Circulatory Failure and Shock

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שאלת חזרה – מבחן רישוי

10. מהי האטיולוגיה השכיחה ביותר למורסה בכבד בעשרים השנים האחרונות?

a. זריעה עורקית
b. זריעה פורטלית (משני לתהליך דלקתי אחר באיברי הבטן)
c. חדירה ישירה מגידולים במעי הגס או בתריסריון
d. זריעה מדרכי מרה בעקבות כולנגיטיס או דלקת בכיס המרה

27. בן 55 פונה למיון עקב הקאה דמית מסיבית. הוא נלקח לגסטרוסקופיה ושם נמצא כלי דם חשוף שאיננו מדמם כעת. מה הסיכון לדימום חוזר עלפי סולם Forrest?

a. אפסי
b. נמוך
c. בינוני
d. גבוה

What is shock?

- Shock is the clinical syndrome that results from inadequate tissue perfusion (less oxygen to tissues)
- The first compensatory response - increase in the SYMPATHETIC ACTIVITY! The body takes the blood from the ”less” important organs to the more important organs (heart, brain, and kidneys)
- The normal physiological response: when cardiac output goes down, vascular resistance rises to maintain adequate perfusion to the brain and heart (at the expense of other organs)
- Vascular resistance is raised through renin (causes eventual vasoconstriction) and also adrenaline, norepinephrine, dopamine and cortisol are released. The problem is – we don’t have endless stores of these hormones!!
- Hypoveolemia decreases the preload, which in turn decreases cardiac output. The patient will become tachycardic – but this will not be sufficient to fully compensate.

Shock index (SI)

- SI = HR/(Systolic BP)
  - If it's greater than 1 it's positive
- It asseses how severe the shock is
- Modified SI (MSI) = HR/MAP
  - The higher the MSI, the lower the stroke vome and systemic vascular resistance
  - Predicts mortality
- Either SI or MSI are much better than looking only at the HR and systolic BP
- Kahoot 1

Lethal Triad (LT)

- LT = acidosis, hypothermia, and coagulopathy
- Common in resuscitated patients who are bleeding/in shock
- Why is this the lethal triad?
  - Acidosis > because of increased lactate
  - Hypothermia > in shock there is less delivery of nutrients leading to decreased ATP, we need ATP to warm our body.
  - Coagulopathy > hypothermia causes enzymes not to work properly which for some reason contribute to worsening coagulopathy = BLEEDING
- The more they bleed, the worse the triad becomes > "vicious circle of death"
- The way to break it is to stop the bleeding > more ATP production> warmer body temperature > coagulopathy stops.
- Note – hypothermia is also caused by use of room temp. fluid or cold blood products!!!!!!
- Kahoot 2

SIRS Criteria vs. qSOFA

- The SIRS criteria is a criteria is positive if 2/4 criteria are met in the CORRECT context -

TABLE 4.5 SIRS criteria.

Body Temperature	>38°C or <36°C
Heart Rate	> 90 Beats per min
Tachypnea	Respiratory rate >20/min or $PaCO_2$ <32 mm Hg
White Blood Cell Count	>12,000/mm^3, <4000/mm^3, or >10% immature neutrophils

SIRS, Systemic inflammatory response syndrome.

- The new criteria, called qSOFA is better (controversial), here you also need 2/4 criteria:

TABLE 4.7 qSOFA.

Respiratory rate ≥22
Altered mental status
Systolic blood pressure ≤100 mm Hg

SOFA, Sequential organ failure assessment.

Sepsis

- Sepsis = SIRS + a source (UTI, blood infection, wound infection, etc.)
- Severe sepsis = sepsis + elevated lactic acid (shock index) that IS responsive to fluids
  - Resolution is seen by improvements in the shock index or a decrease in lactic acid after fluid resuscitation and antibiotics!!
- Septic shock = sepsis + elevated lactic acid (shock index) that is NOT reponsive to fluids (requires vasopressors!!)
  - Treatment – fluids, antibiotics and then vasopressors (norepinephrine)
- Volume resuscitation – 30cc/kg of IV fluids in the first 3 hours.
- Kahoot 3

Assessing the resonse

- Normalization of BP and HR, fever decrease, lactic acid decrease = good resopnse

Blood analysis in shock

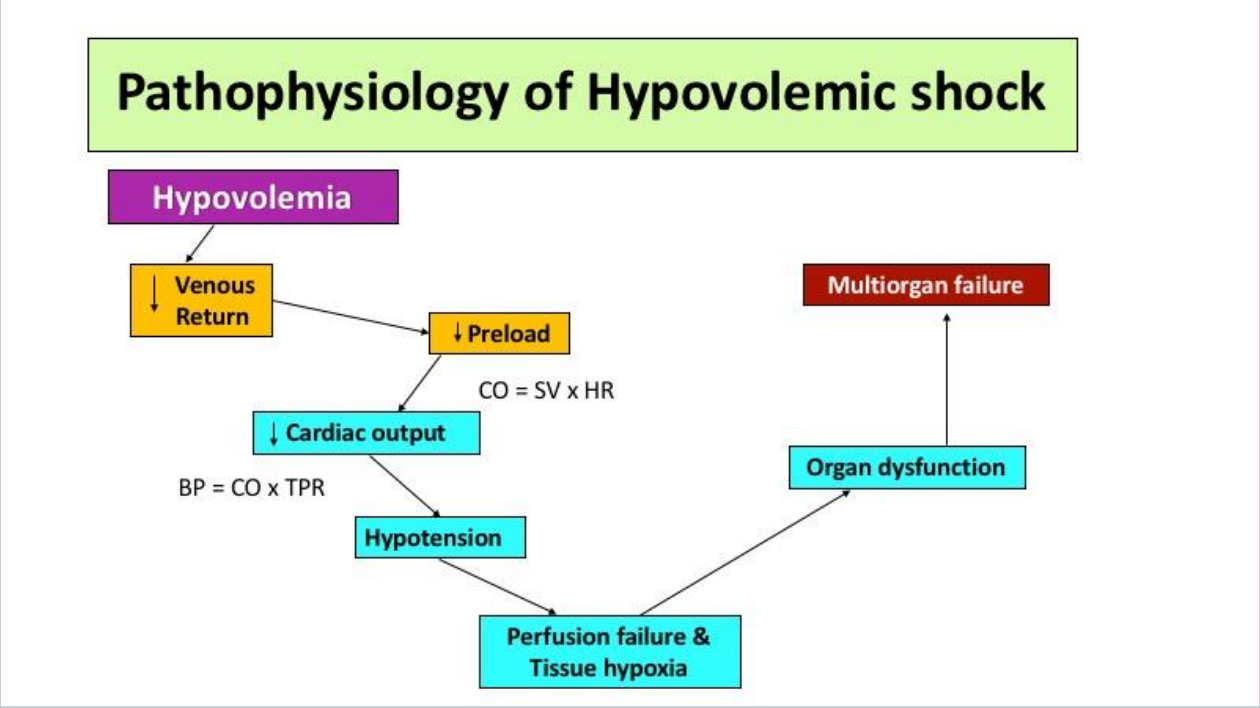
- Lactate rises (we need oxygen for aerobic glycolysis, in the absence of oxygen, the body does anerobic glycolysis which converts pyruvate to lactic acid).

Different types of shock

- Hypovolemic
- Cardiogenic
- Septic
- Traumatic
- Neurogenic
- Hypoadrenal

Hypovolemic Shock

- Occurs due to red blood cell/plasma loss in **hemorrhage**, extravasation of fluid to the extracellular space, or dehydration.



Symptoms

TABLE 324-5 HYPOVOLEMIC SHOCK

Mild (<20% Blood Volume)	Moderate (20–40% Blood Volume)	Severe (>40% Blood Volume)
Cool extremities	Same, plus:	Same, plus:
Increased capillary refill time	Tachycardia	Hemodynamic instability
Diaphoresis	Tachypnea	Marked tachycardia
Collapsed veins	Oliguria	Hypotension
Anxiety	Postural changes	Mental status deterioration (coma)

Diagnosis

- Look for hemodynamic instability and a source of volume loss!
- Note: even after acute hemorrhage, the hemoglobin does not change by much in the acute setting (hemoconcentration). This will only happen after compensatory fluid shifts have occurred.
- Hypernatremia
- Cardiogenic shock presents similarly (low CO and increased vascular resistance), However, you will see JVP, crackles, and s3, etc.

ATLS Classes of hemorrhagic shock

TABLE 4.1 ATLS classes of hemorrhagic shock.

	CLASS I	CLASS II	CLASS III	CLASS IV
Blood loss (%)	0–15	15–30	30–40	>40
Central nervous system	Slightly anxious	Mildly anxious	Anxious or confused	Confused or lethargic
Pulse (beats/min)	<100	>100	>120	>140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure	Normal	Decreased	Decreased	Decreased
Respiratory rate	14–20/min	20–30/min	30–40/min	>35/min
Urine (mL/hr)	>30	20–30	5–15	Negligible
Fluid	Crystalloid	Crystalloid	Crystalloid + blood	Crystalloid + blood

Traumatic Shock

- Usually due to hemorrhage
- Even when hemorrhage is controlled, there may be more bleeding into the interstitium of injured tissues
- ABC – airway, breathing circulation
- Stabilize fracture, perform debridement of devitalized or contaminated tissues, and evacuate the hematomas

Compressive Cardiogenic Shock

- Anything that presses on the heart, can cause cardiogenic shock
- Examples – tamponade, tension pneumothorax, herniation of abdominal viscera, positive pressure ventilation
- MI
- If tamponade – confirm with echo and perform pericardiocentesis
- If tension pneumothorax – chest decompression

Neurogenic Shock

- Injury to the sympathetic fibers due to spinal injury, migration of anesthesia, etc.
- Extremities will be warm (due to vasodilation)
- Treat with fluids and pressors

Hypoadrenal Shock

- Normally, in times of stress (illness, operation, trauma) the adrenal glands release cortisol in excess to fight the infection (this increases BP)
- Sometimes, the body is unable to produce this response
- Causes include: exogenous steroid use, TB, metastatic disease, bilateral hemorrhage, and amyloidosis.
- Diagnose with the ACTH stimulation test
- Treat with IV dexamethasone

Rewarming

- Rapid resuscitation uses refrigerated blood products and can bring down body temp rapidly
- Hypothermia makes CO even lower
- Hypothermia impairs the coagulation cascade
- Treat by rapidly rewarming (to more than 35 degrees celcius) via endovascular countercurrent warmers through femoral vein cannulation

87. איזה מהבאים מוגדר כחלק מה-lethal triad בשוק?

א. Hyperthermia - fever

ב. Metabolic alkalosis

ג. Hypotension

ד. Coagulopathy

3. איזה מבין המצבים הבאים עלול לגרום ל intrinsic cardiogenic shock ?

a. טמפונדה לבבית
b. ספסיס
c. חזה אוויר בלחץ
d. אוטם לבבי
e. חבלת ראש

46. חולה בן 22, מגיע לחדר טראומה לאחר פצע ירי לאגן. החולה מתדרדר במהירות, ואחד העמיתים שלך חושש כי החולה עלול לסבול מן הטריאדה הקטלנית של טראומה (The lethal triad). ממה מורכבת טריאדה זו?

a. חמצת, היפוטרמיה וקואגולופתיה (Acidosis, hypothermia, coagulopathy)
b. חמצת, היפרטרמיה וקרישיות יתר (Acidosis, hyperthermia, hyper coagulopathy)
c. בססת, היפוטרמיה וקואגולופתיה (Alkalosis, hypothermia, coagulopathy)
d. בססת, היפוטרמיה וקרישיות יתר (Alkalosis, hypothermia, hyper coagulability)

46. מהו מנגנון הפיצוי הראשוני של הגוף בשוק היפו וולמי (hypovolemic Shock)?

a. ירידה בתפוקת השתן
b. עלייה בקצב הנשימות
c. עלייה בפעילות הסימפטטית
d. ירידה במצב ההכרה

41. בן 19 מגיע לחדר טראומה לאחר תאונת טרקטורון. בקבלתו: דופק-130, לחץ דם-88/73, סטורציה-100. המוגלובין 13.3, לקטאט 6, ו 9 - BE
על סמך נתונים אלו - מה דרגת השוק?

a. דרגה I
b. דרגה II
c. דרגה III
d. דרגה IV