

Case I: Shock

It is your first night of call during your subinternship month, and you are asked by your resident to evaluate a patient in the emergency room. The patient is a 85yo female with a history of Alzheimer's dementia and Hypertension. She presented to the emergency room via ambulance from a nursing home with a complaint from the nursing home staff of decreased mental status. The ambulance team reports that on their arrival, the patient's blood pressure was 80/40mmHg. Her medications at the nursing home include Aricept, Hydrochlorothiazide, and Metoprolol.

A) What additional history would you like from the nursing home staff, patient's chart, and ambulance team?

Answer:

- a) History from Nursing Home staff:
 - a. Time of onset of symptoms
 - b. Recent illnesses in the patient
 - c. Presence of associated symptoms, such as fever, nausea, vomiting, diarrhea
- b) History from the patient's chart
 - a. Past history, such as recent hospitalizations or illnesses, surgeries, etc.
 - b. Daily and as needed medications
 - c. Recent vital signs prior to the onset of symptoms
 - d. Family contact person
- c) History from the ambulance team
 - a. Patient's mental status on arrival
 - b. Patient's perfusion on arrival
 - c. Patient's other vital signs on arrival
 - d. Any interventions that have taken place on the way to the hospital

B) Define shock. What are the main categories of shock?

Shock is the physiologic state characterized by significant reduction of systemic tissue perfusion, resulting in decreased tissue oxygen delivery. The different types of shock are:

- Hypovolemic shock
- Cardiogenic shock
- Extracardiac Obstructive Shock
- Distributive Shock

The different causes of each of these conditions are listed below:

1. Hypovolemic shock
 - a. Blood loss due to trauma or gastrointestinal bleeding

- b. Third space loss of plasma volume (pancreatitis, bowel obstruction, infarction, anaphylaxis)
 - c. Diarrhea
 - d. Burns
2. Cardiogenic shock
 - a. Acute myocardial infarction (>40% of LV mass)
 - b. Arrhythmia (heart block, Ventricular tachycardia, etc.)
 - c. Acute valvular dysfunction
 - d. Ventricular septal rupture
 - e. Dilated cardiomyopathy
 - f. Ventricular aneurysm
 - g. Left ventricular outflow track obstruction
 3. Extracardiac Obstructive shock
 - a. Pericardial tamponade
 - b. Inferior/superior vena caval obstruction
 - c. Aortic dissection
 - d. Massive pulmonary embolism
 - e. Severe pulmonary hypertension (primary or Eisenmenger)
 4. Distributive shock
 - a. Neurogenic shock
 - b. Septic shock
 - c. Toxic shock secondary to drug overdose
 - d. Anaphylaxis
 - e. Endocrinologic shock

On physical examination, the patient is lying quietly in bed and somewhat difficult to arouse with sternal rub. Her pulse is 120 beats/min, BP is 80/40, RR is 18, and temperature is 101degrees Fahrenheit. Her cardiac and pulmonary exam are within normal limits. Her abdominal exam reveals some mild to moderate suprapubic tenderness but is otherwise normal. The rest of her physical examination is normal. A Foley catheter is in place and contains dark colored urine with small amounts of pus.

C) Based on the history and physical examination, what is your Differential Diagnosis and which diagnosis would you consider most likely in this patient?

Answer:

Differential Diagnosis at this point would be limited to:

- a) Infection/septic shock with causes such as pneumonia, meningitis/encephalitis, urinary tract infection, bacteremia, etc.
- b) Myocardial infarction

Most likely diagnosis in this patient given the history and physical examination would be infection/septic shock with urinary tract infection leading the list of these causes.

D) What is SIRS, sepsis, severe sepsis, and septic shock?

Systemic Inflammatory Response Syndrome: Patient has SIRS if he/she has two of more of the following conditions: temperature $>38.5^{\circ}\text{C}$ or $<35.0^{\circ}\text{C}$; heart rate of >90 beats/min; respiratory rate of >20 breaths/min or PaCO_2 of <32 mm Hg; and WBC count of $>12,000$ cells/mL, <4000 cells/mL, or >10 percent immature (band) forms

Sepsis: SIRS along with documented source of infection.

Severe Sepsis: Sepsis and at least one of the following signs of organ hypoperfusion or organ dysfunction: thrombocytopenia $<100,000$ cells/ml, DIC, areas of mottled skin; capillary refilling of ≥ 3 s; urinary output of <0.5 mL/kg for at least 1 h or renal replacement therapy; lactate >2 mmol/L; abrupt change in mental status or abnormal EEG findings; acute lung injury/ARDS; and cardiac dysfunction

Septic Shock: Severe sepsis and one of the following conditions: systemic mean BP of <60 mm Hg (<80 mm Hg if previous hypertension) after 20 to 30 mL/kg starch or 40 to 60 mL/kg serum saline solution, or PCWP between 12 and 20 mm Hg; and pressors (dopamine, norepinephrine) to keep the mean BP at >60 mm Hg (80 mm Hg if previous hypertension)

E) What laboratory evaluation would you want to obtain in this patient?

Answer:

Chemistry panel, Complete Blood Count with differential, Liver panel, lactic acid level, Urinalysis with culture, Blood Culture from 2 sites, Chest Xray, Electrocardiogram

A Complete Blood Count reveals and elevated white blood cell count with a left shift, and a urinalysis shows many bacteria with >100 WBC/hpf and positive nitrite.

F) How would you continue to manage this patient?

Answer:

First and foremost, intravenous fluids in a crystalloid form such as lactated ringers or normal saline to be given as a bolus of either 1000mL over one hour or 500mL over 30 minutes. Reassessment of the patient and the patient's vital signs should occur after the initial bolus, and if the systolic blood pressure remains below 90mmHg, then another bolus should be given and consideration made for transfer to the Intensive Care Unit where vasopressors can be initiated.

Antibiotics to cover for the urinary tract infection should be given as well.

Discussion with family members about the patient's clinical situation and code status should occur as well once the initial stabilization of the patient is made.

Patient was aggressively volume resuscitated and started on intravenous antibiotics. Over the next 24 hours, patient blood pressure increased to 110/60mm Hg, HR 90. Blood culture from the lab was reported as gram negative bacillus, urine culture also revealed gram negative bacillus. Patient's antibiotic was continued.

G) What is your antibiotic of choice in this case? What antibiotic would you consider if the patient's blood culture and urine culture reported gram positive cocci in clusters?

Third generation cephalosporins, quinolones, Piperacillin/Tazobactam; If gram positive cocci in clusters – consider Vancomycin

H) How would your management differ if your patient's blood pressure continued to be in the low 80s with fluid resuscitation?

Reassessment of the patient and the patient's vital signs should occur after the initial bolus, and if the systolic blood pressure remains below 90mmHg, then another bolus should be given and consideration made for transfer to the Intensive Care Unit where vasopressors can be initiated.

Case Scenario #2

You are on the floor with the intern helping out with floor calls when you receive a call from the cardiac floor about a patient admitted earlier in the day with chest pain. The nurse reports that the patient's blood pressure is currently 80/40mmHg, and he is again complaining of chest pain.

A) What questions would you ask the nurse and how would you proceed?

Answer:

- *What are the patient's other vital signs?
- *When did the chest pain begin?
- *Why was the patient admitted and what has been his hospital course?
- *What recent medications has he been given?
- *Has the patient had any procedures or interventions performed recently?

While walking hurriedly to the cardiac floor, you remember that this particular patient is a 60yo male attorney with Hypertension, Hyperlipidemia, and Diabetes mellitus type II who presented earlier in the day with a complaint of chest pain while questioning a witness in court. His initial EKG on arrival showed nonspecific STT segment changes, and the initial cardiac enzymes were mildly elevated. He was admitted to the hospital to rule out a cardiac cause of his chest pain.

On arrival to the patient's room, the patient is diaphoretic and sitting on the side of the bed clutching his chest.

B) Identify some key points you need to focus on when you arrive in his room.

Answer:

- a) Chart review: This aspect of the patient's evaluation is very important to appropriately assess the patient. Review:
 - Presence of chest pain prior to admission
 - Hospital course
 - Current medications
 - Home medications
 - Recent procedures/laboratory studies performed
- b) History from the patient including:
 - Onset and timing of symptoms
 - Alleviating/exacerbating factors
 - Associated factors such as shortness of breath, diaphoresis, nausea, vomiting, etc.

C) How would you proceed?

Answer:

Physical examination: A physical examination needs to be performed prior to any further management. This examination should include:

- Assessment of the patient's vital signs
- Assessment of the cardiac exam with particular attention paid to any new murmurs, the presence of elevated JVP, capillary refill, etc.
- Assessment of the pulmonary exam with particular attention paid to crackles on lung exam, use of accessory muscles of inspiration, etc.

On physical examination, the patient is tachypneic and diaphoretic. His HR is 100beats/min, BP 80/40mmHg, RR 24, temperature 98.8degrees Fahrenheit, and Oxygen saturations of 88% on room air. His cardiac exam reveals a III/VI holosystolic murmur at the left sternal border as well as a S3 gallop. On lung exam, he has crackles bilaterally without wheezing. His extremities are cool to the touch but otherwise his physical examination is normal.

D) What is the differential diagnosis of shock in this hospitalized patient? What is the main difference in pathophysiology between the patients in case 1 and case 2?

Answer:

- A. Cardiogenic shock
 - a. Acute myocardial infarction (>40% of LV mass)
 - b. Arrhythmia (heart block, Ventricular tachycardia, etc.)
 - c. Acute valvular dysfunction
 - d. Ventricular septal rupture
 - e. Dilated cardiomyopathy
 - f. Ventricular aneurysm
 - g. Left ventricular outflow track obstruction
- B. Extracardiac Obstructive shock
 - a. Pericardial tamponade
 - b. Inferior/superior vena caval obstruction
 - c. Aortic dissection
 - d. Massive pulmonary embolism
 - e. Severe pulmonary hypertension (primary or Eisenmenger)

The table below identifies the difference in the pathophysiology and hemodynamic profile between the different types of shock.

<i>Physiologic variable</i>	Preload	Afterload	Pump function	Tissue perfusion
<i>Clinical measurement of these variables</i>	Pulmonary capillary wedge pressure	Systemic vascular resistance	Cardiac output	Mixed venous oxygen saturation
Cardiogenic (case #2)	Increased	Increased	Decreased	Decreased
Distributive (case #1)	Decreased or normal	Decreased	Increased	Increased
Hypovolemic	Decreased	Increased	Decreased	Decreased

Table -1

***E) What do you expect this patient's hemodynamic profile to be?
See table- 1***

F) What are the next steps in the evaluation and management of this patient?

Answer:

- Electrocardiogram STAT!
- Chest Xray
- Cardiac enzymes
- Place the patient on 2L O2 nasal cannula and continuously assess oxygen saturations and respiratory status
- Once the EKG returns, determine whether the patient requires the other components of the acronym MONA (morphine sulfate, oxygen, nitroglycerin, aspirin).
- Contact the on call resident and cardiology fellow.
- Transfer the patient to the intensive care unit for closer monitoring, possible cardiac intervention, administration of pressors, etc.

As you are waiting on the EKG, chest xray, and labs, you ask the nurse to place the patient on 2L of oxygen. The EKG shows STT segment elevation in leads II, III, and aVF. You immediately page your resident and the cardiology fellow and have the nurse give the patient aspirin, nitroglycerin, and morphine sulfate. The cardiology fellow then arrives and immediately takes the patient to the cardiac catheterization lab.

Case Scenario #3

You are asked by your resident to evaluate a patient in the emergency room. The patient is a 45yo Indian businessman with no medical problems who just returned from an overseas trip and presents with a one day history of abdominal pain and diarrhea. He is on no medications at home. In triage, the patient's blood pressure is noted to be 80/40, and the patient is immediately taken to an examination room.

A) What further questions do you have for this patient?

Answer:

- Timing of onset of symptoms
- Location of the abdominal pain
- Radiation of the abdominal pain
- Severity of the abdominal pain
- Recent travel
- Recent antibiotic use

- Consumption of different foods while abroad
- Associated symptoms such as chest pain, headache, shortness of breath, fever, vomiting, etc.
- Description of the diarrhea, i.e. blood, mucous, color, consistency.
- Quantity of diarrhea
- Ill contacts

B) What are some causes of shock and which would be most likely in this patient?

Answer:

- Hypovolemic shock
 - a. Blood loss due to trauma or gastrointestinal bleeding
 - b. Third space loss of plasma volume (pancreatitis, bowel obstruction, infarction, anaphylaxis)
 - c. Diarrhea

On physical examination, the patient is in mild to moderate distress with a HR of 140beats/min, BP of 90/60, RR of 18, and temperature of 99.8degrees Fahrenheit. His mucous membranes are dry. His cardiac exam is normal except for tachycardia, and his lung exam is normal. His abdominal exam reveals diffuse tenderness to palpation with hyperactive bowel sounds. The rest of the exam is normal. Rectal exam reveals a large amount of clear yellow, watery stool that is guaic negative.

C) How would you proceed with the workup and treatment of this patient?

Answer:

- Obtain the following laboratory studies:
 - Chemistry
 - Liver panel
 - Amylase, Lipase
 - Complete blood count with differential
 - Urinalysis with culture
 - Blood culture from 2 sites
 - Stool studies to include evaluation for parasites, fecal occult blood
 - Stool culture
- Administer intravenous fluids in the form of crystalloid solutions such as lactated ringers or normal saline with 1000mL over one hour of 500mL over 30 minutes.

D) How would you management be different if this patient had a history of melena?

Assess hemodynamic stability:

- Volume depleting GI Bleed needs immediate attention
- Assessed by orthostatic hypotension and tachycardia in the absence of shock
- Shock, orthostatic hypotension, decrease in hematocrit of 6%, transfusion requirements of over 2 units of packed RBCs, active bleeding-admit to ICU for management

- Two large caliber peripheral catheters or central venous line should be inserted for IV access
- Use PRBCs, or FFPs /platelets in the face of underlying coagulopathy
- Hemodynamic stability needs to be established prior to the next step in the management of GI bleed.

Assess the site of bleed:

- *Determination of site of bleed*
 - *Endoscopy*

Treating of underlying condition

Secondary Prevention based on the diagnosis