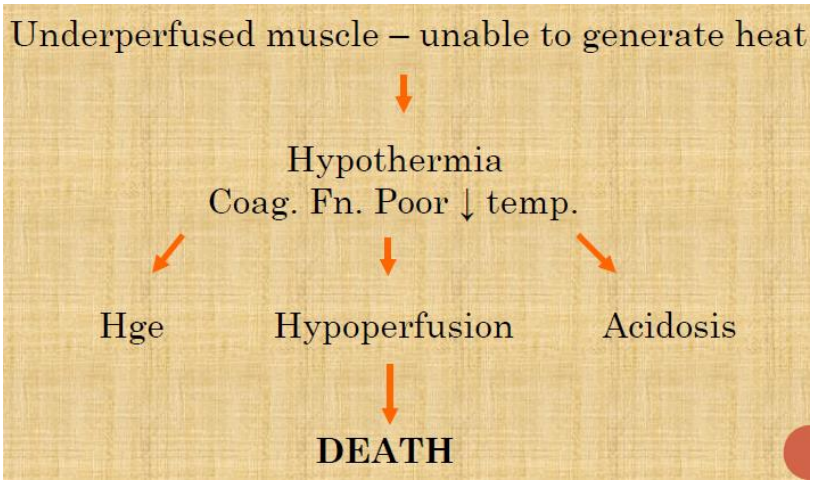
3- TYPE OF INTERVENTION

1- Surgical Haemorrhage: is the result of injury and amenable to surgical control, or from angioembolism.

2- Non-Surgical Haemorrhage: is general ooze from all raw surface due to coagulopathy, it cannot be stopped by surgical mean, require correction coagulation abnormalities.

PATHOPHYSIOLOGY

- Bleeding → Hypovolaemia → Hypoperfusion &Cellular anaerobic metabolism + Lactic acidosis ↓ coag.proteases → coagulopathy & Hge { ↑ Ischaemic cells - anticoagulation pathway } ↓ tissue perfusion + BS – gut & muscle ↓ [early in compensatory process]



CLINICAL FEATURES

- Pallor, thirsty, cyanosis ′

- Tachycardia, tachypnoea ′
- Cold clammy skin due to vasoconstriction ′
- Dry face, dry mouth and goose skin appearance (due to contraction of arrector pilorum). ′
- Rapid thready pulse, hypotension ′
- Oliguria ′
- Features related to specific causes

DEGREE OF HAEMORRHAGE

Degree of hemorrhage is classified into **4** stages

1st stage/

- Blood volume loss < 15%
- Compensation
  – Vasoconstriction
  – Normal BP, pulse pressure, respirations
  – Slight elevation of pulse
  – Release of catecholamines
    - Epinephrine
    - Norepinephrine
  – Anxiety, slightly pale and clammy skin

2nd stage/

- Blood volume loss between 15 – 30%
- Early decompensation
  – Unable to maintain BP
  – Tachycardia and tachypnea
  - Decreased pulse strength
    - Narrowing pulse pressure
    - Significant catecholamine release
  – Increase PVR
  – Cool, clammy skin and thirst
  – Increased anxiety and agitation
  – Normal renal output

3rd stage/

- Blood volume loss between 30 – 40%
- Late decompensation (early irreversible)
  – Compensatory mechanisms unable to cope with loss of blood volume
- Classic Shock
  - Weak, thready, rapid pulse
  - Narrowing pulse pressure
  - Tachypnea
  - – Anxiety, restlessness
  - – Decreased LOC and AMS
  - – Pale, cool, and clammy skin

4th stage/

Blood volume loss > 40%
Irreversible
– Pulse: Barely palpable
– Respiration: Rapid, shallow, and ineffective
– LOC: Lethargic, confused, unresponsive
– GU: Ceases
– Skin: Cool, clammy, and very pale
– Unlikely survival

MEASUREMENT OF BLOOD LOSS

- Normal blood volume (5L) is estimated as 70 ml/kg – children & adults and 80ml/kg –
- Estimation – difficult & inaccurate ′
  - OT - Blood in suction apparatus – measured & swabs soaked in blood – weighed. ′
  - *Hb% and PCV estimation.*
- Identify – Hge / Hypovolemia & Shock – clinically
- Resuscitation – O2 / Blood & Fluids
  - Identify site of Hge - U/S, endoscopy, CT scan, DPL, Blood tools etc.
- Control of Hge – Surgery, endoscopic control, therapeutic embolization.
- Definitive treatment if any
- Sepsis control
- Prevention of coagulopathy
- Critical care management
- End-point resuscitation, fluids & electrolyte management, prevention of organ failure

“When there is blood loss, replace with blood”



Severe Bleeding is a life-threatening condition, therefore the bleeding must be controlled quickly. There are 4 procedures to follow;

Apply Pressure → Elevate → Dress the Wound → Monitor

1. Apply Direct Pressure
This is to try and stop the flow of blood and encourage a clot to form.

2. Apply a Dressing
Applying a sterile non-fluffy dressing covers the wound protecting it and preventing the spread of infection.

3. Elevation
Elevate the bleeding limb or area above player's heart (if practicable). This will reduce the amount of blood flow to the wound.

4. Monitor
If the wound is severe you may need to monitor the player as they may go into shock due to blood loss. You may also want to check that the dressing isn't too tight and restricting circulation.

Blood transfusion

Definition/

- Transfusion of the whole blood or its component such as blood cells or plasma from one person to another person.

- Blood transfusion involves two procedure that is:

1- Collection of blood from donor 2- Administration of blood to the recipient.

Purposes /

- To restore the blood volume when there is sudden loss of blood due to hemorrhage.

- To raise the Hb level in cases of severe anemia

- To treat deficiencies of plasma protein, clotting factors or hemophilic globulin etc.

- To provide antibodies to those persons who are sick and having lowered immunity.

- To replace the blood with hemolytic agents with fresh blood

- To improve the leukocyte count in blood as in agranulocytosis.

- To combat infection in leucopenia

Components of blood/ (for transfusion)

- Each unit of blood is tested for evidence of hepatitis-b, hepatitis-c, human immuno deficiency virus I&II and syphilis.

- The blood is then processed into sub-components. These are-

- Whole blood
- Packed cell volume
- Fresh frozen plasma
- Platelets
- Cryoprecipitate

1- Whole blood

- unseparated blood containing an anticoagulant – preservative solution.

- One unit of whole blood contains- (450 ml of donor blood. , 50 ml of anticoagulant-preservative solution.)

- Hemoglobin approx.12g/ml & haematocrit 35%- 45%.

- No functional platelets.

- Stored between +2 and +6 degrees centigrade in a blood bank refrigerator.

- Transfusion should be started within 30 minutes of removal from the refrigerator and completed within 4 hours of commencement because changes in the composition may occur due to red cell metabolism.

2- Packed Red Cells

- cells that are spun down and concentrated.

- One unit of packed red cells is approx. 330 ml and has a haematocrit of 50-70%.

- They are stored in a SAG-M (**saline-adenine- glucose-mannitol**) solution to increase their shelf life to 5weeks at 2-6degrees centigrade.

3- Fresh frozen plasma

- rich in coagulation factors.
- It is separated from whole blood and stored at-40 to -50 degrees centigrade with a 2year shelf-life.
- It is the first line therapy in the treatment of **coagulopathic haemorrhage**

4- Cryoprecipitate

- is a supernatant precipitate of fresh frozen plasma and is rich in factor VIII and fibrinogen.
- It is stored at -30 degrees centigrade with a 2 years shelf life.
- Indicated in low fibrinogen states (<1g/l) or in cases of factor VIII deficiency (hemophilia-a), von will brand's disease and as a source of fibrinogen in disseminated intravascular coagulation.
- Pooled units containing 3-6 gms fibrinogen in 200-500 ml raises the fibrinogen level by approx. 1g/L.
- Must be infused within 6 hours.

Blood grouping and cross matching/

- The blood used in a transfusion must be compatible with the patient's blood type.
- Type **O** blood is called the universal donor
- People with type **AB** blood are called universal recipients
- People with Rh-positive blood can get Rh-positive ***OR*** Rh-negative blood. But people with Rh-negative blood should get only Rh-negative blood.

Blood Type Compatibility

Blood Type	Gives	Receives
A+	A+, AB+	A+, A-, O+, O-
O+	O+, A+, B+, AB+	O+, O-
B+	B+, AB+	B+, B-, O+, O-
AB+	AB+	Everyone
A-	A+, A-, AB+, AB-	A-, O-
O-	Everyone	O-
B-	B+, B-, AB+, AB-	B-, O-
AB-	AB+, AB-	AB-, A-, B-, O-

Types of blood transfusion reactions/

- Acute hemolytic transfusion reaction
- Delayed hemolytic transfusion reaction
- Pyrogenic reaction
- Allergic reaction
- Anaphylactic reaction
- Transmission of infectious diseases

1- Acute hemolytic transfusion reaction

- Develops during the first 5-15 minutes.
- In hemolytic transfusion reaction circulating RBCs are ruptured with the release of hemoglobin
- Causes
  - ABO incompatibility
  - Rh incompatibility
  - Improper storage of blood
  - Uncontrolled refrigeration of blood resulting in freezing
  - Storage beyond 21 days limit
  - Warming of blood above 40 degree C
  - Exposure of blood to dextrose solutions.
- Clinical features
  - Onset of fever ,Chills, headache, dyspnea, cynosis, chest pain
  - Nausea, vomiting
  - Increased heart rate and respiratory rate
  - Hemoglobinuria •
- Complications
  - Hypotension followed by shock
  - Oliguria then anuria followed by renal failure
- management
  - Closely observe the patient for the first ten minutes of the transfusion. Since these reactions occur very rapidly, the rate of flow should be minimal.
  - Discontinue the transfusion immediately when reaction is assessed.
  - Inform the laboratory to do the cross matching and grouping of the blood
  - Maintain IV infusion with 5% glucose or saline using a new IV set
  - Large quantities of fluid is given to promote diuresis and counteract shock
  - Monitor vital sign every 15 min. to assess shock and collapse

2- Delayed hemolytic transfusion reaction

- Occurs due to incompatibility of RBC antigens other than ABO group
- It develops days to weeks after transfusion
- It is featured by persistent decrease in Hb level and low grade fever
- Many time this reaction is missed

3- Pyrogenic reactions

- It develops immediately or within 6 hrs of infusion.
- It results from pyrogenic substances from the tubings
- Causes
  - Improper preparation of donor's site
  - Not following proper aseptic technique
  - Antigen and antibody reactions to WBCs and platelets contained in blood product.
  - Improper refrigeration

- Clinical features-
  - Fever with chills, Headache & Backahe
  - Nausea, vomiting and diarrhea
  - Delirium, shock and renal failure
- Prevention
  - Proper screening of donor
  - Use of disposable and pyrogen free sterile syringes and tubing for collecting and transfusing the blood
  - Proper technique for storing the blood.

4- Allergic reaction

- It develops any time or within one hour of transfusion
- Allergic reactions are the result of sensitivity of the individual to the plasma protein in the transfused blood
- It is characterized by itching, rashes, laryngeal edema and bronchial spasm in severe cases.
- Treatment normally include injections of antihistamines and corticosteroids as necessary.

5- Anaphylactic reactions

- Extremely rare but life threatening
- develops immediately after transfusion of few ml. of blood
- It is caused by idiosyncratic reaction in clients with IgA deficiency.
- It is characterized by sever cardio-respiratory features such as- dyspnea, cyanosis, tachypnea, tachycardia, hypotension and collapse.
- Immediately transfusion is stopped and resuscitative measures are started
- Monitor the vital signs every 15. min until patient recovers

Complications of blood transfusion-/

1- Circulatory overload
2- Hyperkalemia
3- Hypocalcemia
4- Haemosiderosis
5- Infiltration and Hematoma
6- Thrombophlebitis
7- Pulmonary embolism

Circulatory overload-

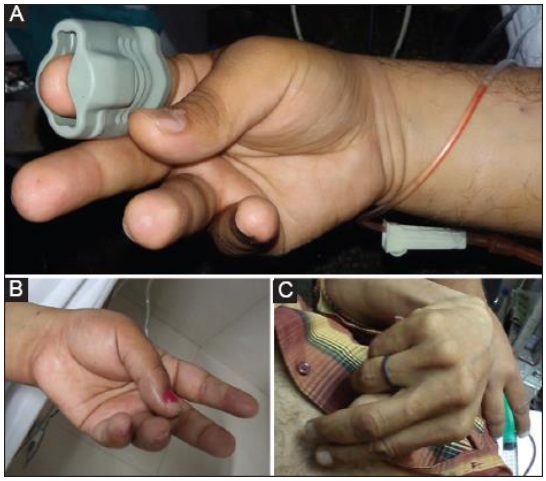
- Giving whole blood to patient with severe anemia is very dangerous as patient require the RBCs not the other component of blood and may develop circulatory overload
- Condition of heart failure may also cause the circulatory overload with blood transfusion.
- Prevention
  - Use packed RBCs instead of whole blood
  - Administer diuretics prior to blood transfusion to reduce the plasma volume
  - Transfuse the blood at a slow rate
  - Check the patient's pulse at every 15 minutes

- Check the patient's neck vein for fullness
- Observe the CVP, if it is greater than 10 cm of water indicates circulatory overload
- Observe for the signs of respiratory distress
- Give minimum quantity of blood at a time

Hyperkalemia-

- Stored blood may cause hyperkalemia
- Blood that is one day old has plasma potassium content approximately 7mEq/litre and 21 days old blood contains about 23mEq/litre.

Hypocalcemia-



- It develops due to **citrate toxicity**.
- During massive transfusion citrate in the blood combines with ionized calcium and **tetany** may result.
- Higher level of citrate may cause cardiac arrest.
- Treatment
  - administration of calcium gluconate to prevent or eliminate the toxic effects by neutralizing the acidosis

Hemosiderosis-

- It is also known as **iron over load**
- It may develop in clients receiving frequent blood transfusion.
- Hemosiderosis is an abnormal deposition of iron in various tissues in the form of hemosiderin which is an iron rich pigment that is the product of hemolysis

Other complications-

- Infiltration and hematoma at the site of the needle
- Thrombophlebitis
- Pulmonary embolism