HAEMORRHAGE

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POINTS

- INTRODUCTION
  - importance
  - physiology/homeostasis
  - integrity of circulatory system
- TYPES/CAUSES
- CONTROL METHODS
- BLOOD TRANSFUSION

INTRODUCTION

Subject's importance

Hemorrhage is one of the basic problem and considerations in surgery

A wide spectrum of problems involves hemorrhage

Causes- From-trivial trauma or major abdominal organ injuries-to-congenital and acquired coagulation disorders

For exam most important topic.

Transfusion of blood is the main remedy

INTRODUCTION
Definitions

Haemorrhage--bleeding

Escape of blood from a blood-vessel

Exsanguination- total loss of blood

Desanguination- major loss of blood

HAEMORRHAGE

- **Hemorrhage:** is any profuse internal or external bleeding from the blood vessels which is difficult to stop.
- **Bleeding** :is any loss of **blood** from the body
- The most obvious cause of hemorrhage is trauma or injury to a blood vessel

- The sight of **blood** evokes a primal response of panic and fear in most people

Blood

- Approximately 8% of an adult's body weight is made up of blood
- Females have around 4-5 litres, while males have around 5-6 litres. This difference is mainly due to the differences in body size between men and women.
- Its mean temperature is 38 degrees Celcius.
- It has a pH of 7.35-7.45, making it slightly basic (less than 7 is considered acidic).

Blood

- Whole blood is about 4 to 5 times as viscous as water, indicating that it is more resistant to flow than water. This viscosity is vital to the function of blood because if blood flows too easily or with too much resistance, it can strain the heart and lead to severe cardiovascular problems.
- Blood in the arteries is a brighter red than blood in the veins because of the higher levels of oxygen found in the arteries.
- An artificial substitute for human blood has not been found.

Functions of blood

- Blood has three main functions:
- Transport,
- Protection and
- Regulation.

Transport

- **Blood transports the following substances:**
- Gases, oxygen (O_2) and carbon dioxide (CO_2), between the lungs and rest of the body
- Nutrients from the digestive tract and storage sites to the rest of the body
- Waste products to be detoxified or removed by the liver and kidneys
- Hormones from the glands in which they are produced to their target cells

Protection

- Blood has several roles in inflammation:
- Leukocytes, or white blood cells, destroy invading microorganisms and cancer cells
- Antibodies and other proteins destroy pathogenic substances
- Platelet factors initiate blood clotting and help minimise blood loss

Regulation

- **<u>Blood helps regulate:</u>**
- pH by interacting with acids and bases
- Water balance by transferring water to and from tissues
- to help regulate body temperature

Causes

- **Trauma /accidents**
- **General operative interventions**
- **Gynecological procedures**
- **Congenital coagulation disorders**
- **Acquired coagulation disorders**
  - **DIC**
  - **Anticoagulants**
  - **Fulminate sepsis**
- **Common surgical conditions pres w bleed**
  - **Intracranial hemorrhages/CVA**
  - **Upper GIT bleed/ haemetemesis and melena**
  - **Bleeding hemorrhoids**
  - **Chronic wounds**
  - **Anal fissures**
  - **Aneurysms**

Physiology

- BODY'S SYSTEM OF HOMEOSTSIS
- INTEGRITY OF EVERY SYSTEM
  - ANATOMICAL
  - FUNCTIONAL

Claude Bernard's concepts

French physiologist Claude Bernard (1813–1878), the founder of experimental physiology and experimental pharmacology.

Bernard believed that the body has mechanisms by which it seeks to maintain a stable internal environment despite changes in the external environment– **Homeostasis** [1851]

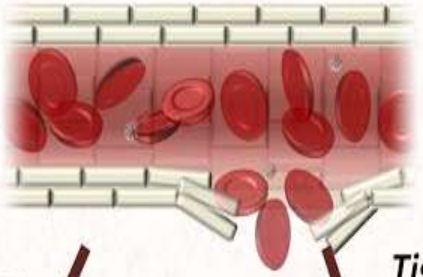
Homeostasis and Hemostasis

Homeostasis # Hemostasis

Keeping the conditions in the internal environment constant.

Stoppage of bleeding

Major Components of Hemostasis



Vascular Injury

Collagen

Tissue factor

Vasoconstriction

Platelet Activation

Coagulation Cascade

Antithrombotic Control Mechanisms

vWF, fibrinogen

Thrombin

Platelet Plug

Fibrinogen → *Fibrin*

Blood Clot

Plasmin

Fibrinolysis & Clot Degradation

Primary Hemostasis

Secondary Hemostasis

What Prevents Haemorrhage? hemostasis

NATURAL BARRIERS AGAINST HAEMORRHAGE

- Integrity of vascular wall
- Coagulation system

Body's response to haemorrhage/injury

Attempts to repair the loss & restore normality

There are several interrelated stages

Local response / Gen response

Aims at:

- wall repair
- Restoration of volume loss

Body's response to haemorrhage/injury

Virchow (1856) famous triad:

- 1. Stasis
- 2. Endothelial damage
- 3. Hypercoaguable states

local

- Vasoconstriction
- Platelet aggregation and plug formation
- Coagulation leading to Fibrin formation –Intrinsic & Extrinsic Paths

General

- Compartmental Volume movement

PATHOLOGICAL BASIS OF HAEMORRHAGE

BLEEDING CAN RESULT DUE TO:

LOSS OF INTEGRITY OF WALL

TRAUMA/OPERATIONS

COAGULATION DEFECTS

CONGENITAL

AQUIRED

ETIOLOGY OF HAEMORRHAGE
CAUSES OF HAEMORRHAGE

- **INJURY /TRAUMA [+ operations]-It commonly results in**

  tearing or cutting of a blood-vessel-integrity of wall breached - *Trivial OR Major*

- **DISEASES that alter coagulation**

  Congenital –platelet defects

  Coagulation factor defects

  Acquired

  scurvy

  Sepsis

  DIC

Pathophysiology

- Hemorrhage leads to hypovolemic shock
- Hypoperfused state leads to cellular anabolic metabolism
- cellular anabolic metabolism leads to lactic acidosis
- The acidosis leads to decreased function of coagulation proteases enzymes resulting in coagulopathy and further haemorrhage

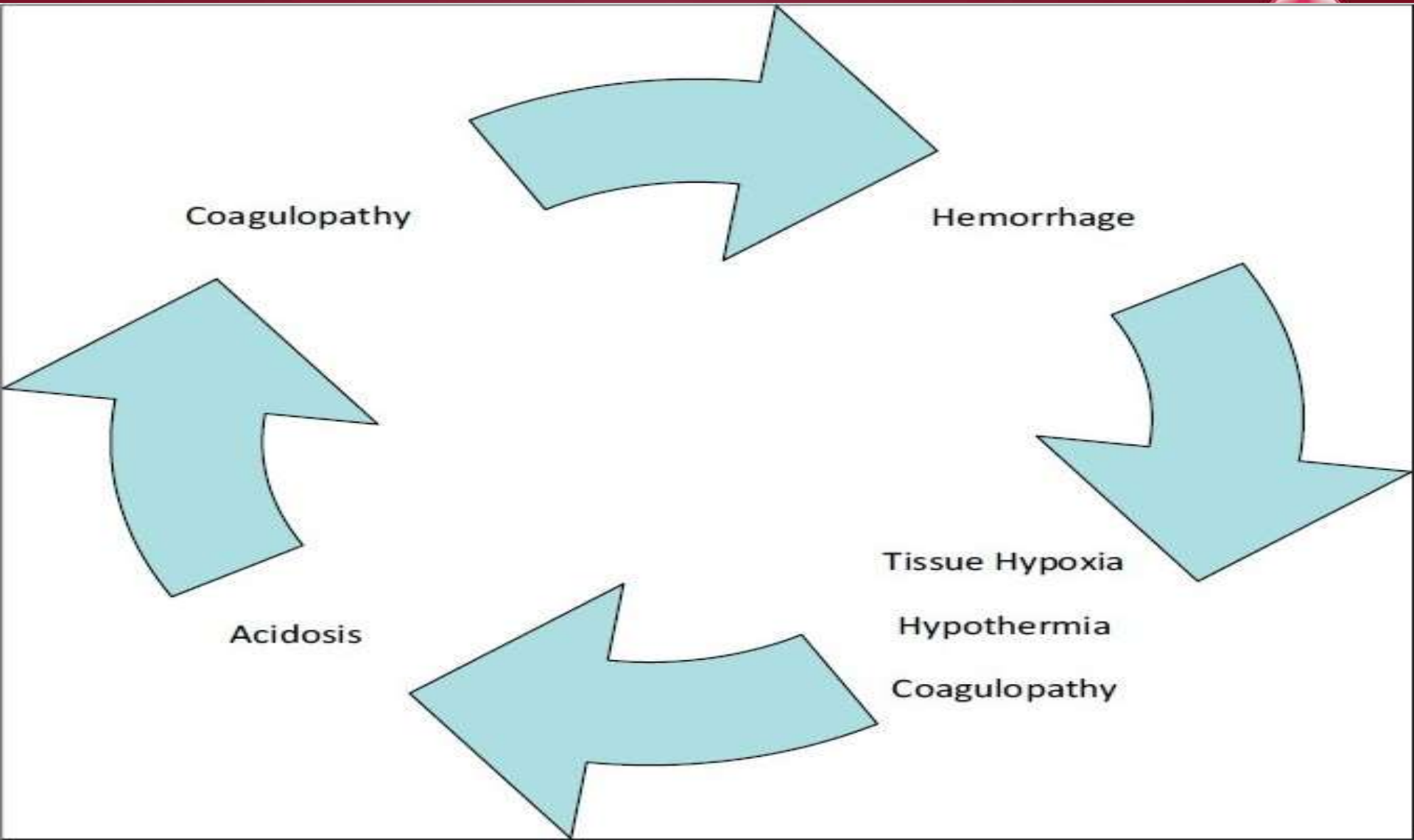
Pathophysiology

- These are exacerbated by ischemic endothelial cells activating anticoagulant pathway
- Additionally ,thre is reduced perfusion to tissue and the blood supply to gut and the muscles beds is reduced early in the compensatory process
- Underperfused muscles unable to generate heat and hypothermia occurs
- Hypothermia cause decreased coagulation functions and lead to haemorrhage and further hypoperfusion

The lethal triad

- These three factors hypothermia,acidosis and coagulopathy results in downward spiral,leading to physiological exahaustion and death.
- Medical therapy has worsen the effect,intravenous fluids and blood are cold and exacerbate hypothermia
- Further heat is lost by opening body cavity during surgery
- Surgery leads to further bleeding and many crystalloid fluids are themselves acidic.

The lethal triad



TYPES OF HAEMORRHAGE

- **AMOUNT OF LOSS --MINOR/MAJOR**
- **ACUTE/CHRONIC**
- **ARTERIAL/VENOUS/CAPILLARY/MIXED**
- **LOCALIZED/DIFFUSE**
- **EXTERNAL/ INTERNAL**
- **OVERT/OCCULT**

Types of bleeding

- **1. Major**
- Any intracranial bleeding (excluding microhemorrhages <10 mm evident only on gradient-echo MRI)
- Clinically overt signs of hemorrhage associated with a drop in hemoglobin of ≥5 g/dL or a ≥15% absolute decrease in haematocrit
- Fatal bleeding (bleeding that directly results in death within 7 d)

2. Minor

- Clinically overt (including imaging), resulting in hemoglobin drop of 3 to <5 g/dL or ≥10% decrease in haematocrit
- No observed blood loss: ≥4 g/dL decrease in the haemoglobin concentration or ≥12% decrease in haematocrit

2. Minor

- Requiring intervention (medical practitioner-guided medical or surgical treatment to stop or treat bleeding, including temporarily or permanently discontinuing or changing the dose of a medication or study drug)
- Leading to or prolonging hospitalization
- Prompting evaluation (leading to an unscheduled visit to a healthcare professional and diagnostic testing, either laboratory or imaging)

3. Minimal

- Any overt bleeding event that does not meet the criteria above
- Any clinically overt sign of haemorrhage (including imaging) associated with a <3 g/dL decrease in haemoglobin concentration or <9% decrease inhaematocrit

DEPENDING ON THE VISIBILITY

A- EXTERNAL (REVEALED) BLEEDING

B- INTERNAL (CONCEALED) BLEEDING LIKE INTRA-ABDOMINAL OR INTRACRANIAL BLEEDING

THE INTERNAL BLEEDING MAY BECOME EXTENAL AS IN HEMATEMESIS DUE TO A BLEEDING PEPTC ULCER OR HEMATURIA AFTER RENAL INJURY OR AN INTRUTERINE BLEEDING TURNS INTO BLEEDING PER VAGINA

CONCEALED/ INTERNAL HAEMORRHAGE

Causes

- Penetrating wounds to chest , abdomen ,neck, limbs
- Upper GI haemorrhage
  - Bleeding Ulcers
- Lower GI haemorrhage
  - Diverticulosis
  - Haemorrhoids
  - Carcinomas

SURGICAL HAEMOSTASIS
INTERNAL HAEMORRHAGE

Principles of management

-Treat the primary cause

-Avoid irreversible shock by giving Fluid

and maintain electrolytes balance.

-Give Blood and blood products

Transfusion management

- All patients require large-bore intravenous cannulas.
- Central venous pressure monitoring is valuable in major hemorrhage or if there is cardio-respiratory disease.
- Hemoglobin concentration – interpretation
- The hemoglobin can
- **underestimate** the extent of blood loss in cases of acute hemorrhage *before haemodilution has occurred*, or can
- **overestimate** it if the patient is ***already anemic*** from chronic blood loss.

TYPES OF HAEMORRHAGE

1)**Bleeding from an artery:** is of a bright red colour, and escapes from the end of the vessel nearest the heart in jets synchronous with the heart's beat .

2)**Bleeding from a vein :**is of a darker colour; the flow is steady, the bleeding is from the distal end of the vessel .

3)**Capillary bleeding :**is a general oozing from a raw surface .

TYPES OF HAEMORRHAGE

SPECIFIC TYPES

- Bruise or ecchymosis .
  Extravasations of blood /pouring out of blood into the areolar tissues, which become boggy

- Haematemesis and melena
- Haemoptysis .
- Haematuria
- Epistaxis

TYPES OF HAEMORRHAGE –M.IMP

CLASSIFICATION OF SURGICAL HAEMORRHAGE has been classified as—

1-**Primary**,: occurring at the time of the injury

2-**Reactionary**,: or within 4-24 hours of the accident, during the stage of reaction. It is due to dislodgment of blood clot or slipping of ligature

3-**Secondary**, ;occurring at a later after 7 to 14 days period and caused by faulty application of a ligature or septic condition of the wound . In severe hemorrhage, as from the division of a large artery, the patient may collapse and death ensue from syncope .

HOW TO MEASURE ACUTE BLOOD LOSS ?

A NORMAL BLOOD VOLUME IS 80-85 ML / KG IN INFANTS AND ABOUT 65-75 ML / KG IN ADULTS

1- BLOOD CLOT SIZE – A Clenched FIST SIZE CLOT ROUGHLY EQUALS 500 ML

2 - SITE OF A CLOSED # SWELLING -- A MODERATE SWELLING IN A # TIBIA EQUALS TO 500- 1500 ML OF BLOOD, WHILE A MODERATE SWELLING IN A # FEMUR EQUALS TO 500-2000 ML OF BLOOD LOSS

HOW TO MEASURE ACUTE BLOOD LOSS ?

3- **SWAB WEIGHING** – BY SUBSTRACTING THE WEIGHT OF SOACKED SWABS FROM THEIR WEIGHT WHEN THEY WERE DRY AND THE BLOOD LOSS IS 1 ML FOR EVERY 1 GM DIFFERENCE

4- **HEMOGLOBIN LEVEL ESTIMATION** – THERE IS NO IMMEDIATE DECREASE IN Hg LEVEL AFTER BLEEDING BUT AFTER 8 HOURS IT WILL DROP BECAUSE OF THE INFLUX OF THE INTERSITIAL FLUID INTO THE **VASCULAR COMPARTEMENT (DILUTION)**

Tolerance

- *Young Individuals* may have more effective compensatory mechanisms before experiencing cardiovascular collapse.
  These patients may look deceptively stable,
  with minimal derangements in vital signs,
  while having poor peripheral perfusion.

  Elderly patients or those with chronic medical conditions may have *less tolerance* to blood loss,
  less ability to compensate,
  and may take medications such as betablockers that can potentially blunt the cardiovascular response.

  Care must be taken in the assessment of these patients.

EFFECTS OF HAEMORRHAGE

Depend upon following:

- Acute loss vs Chronic loss
- The amount of loss
- The compensatory mechanisms
- General state of health

EFFECTS OF HAEMORRHAGE

Depends upon the amount of blood loss

Stages of Hypovolemia

Stage 1

- Up to 15% blood volume loss (750mls)
- Compensated by constriction of vascular bed
- Blood pressure maintained
- Normal respiratory rate
- Pallor of the skin
- Slight anxiety

EFFECTS OF HAEMORRHAGE

Stage 2

- 15-30% blood volume loss (750 - 1500mls)
- Cardiac output cannot be maintained by arterial constriction
- Tachycardia >100bpm
- Increased respiratory rate
- Blood pressure maintained
- Increased diastolic pressure
- Narrow pulse pressure
- Sweating from sympathetic stimulation
- Mildly anxious/Restless

EFFECTS OF HAEMORRHAGE

Stage 3

- 30-40% blood volume loss (1500 - 2000mls)
- Systolic BP falls to 100mmHg or less
- Classic signs of hypovolemic shock
- Marked tachycardia >120 bpm
- Marked tachypnoea >30 bpm
- Decreased systolic pressure
- Alteration in mental status (Anxiety, Agitation)
- Sweating with cool, pale skin

EFFECTS OF HAEMORRHAGE

Stage 4-----Shock

- Loss greater than 40% (>2000mls)
- Extreme tachycardia with weak pulse
- Pronounced tachypnoea
- Significantly decreased systolic blood pressure of 70 mmHg or less
- Decreased level of consciousness
- Skin is sweaty, cool, and extremely pale (moribund)

	CLASS I	CLASS II	CLASS III	CLASS IV
BloodLoss (ml) %	<750 15%	750-1500 15%-30%	1500-2000 30-40%	>2000 >40%
HR	<100	>100	>120	>140
BP	normal	normal	decrease	decrease
PP	normal	decrease	decrease	decrease
RR	14-20	20-30	30-40	>35
UOP	>30	20-30	5-15	negligible
CNS	slightly anxious	mildly anxious	anxious confused	confused lethargic

urine output ml/hour

MANAGEMENT OF HAEMORRHAGE

- Prevention
- Precautions during surgery
- Operative method of control of haemorrhage
- Blood Transfusion

SURGICAL HAEMOSTASIS

NATURAL
ARTIFICIAL

Natural CONTROL/arrest of hemorrhage arises from ;

(1) the coagulation of the blood itself,
(2) changes taking place in the cut vessel causing its retraction and contraction .

SURGICAL HAEMOSTASIS
EXTERNAL HAEMORRHAGE /WOUNDS

The surgical procedure for the treatment of an open wound is–

(1) arrest of hemorrhage;

(2) cleansing of the wound and removal of any foreign bodies;

(3) careful apposition of its edges and surfaces with sutures of aseptic silk or catgut, the surfaces by carefully applied pressure;

(4) free drainage, if necessary, to prevent accumulation either of blood or serous effusion;

(5) avoidance of sepsis;

(6) perfect rest of the part .

SURGICAL HAEMOSTASIS

Surgical treatment of hemorrhage

minor means of arresting bleeding are:

cold, which is most valuable in general oozing and local extravasations;

very hot water, 130° to 16o ° F., a powerful haemostatic;

Position, such as elevation of the limb, valuable in bleeding from the extremities;

Astringents, applied locally, as perchloride of iron, tannic acid and others, the most valuable being suprarenal extract .

SURGICAL HAEMOSTASIS

Surgical treatment of haemorrhage

DIRECT PRESSURE

In small blood-vessels pressure will be sufficient to arrest.

LIGATURE

In large vessels with a knot

main artery of the limb exposed by dissection at the most accessible point .

SURGICAL HAEMOSTASIS

Surgical treatment of haemorrhage

- Diathermy
- Sutures

Diathermy

- Diathermy is a Greek word “ through heating”, in which a high frequency (>10.000Hz) electromagnetic current applied to induce deep heating within body tissue, to induce physiological effects for therapeutic purpose.

1. **Shortwave Diathermy (SWD)**
2. **Microwave Diathermy(MWD)**
3. **Pulsed Electromagnetic** (PEM

Blood transfusion

TRANSFUSION MANAGEMENT

- Early recognition of significant blood loss
- It is given in class iii and class iv category
- it is common to see patients who have been under-transfused than over-transfused.
- It is essential to pay attention to and act on recordings of pulse rate and blood pressure.
- In a fit patient without cardiac disease, persistent tachycardia – even if blood pressure is maintained – is likely to indicate continuing blood loss.

Requirements for Administering Blood Products

- In non-emergent situations a separate consent for transfusion must be obtained
- No blood product may be administered before establishing agreement between the data on:
  - Patient's two identifiers.
  - Blood unit's data in relation to patient's identifier data, blood unit number, ABO/Rh, expiration date/time.
  - Blood infusion record (crossmatch form) data in relation to patient's identifier data, blood unit number, ABO/Rh, expiration date/time.

Consent Form

Checking for Clerical Errors

- Was the blood transfused to the intended recipient?
- Was the correct unit tagged?
- Was the correct unit issued?
- Was the correct sample used for testing?

ANY QUESTIONS ?