Shock and the Perfusion Triangle

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1. What is Shock?

- **Shock is not just low blood pressure**.
- Shock is a state of **inadequate perfusion**.
- Perfusion is the **adequate flow of blood and its contents** to organs and cells.
- This blood needs to carry oxygen, glucose, and other things.
- If the body isn't getting enough oxygen to the cells, that's called **Hypoperfusion**.

2. The Perfusion Triangle Explained

- Adequate perfusion depends on **three different parts**.
- This is called the **Perfusion triangle**.

Component	Role	Details
Heart	The Pump	Pumps blood around the body.
Blood Vessels	The Container	Hold the blood in the circulatory system.
Blood Volume	The Fluid	The amount of blood in the system.

- All three parts need to work correctly for good perfusion.

3. The Heart as a Pump

- Think of the heart as a pump.
- Its main job is to pump blood around the body.
- The heart makes sure nutrients and oxygen go everywhere.
- For good perfusion, the heart must work right.
- If the heart fails, like in a heart attack or heart failure, the body is at risk of Shock.

4. Blood Vessels as the Container

- The blood vessels are like the container.
- They hold the blood in the circulatory system.
- If vessels are too wide (**vasodilation**), blood pressure drops.
- This affects getting blood where it needs to go.
- Whether vessels are constricted or dilated affects perfusion.

5. Blood Volume

- The third part of the triangle is the blood itself.
- It's important to have enough blood volume.
- The condition of the blood also matters.

- For example, is it lacking oxygen?
- Are we bleeding out?

6. How the Body Compensates for Failure

- If one part of the triangle fails, the body tries to compensate.
- Compensation means changing another part to keep things normal.
- The body is always trying to achieve **Homeostasis**.
- Homeostasis is the body being in a normal, balanced state.
- One way the body compensates is by increasing Heart rate.
- Another way is by causing **Vasoconstriction**, making vessels smaller.

7. Cardiac Output and Compensation

- Cardiac output is how much blood the heart pumps per minute.
- The equation is **Heart rate times Stroke volume equals Cardiac output**.

Example Patient	Heart Rate (beats/min)	Stroke Volume (mL/beat)	Cardiac Output (mL/min)	Compensation Seen?	Source
Normal Adult	60	100	6000 (6L)	No	
Same Patient	120	50	6000 (6L)	Yes (Increased HR)	

- Stroke volume is the blood pumped with each beat.
- A normal adult male might have a Cardiac output of 5 to 6 liters a minute.
- If Stroke volume drops, the Heart rate increases to keep Cardiac output the same.
- This increase in Heart rate is the body compensating.

8. Stages of Shock

- Shock has **three different stages**.
- These stages are Compensated shock, Decompensated shock, and Irreversible shock.

- It's hard to know when a patient reaches Irreversible shock.
- We will focus on compensated and Decompensated shock.

9. Compensated Shock

- **Compensated shock** is when the body is still coping.
- One part of the triangle is failing, but others compensate.
- Blood pressure usually stays normal at this stage.
- The patient is typically awake and talking normally.
- Look for subtle signs during assessment.
- Signs can include pale skin, mild fast Heart rate (Tachycardia), restlessness, agitation, anxiety, feeling of doom, or fast breathing.

10. Decompensated Shock

- **Decompensated shock** happens when the body's compensation fails.
- The main sign is a **decreased blood pressure**, usually below 90 Systolic.
- Patients may show changes in how they think or respond.
- This is because not enough blood and pressure are getting to the brain.
- Skin signs start to worsen.
- It is a very bad sign for a patient.

11. Irreversible Shock

- **Irreversible shock** is a very severe stage.
- The patient is so profoundly in Shock that recovery is unlikely.
- We don't know exactly when this stage starts.
- Treatment doesn't change at this point.
- You may feel the patient is near cardiac arrest or in a coma.

12. The Importance of Early Recognition

- Recognizing Shock early is very important.
- Look for the subtle signs of Compensated shock.
- This helps you recognize Shock before it becomes decompensated.
- Don't just look at blood pressure.

- Thinking about the Perfusion triangle helps see these signs.

13. The Golden Hour and Platinum 10 Minutes

- You may have heard of the **Golden hour**.
- You may also know about the **Platinum 10 minutes**.
- The Golden hour means getting the patient to final medical care within an hour.
- The Platinum 10 minutes means moving, preparing, and transporting the patient within 10 minutes.
- Recognizing Shock early helps meet these time goals.

14. Types of Shock

- There are different types of Shock.
- Understanding these types helps with treatment.

Shock Type	Cause	Source
Cardiogenic	Heart pump failure.	
Obstructive	Physical blockage of blood flow.	
Distributive	Problem with blood vessels widening too much.	
Hypovolemic	Loss of blood volume.	

- Distributive Shock has four subtypes.

15. Cardiogenic Shock

- **Cardiogenic Shock** is caused by the heart failing as a pump.
- Causes include heart attack (**myocardial infarction**) or heart disease like congestive heart failure (CHF).
- Signs include crackling sounds in the lungs (**rales** or **crackles**).
- Fluid builds up in the lungs (**pulmonary edema**).
- Poor gas exchange happens because of lung fluid.
- Blood backs up, causing things like swelling in neck veins (JVD).

16. Obstructive Shock

- **Obstructive Shock** is when something blocks blood flow.
- There are three main causes to know.
  - **Cardiac tamponade**: fluid squeezes the heart, preventing it from pumping well.
  - **Tension pneumothorax**: a collapsed lung with air around it causes circulation problems.
  - **Pulmonary embolism**: a blockage in the lung arteries.
- Fixing the blockage can restore blood flow.

17. Distributive Shock: General Concepts

- **Distributive Shock** is a large category.
- The biggest thing to remember is widespread, abnormal **vasodilation**.
- Blood vessels get much wider.
- This means there's not enough blood to fill the larger space.
- It's sometimes called **relative hypovolemia**.
- This causes blood pressure to drop.

18. Types of Distributive Shock

- Distributive Shock has **four main subtypes**.
- These are septic Shock, neurogenic Shock, anaphylactic Shock, and psychogenic Shock.

19. Anaphylactic Shock

- **Anaphylactic Shock** is a severe allergic reaction.
- The body sees a foreign substance as a threat.
- The body reacts very strongly.
- The upper airway can swell, and airways in the lungs can narrow (bronchial constriction).
- Widespread vasodilation happens.
- This causes blood pressure to drop.
- Signs and symptoms often show up during the first assessment.

- Listen for stridor (noisy breathing) from upper airway swelling.
- Listen for wheezing in the lungs.
- Skin is often flushed, not cool and pale.
- Other signs include a rash (urticaria).
- Patients may have a sense of impending doom.
- Ask about allergies and exposures in the patient's history.
- Treatment is crucial.
- Patients need **epinephrine**.
- Epinephrine helps blood vessels constrict (Vasoconstriction).
- It also helps open up airways (bronchial dilation).
- Oxygen is also very important.

20. Neurogenic Shock

- **Neurogenic Shock** is caused by **severe trauma to the spinal cord**.
- This injury affects how the brain communicates with the body.
- Blood vessels below the injury dilate widely.
- This causes low blood pressure.
- The brain tells the heart to beat faster, but the signal doesn't get through.
- So, the Heart rate is often normal or even slow, despite low blood pressure.
- Skin signs are a big clue.
- Skin **above the injury** is cool, pale, and sweaty.
- Skin **below the injury** is warm and flushed.
- Airway management is key, often using a jaw thrust due to spinal injury risk.
- Breathing can be slow or shallow if the injury is high in the spinal cord (above C5).
- In the secondary assessment, check for other injuries and document neurological status carefully.
- Treatment involves keeping the patient flat and warm.
- Some fluid replacement might be used.
- Rapid transport to a trauma center is important.
- Patients are usually transported with spinal precautions.

21. Septic Shock

- **Septic Shock** is caused by a **widespread infection** in the body.
- Common infections that lead to sepsis are pneumonia and UTIs.
- The infection spreads throughout the bloodstream.
- The body reacts by causing widespread vasodilation.
- This lowers blood pressure.
- Vessels also start to leak.
- Signs include hot, flushed skin.
- The patient usually has a fever.
- A high Heart rate is common with a fever.
- Breathing may be affected if pneumonia is present.
- High flow oxygen is often needed.
- On assessment, note hot skin, which means fever.
- Identifying septic Shock and getting the patient to the right hospital is critical.
- Beyond oxygen, some fluid can be given if in your scope of practice.
- The goal is to prevent blood pressure from dropping too low, not always make it normal.
- Antibiotics are needed to fight the infection.

22. Psychogenic Shock

- **Psychogenic Shock** is caused by a sudden, strong emotional event.
- This stimulus causes a temporary vasodilation.
- Blood pressure drops quickly.
- This leads to fainting or passing out (syncope).
- Examples include hearing bad news or seeing a needle.
- This is often called an event-related fainting.
- Assessment and treatment involve treating any injuries from the fall.
- Oxygen might be given for comfort.
- The main thing is recognizing the cause.
- The assessment is usually like any other patient fainting.

23. Treatment Principles for Shock

- **Treatment for Shock depends on the type of Shock**.
- You need to figure out why the patient is in Shock.

- Then, you treat the specific problem causing the Shock.
- For example, treat a heart attack for cardiogenic Shock.
- Give epinephrine for anaphylaxis.
- For neurogenic Shock, focus on spinal precautions and rapid transport.
- For septic Shock, identifying it and getting antibiotics at the hospital is key.
- For psychogenic Shock, treat any injuries from fainting.
- Early recognition is the most important thing to help patients.