



## Fourth Stage

### General Surgery

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### Lecture 5

# Shock

Shock is defined as an acute circulatory failure leading to inadequate tissue perfusion and organ injury. The main feature of circulatory shock is loss of fluid from the circulating blood volume, so that adequate circulation to all parts of body cannot be maintained.

## CLASSIFICATION OF SHOCK:

1. Hypovolemic Shock
2. Cardiogenic Shock
3. Neurogenic Shock
4. Vasogenic Shock :
  - Anaphylactic shock .
  - Septic shock .

## PHYSIOLOGICAL CAUSES OF SHOCK

Circulatory shock caused by decreased cardiac output Shock usually results from inadequate cardiac output. Two types of factors can severely reduce cardiac output:

1. Cardiac abnormalities that decrease the heart to pump blood. These includes MI, severe heart valve dysfunction, heart arrhythmias. Circulatory shock results from diminished cardiac pumping ability is called cardiogenic shock. 85% people die who develop cardiogenic shock
2. Factors decrease venous return also decrease cardiac output because the heart cannot pump blood that does not flow into it. The common cause of decreased venous return is; diminished blood volume, decreased vascular tone.

## GENERAL MECHANISM

Flow= Pressure Adequate Flow = Adequate pressure

In adequate flow = In adequate pressure [Hypo perfusion] Adequate perfusion = No Shock.

## STAGES OF SHOCK

Stages of Shock: Circulatory shock change with different degrees of severity, shock is divided into following major stages:

1. **A non-progressive stage (Compensated stage):** The normal circulatory compensatory mechanisms eventually cause full recovery without help from outside therapy.
2. **A progressive stage:** Without therapy, shock worse until death.
3. **An irreversible stage:** Shock progressed to an extent that all forms of known therapy are inadequate to save the life, even though, for the moment, the person is still alive.

### CAUSES OF HYPOVOLMIC SHOCK [Decreased Blood Volume] :

- 1-Hemorrhage [Trauma, GI bleed, ruptured aneurysm].
- 2-Surgery.
- 3-Burns [Loss of plasma].
- 4-Vomiting and Diarrhea [Fluid Loss].

**HYPOVOLMIC SHOCK:** The human body responds to acute hemorrhage by activating four major physiologic systems:

1. Hematologic system.
2. Cardiovascular system.
3. Renal system.
- 4- Neuroendocrine system.

### Hematologic System:

- 1-Activating the coagulation cascade.
- 2-Contracting the bleeding vessels (via local thromboxane A2 release)
- 3- Platelets activated which form an immature clot on the bleeding source The damaged vessel exposes collagen, which subsequently causes fibrin deposition.

### Cardiovascular System:

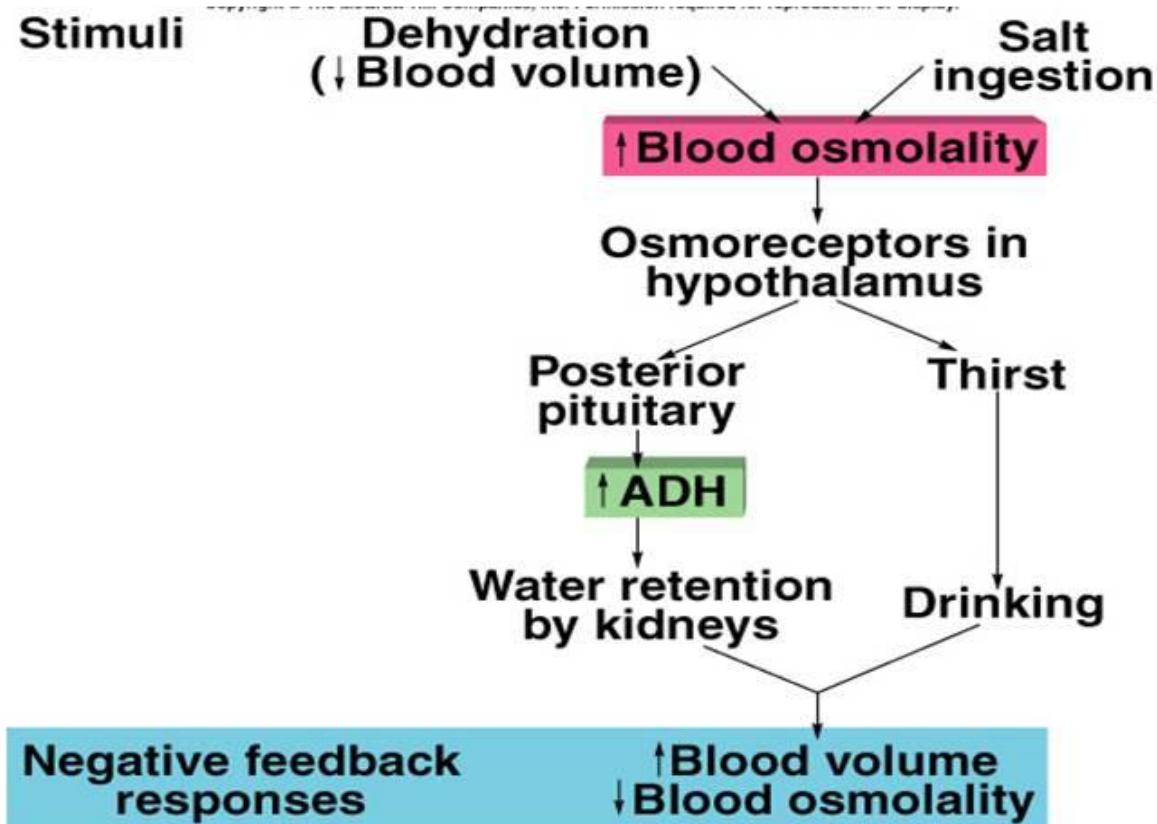
- 1-Increase heart rate.
- 2-increase myocardial contractility.
- 3- and constricting peripheral blood vessels.

This response occurs secondary to an increase secretion of norepinephrine and a decrease in vagal tone (regulated by the baroreceptors in the carotid arch, aortic arch, left atrium, and pulmonary vessels). The CVS also responds by redistributing blood to the brain, heart, and kidneys and away from skin, muscle, and GI tract.

### Renal System:

The kidneys respond to hemorrhagic shock by stimulating an increase in renin secretion from the juxtaglomerular apparatus. Renin affected Lungs and Liver. Angiotensinogen convert to Angiotensin I , Angiotensin II

- ❖ **Angiotensin II has two main effects, both of which help to reverse hypovolemic shock, vasoconstriction of arteriolar smooth muscle and stimulation of aldosterone secretion by the adrenal cortex**



### Neuroendocrine system:

Causes an increase in circulating antidiuretic hormone (ADH). ADH is released in response to a decrease in blood pressure (as detected by baroreceptors) and a decrease in sodium concentration. ADH increases in reabsorption of water and salt (NaCl) by the distal tubule and the collecting ducts.

### Clinical Features of Hypovolemic Shock :

1-Pale.	7- Increased thirst.
2-Cold clammy skin.	8-Decreased urinary output.
3-Hypotension.	9-Metabolic Acidosis.
4- Weak, rapid pulse.	10-Restlessness.
5- Increased respiratory rate.	11- Vasoconstriction due to increased sympathetic stimulation.
6-Sweating.	

## Hypovolemic shock :

### Causes:

- 1-Bleeding (internal/external)
- 2- dehydration (sever vomiting, severe diarrhea)
- 3-plasma loss (as in burns)
- 4-low blood volume because decreased cardiac output

### Signs of decreased cardiac output :

- ❖ Hypotension.
- ❖ weak but rapid pulse.
- ❖ cool clammy skin.
- ❖ rapid, shallow breathing.
- ❖ anxiety, altered mental state.

## Cardiogenic shock:

Heart problems (e.g., myocardial infarction, heart failure; cardiac dysrhythmias) decreased contractility - decrease in stroke volume decreased cardiac output hypotension as for hypovolaemic shock + distended jugular veins & may be absent pulse.

## obstructive shock:

Circulatory obstruction (e.g., constrictive pericarditis, cardiac tamponade, tension pneumothorax, pulmonary embolism lead to reduced blood flow to lungs and decreased cardiac output lead to hypotension as for hypovolaemic shock + distended jugular veins (in cardiac tamponade).

## Distributive shock:

Vasogenic Low resistance shock :

**1- Septic shock:** infection release of bacterial toxins activation of NOS in macrophages production of NO(nitric oxide) vasodilation decreased vascular resistance and hypotension . Septic shock: hypotension; fever; warm, sweaty skin .

**2-Anaphylactic shock:** allergy (release of histamine lead to vasodilation and decreased vascular resistance cause hypotension. skin eruptions; . breathlessness, coughing; localized edema; weak, rapid pulse.)

## Neurogenic shock:

spinal injury cause loss of autonomic and motor reflexes lead to reduction of peripheral vasomotor tone and vasodilation cause decrease in peripheral vascular resistance cause hypotension.

### Management the Emergency:

1-Control airway and breathing

2-Maximize oxygen delivery Place lines, tubes, and monitors

3-Get and run IVF on a pressure bag

4- blood transfusion

### Definitive Management :

1- Fluid resuscitate (blood or crystalloid)

2- control the hemorrhage

3-Restore blood pressure

4- prevent ongoing cardiac death

## Treatment of Shock:

Restore normal tissue perfusion, the signs of normal tissue perfusion :

- Normal Blood pressure
- normal Pulse and Respirations
- Skin Appearance
- Urine output (30-50 cc per hour)
- Hemoglobin 8-10 gm

## surgical control for infection:

- ❖ inserting IV fluid.
- ❖ draw blood for laboratories and for blood typing.
- ❖ Relieve pain with IV narcotics.
- ❖ Blood transfusion.
- ❖ Vasopressors.
- ❖ Antibiotics.

## Multiple organs failure:

Sepsis is a clinical syndrome of life-threatening organ dysfunction caused by a response to infection. In shock, there is critical reduction in tissue perfusion; **acute failure of multiple organs, including the lungs, kidneys, and liver, can occur.**