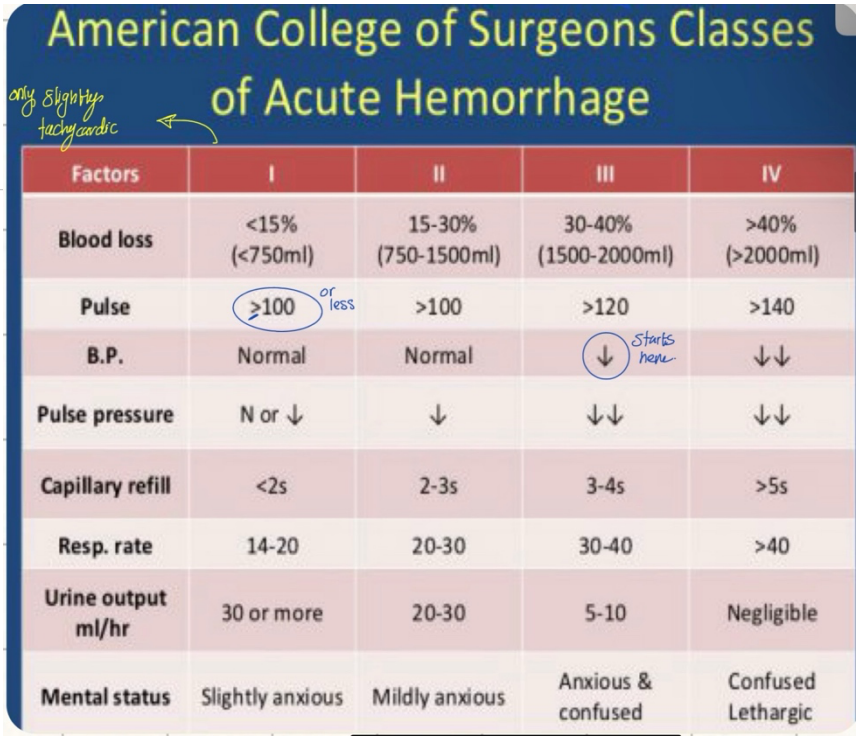
Lecture 14: hypovolemic shock

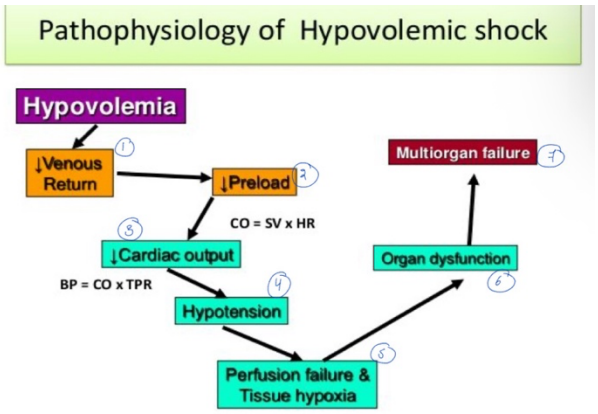
- It's a life-threatening condition of **circulatory failure**, O_2 demand and delivery are inadequate resulting in **cellular and tissue hypoxia**
  ⭐ The effect of shock are **initially reversible** but eventually and rapidly it will become **irreversible** causing:
  MOD → (Acidosis / hypothermia / coagulopathy) and **death**

Types of shock:

1. Hypovolemic→ It's an **intravascular volume loss** which in turn reduces **CO** resulting in tissue hypoxia and cellular hypoxia.
   ✅ It can be divided into:
   A) **Hemorrhagic**
   B) **Non-hemorrhagic**
2. Cardiogenic
3. Obstructive
4. Distributive (**septic / neurogenic**)



Factors	I	II	III	IV
Blood loss	<15% (<750ml)	15-30% (750-1500ml)	30-40% (1500-2000ml)	>40% (>2000ml)
Pulse	≥100 or less	>100	>120	>140
B.P.	Normal	Normal	↓ Starts here	↓↓
Pulse pressure	N or ↓	↓	↓↓	↓↓
Capillary refill	<2s	2-3s	3-4s	>5s
Resp. rate	14-20	20-30	30-40	>40
Urine output ml/hr	30 or more	20-30	5-10	Negligible
Mental status	Slightly anxious	Mildly anxious	Anxious & confused	Confused Lethargic



Losses:

1. **GIT** → in **normal** cases **3–6 L** are secreted daily, and **100–200 ml** are lost in stool
2. **Renal loss** → everyday **130–180 L** (liters) are filtered and **1–2 L** are urine output (98-99 of filtration)
   ⭐ Note: if even 1-2% of tubular reabsorption is affected can lead to **2-4L increase in sodium and water loss**
3. **Skin loss** → if you exercise in hot, dry climate this can lead to 1–2 L sweat loss
   🔥 **Burns** or **exudative skin lesions** can affect skin integrity

Non-Haemorrhagic causes	Haemorrhagic Causes
1. Gastrointestinal losses (diarrhea, vomiting, external drainage) 2. Skin losses (heat stroke, burns, dermatologic conditions) 3. Renal losses (excessive drug-induced or osmotic diuresis, salt-wasting nephropathies, hypoaldosteronism) 4. Third space losses into the extravascular space or body cavities (postoperative and trauma, intestinal obstruction, crush injury, pancreatitis, cirrhosis)	• Trauma • Gastrointestinal bleeding (varices, peptic ulcer) • Intraoperative and postoperative bleeding • Retroperitoneal bleeding (ruptured aortic aneurysm) • Hemorrhagic pancreatitis • Tumor or abscess erosion into major vessels • Ruptured ectopic pregnancy • Postpartum hemorrhage • Uterine or vaginal hemorrhage • Spontaneous peritoneal hemorrhage from bleeding diathesis

❑ **Signs** ●Tachycardia ●Hypotension ●Cool extremities ●Weak peripheral pulses ●Prolonged capillary refill (>2 seconds) ●Narrowing of the pulse pressure ●Tachypnea ●Change in skin color (eg, pale, cyanotic) ●Altered mental status ●Oliguria

❑ **Symptoms:** Headache/ thirst/ fatigue/ nausea/ profuse sweating/ dizziness/ muscle cramps //cold or clammy skin/ rapid, shallow breathing/ decreased urine output/ Dry mucous membranes/ decreased skin turgor/ agitation/ lethargy/ confusion or loss of consciousness

Recognizing and initial assessment:

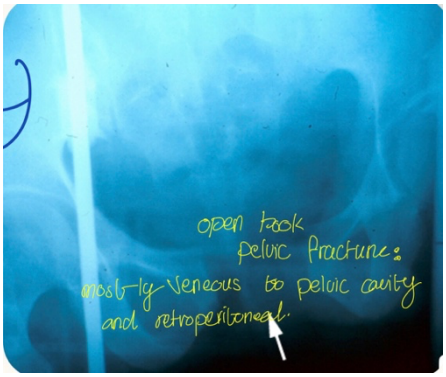
✅ **Early Recognition is the first step**
You have to use **ATLS four classes of hemorrhage** to decide the stage of the patient.
🚫 You're not gonna see **hypotension** until we reach **stage 3** or **30% blood loss**.

Assessment of seriously injured patients:

1. Control hemorrhage
2. Establish the airway and maximize O_2
3. Gain IV access and start fluid or blood resuscitation
4. Reverse immediate threats to life (e.g. pericardial tamponade, tension pneumothorax)
5. Obtain blood for lab and blood bank testing
   ⭐ Most important lab test is **cross-matching**

Hemorrhagic sites and management:

1. **External bleeding** (scalp/laceration/open fracture site)
   → controlled by **direct pressure** primarily
   → direct **clamping of bleeding vessels** and **NOT blind clamping**
   (⚠️ this is used in scalp bleeding)
   → **Scalp laceration** is managed by **lidocaine with epinephrine**, directly into the wound or by placing clips called raney clips or by closing the wound with running sutures
   → you can also use **tourniquets ONLY in amputation or severe hemorrhage** when other methods don't work
   💡 Make sure to release it **every 45 min to avoid ischemia**
2. **Retroperitoneal space** (usually from **pelvic fractures**)
   → Initially you should manage it by **adding pelvic binder** or **tying a sheet around the pelvis**
   → This is mostly imp **with open book fractures**
3. **Peritoneal cavity**
4. **Muscle & subcutaneous tissue** (from long bone fractures)
5. **Thoracic cavity**
   → Start with **Hx and PE** then **FAST** → If unstable, **DPL or CT**



Early diagnostic imaging:

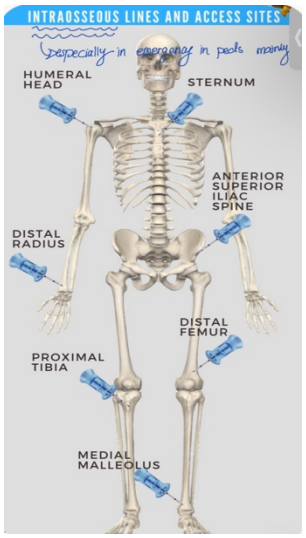
1. **FAST** if unstable to see hemoperitoneum / intraabdominal bleeding
2. **CT** only if stable
3. If no CT and FAST → use **DPL** → you raise the umbilicus, then add a cath
   → if you see blood → go to **surgery**
   → if no blood → do **analysis**, if +ve → go to **surgery**

Control of non-compressible bleeding → like liver / spleen / retroperitoneal.

zone 1 : central retro
zone 2 : peripheral retro
zone 3 : pelvis
each have a different cause of bleeding

- Methods for identifying noncompressible bleeding include focused abdominal sonography for trauma (FAST) for the abdomen, chest radiograph for the chest, and computed tomography (CT) for the retroperitoneal space.
- Unstable patients should be stabilized either by resuscitation in the operating room or endovascular interventions. → Depends on the source.
- Definitive management of the patient with traumatic shock often requires emergency surgery.

Type of surgery ← depends on the bleeding



Transfusion of blood products:

✅ The **best way** to give pts is to take blood, type it, and **crossmatch**. However, this takes time →
⇒ so when needed, give **Type O −**.
✅ Make sure to give (1:1:1 → plasma: RBC: platelets)

⭐ When can we use **whole blood**?
→ You don't give it unless you don't have blood banks because blood <u>stays sufficient when stored separately,</u> in which:
- Plasma → 12 months
- RBC → 42 days
- Platelets → 1 week

Fluid resuscitation:

💧 Until this day, **we don't know the ideal fluid** of resuscitation → we use **0.9% normal saline**
(if used largely could cause **non-anionic gap hyperchloremic metabolic acidosis**)
OR Ringer's lactate (**could cause metabolic alkalosis**)
💡 Note that: from the fluid resuscitation only **20%** stays **intravascular**

⭐ How do we give it?
→ Give **2 L**, if patient still hypovolemic → **give blood**,
if you don't have blood → **give fluids**

Cases that need massive transfusion?

We depend on **(ABC) score**:

1. Penetrating injury
2. +ve FAST
3. SBP < 90 or less
4. Heart rate of 120 or greater

What is a massive transfusion?
→ 10 units over 24h /// 4 units over 1h /// 10 or more in 6h
✅ You have to prepare (6:6:6)

⭐ Make sure to make **temperature management**
→ (>= 35.5°C)

Other considerations

- **Tranexamic Acid** (TXA) is an antifibrinolytic agent that can be given to within three hours of injury. then not useful
- **Calcium administration** ⟶ to remove citrate in the saved blood to avoid renal side effects.

  Calcium may be depleted due to hemodilution or due to binding by the citrate in blood products during massive transfusion.
- **General Anesthesia**

  Anesthetic induction and maintenance agents with minimal hemodynamic effects.

  Doses are usually reduced.

  Avoid high levels of positive end-expiratory pressure (PEEP) which can increase intrathoracic pressure, decrease venous return, and further reduce CO.

Delayed fluid resuscitation controlled hypotension

* المعلومة فقط لا غير

- Aggressive intravenous fluid administration could be ineffective and potentially harmful, suggestion of limited volume replacement intended to maintain minimally adequate organ perfusion may improve outcomes.

- This strategy has been referred to as **delayed fluid resuscitation, controlled hypotension, permissive hypotension, hypotensive resuscitation, or controlled resuscitation**, all of which describe an approach that targets early intravenous fluid resuscitation only to a SBP of greater than 70-90 mmHg

  50/90 Preg

- The rationale for improved outcomes with delayed fluid resuscitation is that aggressive fluid administration might, via augmentation of blood pressure, dilution of clotting factors, and production of hypothermia, disrupt thrombus formation and enhance bleeding

Remember that blood in blood bank is cold with few clotting factors.