Hypovolemic Shock

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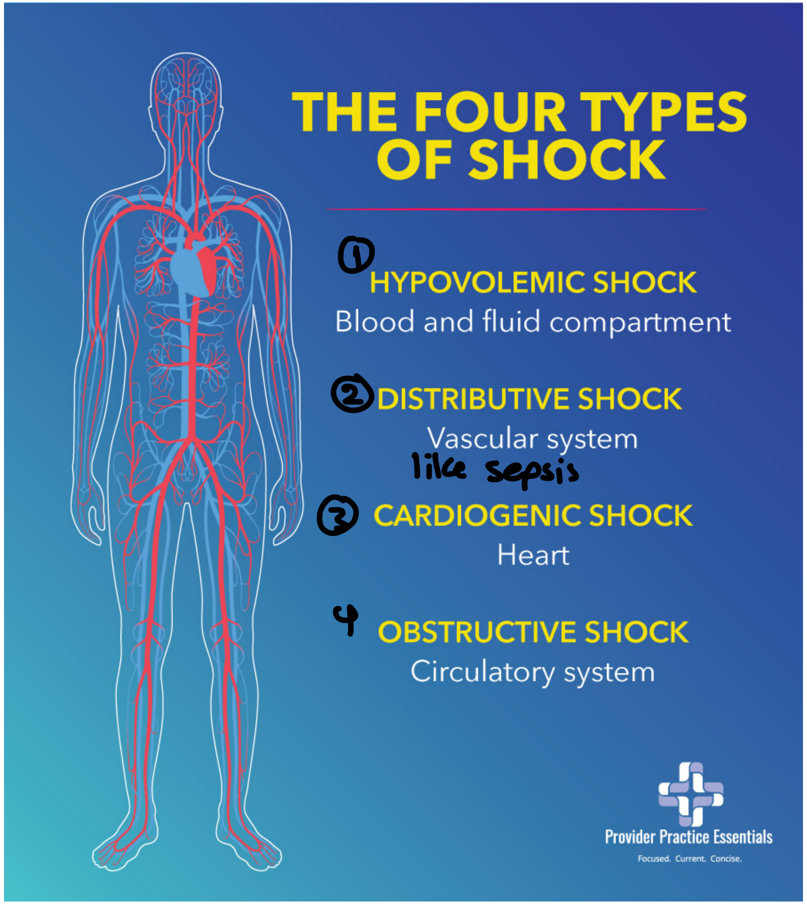
Introduction

- Shock is a life-threatening condition of circulatory failure, causing inadequate oxygen delivery to meet cellular metabolic needs and oxygen consumption requirements, resulting in cellular and tissue hypoxia.
- The effects of shock are initially reversible, but rapidly become irreversible, resulting in multiorgan failure (MOF) and death.

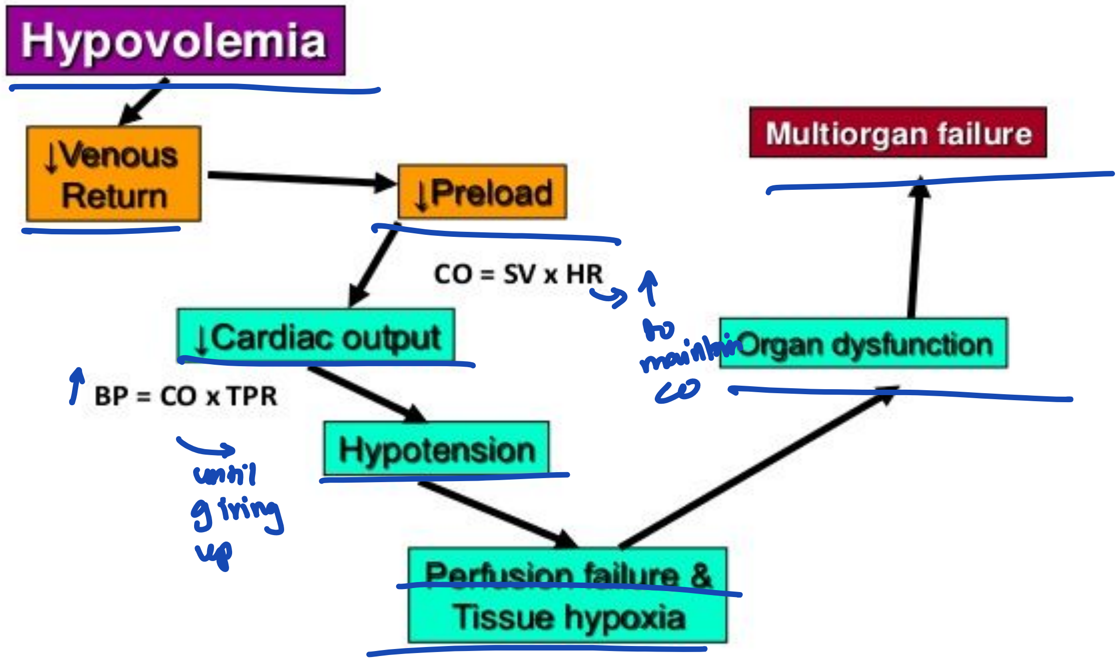
- Four types of shock are recognized: distributive, cardiogenic, hypovolemic, and obstructive.
- However, these are not exclusive, and many patients with circulatory failure have a combination of more than one form of shock



Definition

- Hypovolemic shock is due to reduced intravascular volume, which in turn, reduces CO. Resulting in tissue and cellular hypoxia
- Hypovolemic shock can be divided into two categories:
- **Hemorrhagic** — Reduced intravascular volume from blood loss.
- **Nonhemorrhagic** — Reduced intravascular volume from fluid loss other than blood.

Pathophysiology of Hypovolemic shock



Haemorrhagic Causes

(intravascular loss of blood)

- 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

Non-Haemorrhagic causes

1. Gastrointestinal losses

(diarrhea, vomiting, external drainage)

→ gastroenteritis

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)

*Always any patient coming with gastroenteritis start treating by fluids

- **Gastrointestinal losses**

  Each day, approximately 3 to 6 liters of fluid are secreted.

  only 100 to 200 mL are lost in the stool. → the remainder is reabsorbed

- **Renal losses**

  In a normal adult, approximately 130 to 180 liters is filtered each day.

  98 to 99 percent of the filtrate is reabsorbed, resulting in a urine output averaging 1 to 2 L/day.

  Thus, a small (1 to 2 percent) reduction in tubular reabsorption can lead to a 2- to 4-liter increase in sodium and water excretion.

- **Skin losses**

  Sweat production can exceed 1 to 2 L/h while exercising in a hot, dry climate.

  The skin also acts as a barrier, When it is interrupted by burns or exudative skin lesions, a large volume of fluid can be lost.

Clinical Manifestations

- **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

- **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

→ We end up with metabolic acidosis or hyperlactemia

Recognition & Initial Assessment of haemorrhagic shock

- Early recognition is the first step in managing Hemorrhagic shock
- The advanced trauma life support (ATLS) manual describes four classes of hemorrhage to emphasize the early signs of the shock state.
- Significant drops in blood pressure are generally not manifested until class iii hemorrhage develops, and up to 30 percent of a patient's blood volume loss

early response

late response

American College of Surgeons Classes of Acute Hemorrhage

Factors	I	II	III	IV
Blood loss	<15% (<750ml)	15-30% (750-1500ml)	30-40% (1500-2000ml)	>40% (>2000ml)
Pulse	>100	>100	>120	>140
B.P.	Normal	Normal	↓	↓↓
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

Haemorrhage sites

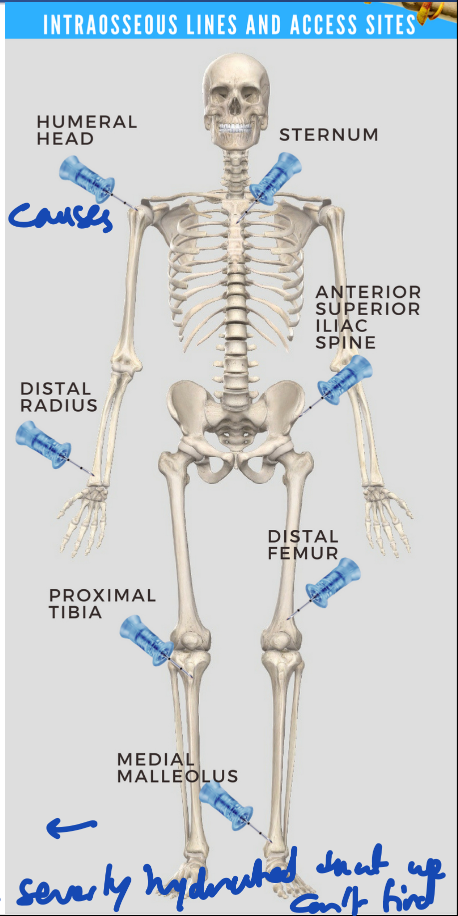
- Large-scale bleeding can occur at five possible locations:

1. External haemorrhage (scalp laceration, open fracture site)
2. Thoracic cavity hemothorax
3. Peritoneal cavity splenic / liver injury ....
4. Retroperitoneal space (often from pelvic fracture)
5. Muscle or subcutaneous tissue (often from a long-bone fracture)

إذا كان مثلا الجرح داخلي مثل الspleen : يا بشيله
يا بعمل embolization

Assessment and treatment in the seriously injured patient

1. Control hemorrhage → pressure / don't use tourniquete because it causes ischemia
2. Establish a patent airway while protecting the cervical spine (may take first priority in some situations)
3. Maximize oxygenation
4. Gain intravenous (IV) access and initiate fluid resuscitation or blood transfusion as indicated
5. Identify and reverse immediate threats to life (eg, pericardial tamponade, tension pneumothorax)
6. Obtain blood for laboratory and blood bank testing



interosseus fluid when the patient is severly hydrated that we can't find ←

Initial Management Of Hemorrhage

vein

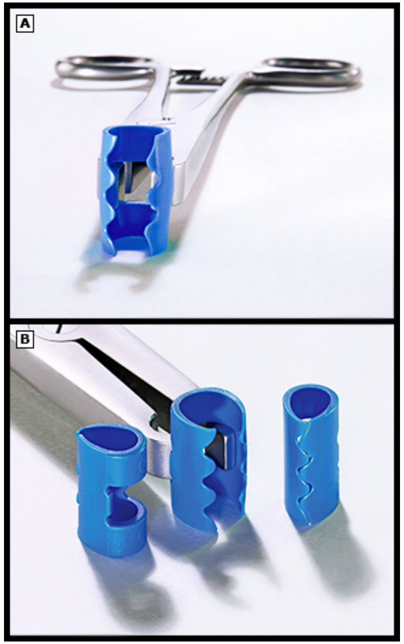
Control of compressible or extremity bleeding

- Direct pressure is the primary and preferred means.
- Clamping bleeding vessels under direct visualization is acceptable, blind clamping is not.
- Scalp lacerations can be managed by injecting lidocaine with epinephrine directly into the wound, or by placing clips (Raney clips) or by closing the wound with running sutures.
- Use of a tourniquet is **only acceptable** to stop hemorrhage in cases of amputation or severe extremity injury when other measures have not successfully controlled bleeding.
- Tourniquets should be released periodically (eg, every 45 minutes) when possible to avoid prolonged ischemia and possible tissue loss.

vasoconstriction locally

thick skin

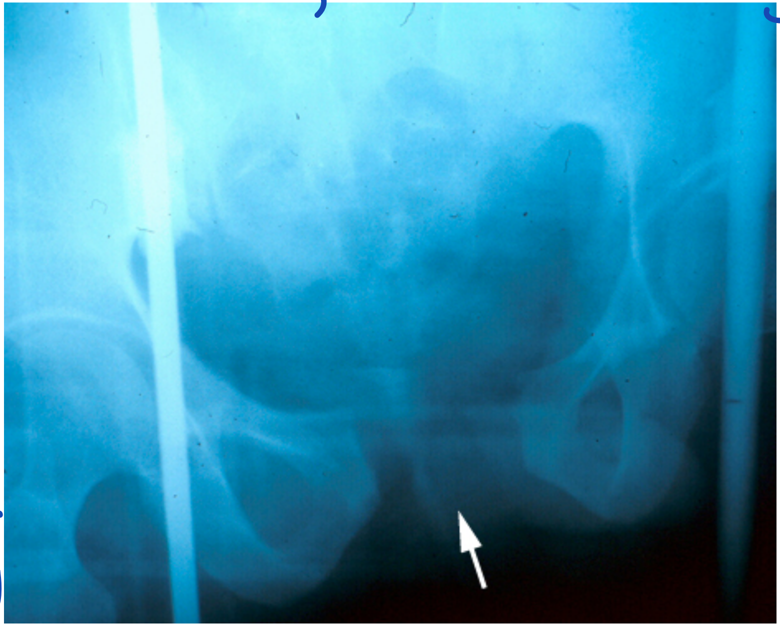
عن الأطراف فقط



Treatment: pelvic binder to act like compartment syndrome and stop bleeding

Hemorrhage from pelvic fracture

- Preliminary stabilization of the pelvis by applying a circumferential pelvic binder or tying a sheet firmly around the pelvis.
- Such interventions are most important with "open-book" pelvic fractures.



no embolization ← venous bleeding

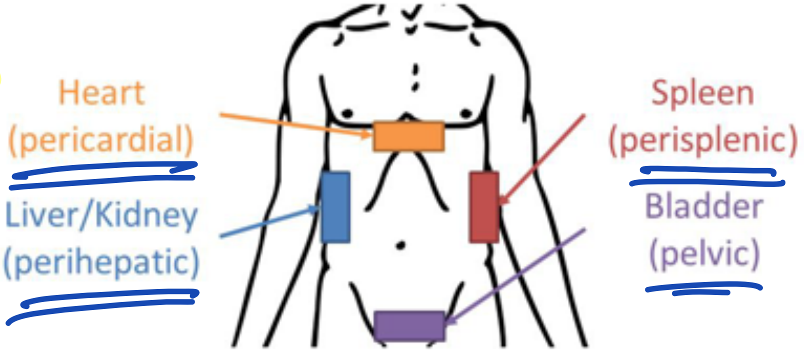
open book pelvic fracture

symphysis pubis
مو مرتبطين مع بعض

FAST Examination

Diagnostic examination for internal bleeding

- **Early diagnostic imaging** — A trauma ultrasound examination, or Focused Assessment with Sonography for Trauma (FAST), is performed early in the assessment to look for hemopericardium, intraabdominal bleeding.
- If patient stable enough, can undergo CT scan



Control of non-compressible 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.
- Definitive management of the patient with traumatic shock often requires emergency surgery.

O2 cannulas

Patient hypotensive
RTA
↓
direct
cross match
test for
blood transfusion

Transfusion of blood products

- Blood products should be given as soon as the need for transfusion is recognized.
- Typed and cross-matched PRBCs are best, but can require significant time to prepare.
- Type O RhD-negative is the universal donor and can be given to all individuals.
- Blood products (red blood cells, plasma, and platelets) should be given in equivalent amounts – in a 1:1:1 ratio. Whole blood can be used.

Intravenous fluid resuscitation

- The ideal resuscitation fluid for injured patients remains unclear. If intravenous fluids must be administered, using balanced crystalloids such as lactated ringers until blood products are available.
- Infusions of large volumes of isotonic (0.9%) normal saline can lead to the development of a non-anion gap hyperchloremic metabolic acidosis.
- Large volume resuscitation using lactated ringers (LR) can cause a metabolic alkalosis.
- However, the typical volumes of either NS or LR used during a trauma resuscitation do not appear to have significant clinical consequences.

Delayed Fluid Resuscitation Controlled Hypotension

another strategy

- 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
- 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

Predicting the need for massive transfusion

- Anticipation of the need for large-scale transfusion in presence or likelihood of severe, ongoing hemorrhage
- the Assessment of Blood Consumption (ABC) score relies on 4 parameters that can be determined upon arrival to the ED:
  - ●Penetrating mechanism of injury
  - ●Positive FAST (Focused Assessment with Sonography in Trauma) examination.
  - ●SBP of 90 mmHg or less
  - ●Heart rate of 120 beats per minute or greater

- Traditionally, a massive transfusion was considered 10 units of PRBCs or more over a 24-hour period, but requiring 4 or more units of PRBCs over one hour (or 10 or more units over 6 hours), is considered massive blood transfusion

- If massive transfusion is anticipated: transfusing 6 units of PRBCs, 6 units of FFP, and 6 units of random donor platelets (or 1 unit of apheresis platelets) should be administered.

- **Temperature management** — Warming devices are employed to maintain normothermia (temperature ≥35.5°C). These include upper- and lower-body forced-air warming devices and blankets, insulation water mattresses, and devices for warming all IV fluids

→ hypothermic fluids cause more damage

Other considerations

- **Tranexamic Acid** (TXA) is an antifibrinolytic agent that can be given to within three hours of injury.
- **Calcium administration**

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

  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.

THANK YOU