

Cardiogenic Shock

A Clinical Overview

Done by:

Dina Nassraween

Alaa Alazzeah

Abdallah Ennab

Fadi Horani

Objectives:

1. Define shock and specifically cardiogenic shock.
2. Describe the causes and risk factors of cardiogenic shock.
3. Explain the pathophysiology of cardiogenic shock.
4. Identify the clinical features.
5. Recognize the hemodynamic profile of cardiogenic shock.
6. Outline the management principles.

General definition of shock

A life-threatening condition characterized by inadequate tissue perfusion, leading to cellular hypoxia, impaired metabolism, and potential organ dysfunction and failure.

- It's about inadequate oxygen delivery to tissues relative to their metabolic needs.
- Can result from:
 1. Low cardiac output (cardiogenic, obstructive)
 2. Low intravascular volume (hypovolemic)
 3. Maldistribution of blood flow (distributive – septic, anaphylactic, neurogenic)
- If uncorrected → progresses to multi-organ failure and death

Type of shock	Description	Cardiovascular complications	Management
Hypovolemic shock	Caused by significant loss of blood or body fluids.	↓ Cardiac output, ↑ Heart rate, Hypotension	Immediate fluid resuscitation and blood transfusion
Cardiogenic shock	Due to heart's failure to pump effectively, often from myocardial infarction.	Severe hypotension, ↓ Cardiac output, Pulmonary congestion	Early revascularization, mechanical support devices, inotropic agents
Anaphylactic shock	Extreme allergic reaction causing widespread vasodilation.	Hypotension, Tachycardia, Potential for cardiac arrest	Immediate epinephrine, antihistamines, corticosteroids
Septic shock	Triggered by severe infection leading to systemic vasodilation. Due to spinal cord injury or nervous system disturbances.	Hypotension, ↑ Cardiac output, Potential for myocardial depression	Early antibiotic therapy, aggressive fluid resuscitation, vasopressors
Neurogenic shock	Due to spinal cord injury or nervous system disturbances.	Hypotension, Bradycardia, Loss of vascular tone	Stabilization of spinal injury, vasopressor support, fluid resuscitation
Obstructive shock	Physical obstruction (e.g., pulmonary embolism) impedes blood flow.	↑ Right ventricular afterload, ↓ Cardiac output	Immediate anticoagulation, thrombolytic therapy, surgical intervention if necessary

Definition

It is a life-threatening condition where the heart fails to pump enough blood to meet the body's needs, leading to severe tissue hypoperfusion and organ dysfunction. It is most often a complication of acute myocardial infarction (MI).



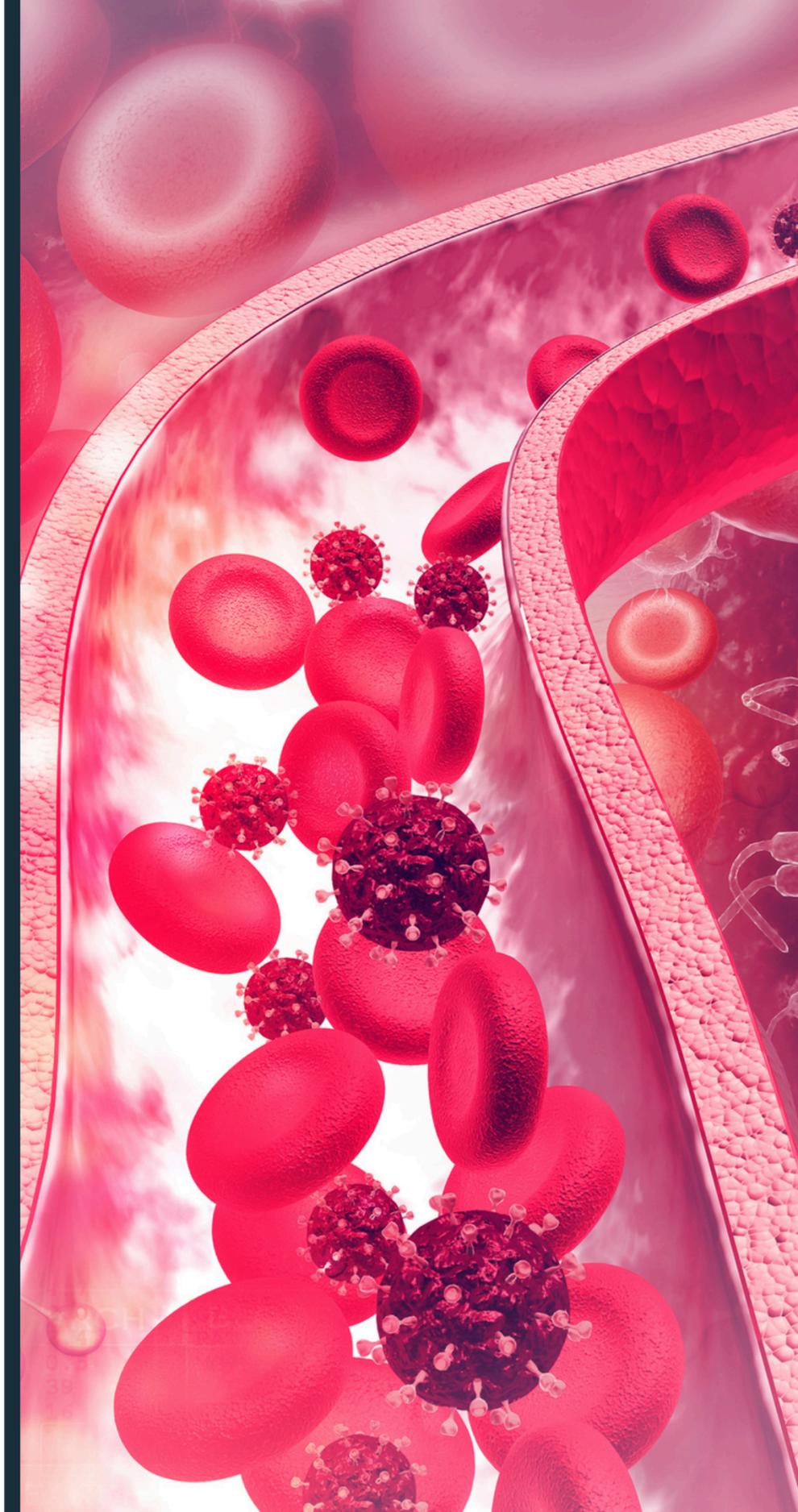


Pathophysiology

- Pump failure → low cardiac output
- ↓ Stroke volume & cardiac output → ↓ blood pressure & tissue perfusion
- Body compensates with ↑ systemic vascular resistance (SVR) → worsens afterload and myocardial oxygen demand
- Results in hypotension + pulmonary congestion + end-organ hypoperfusion

Hemodynamic Profile (Right Heart Cath)

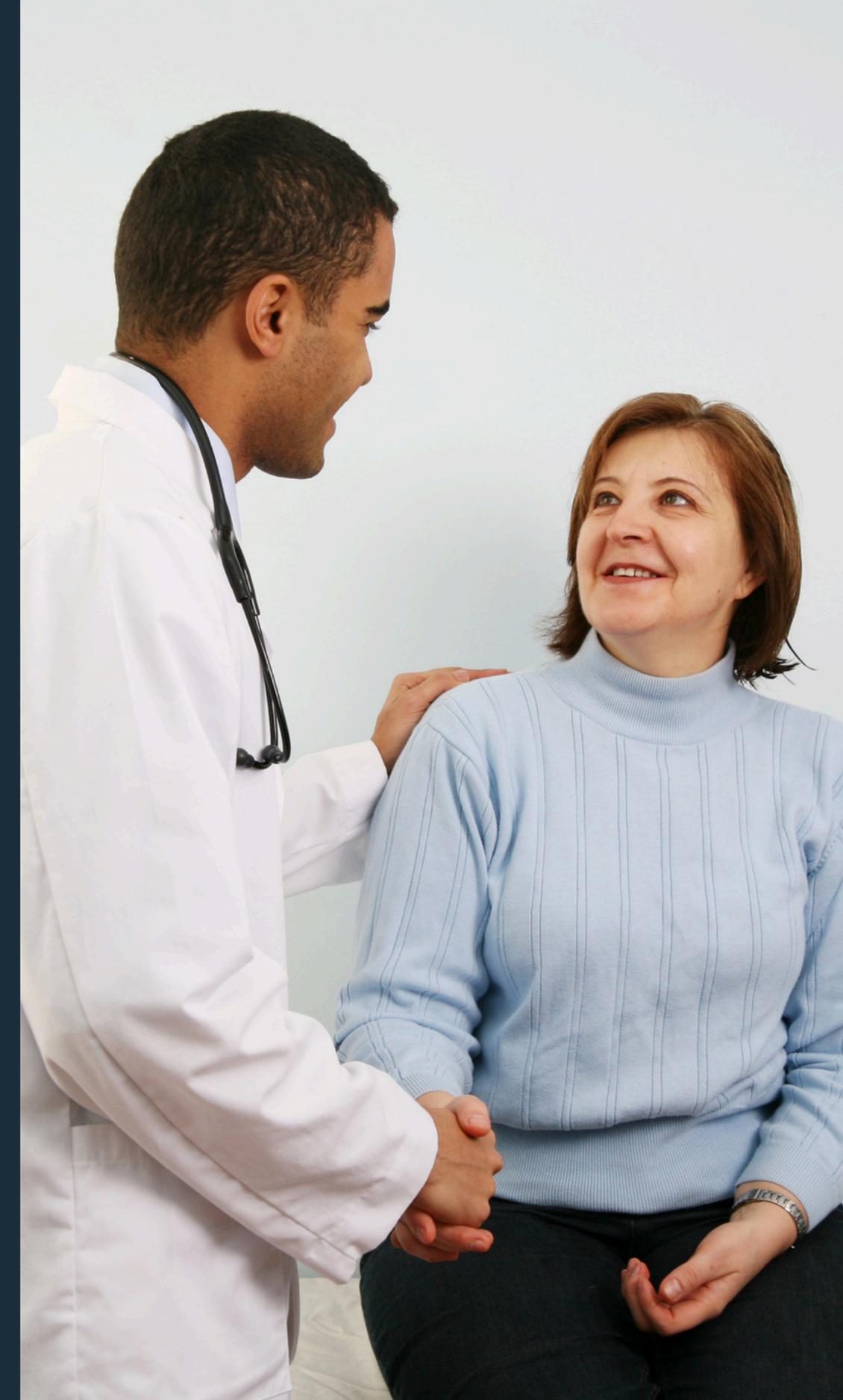
- Cardiac index: $< 2.2 \text{ L/min/m}^2$
- PCWP (pulmonary capillary wedge pressure): $> 15 \text{ mmHg}$
(reflecting high LV filling pressure)
- SVR: Increased



Risk Factors for Cardiogenic Shock (especially after MI)

1. Patient-related factors

- Advanced age (≥ 75 years)
- Female sex
- History of diabetes mellitus
- Prior myocardial infarction or heart failure
- Chronic kidney disease



Risk Factors for Cardiogenic Shock (especially after MI)

2. MI-related factors

- Large anterior MI (LAD occlusion).
- Extensive myocardial damage ($\geq 40\%$ LV infarction).
- Delayed or absent reperfusion therapy.
- Reinfarction.
- Right ventricular infarction (especially with inferior MI).
- Mechanical complications of MI:
 1. Papillary muscle rupture \rightarrow acute severe mitral regurgitation.
 2. Ventricular septal rupture.
 3. Free wall rupture \rightarrow tamponade.

Risk Factors for Cardiogenic Shock (especially after MI)

3. Clinical factors

- Severe baseline LV dysfunction (low ejection fraction)
- Persistent hypotension during MI
- Multi-vessel coronary artery disease
- Significant valvular disease (esp. aortic stenosis, mitral stenosis)
- Malignant arrhythmias (sustained VT, VF, high-degree AV block)

Causes

- Acute myocardial infarction (most common)
- Severe heart failure (decompensated dilated cardiomyopathy)
- Arrhythmias (sustained VT, VF, severe bradycardia, complete heart block).
- Myocarditis or severe cardiomyopathy
- End-stage valvular disease (aortic stenosis, mitral stenosis)
- Mechanical complications of MI:
 1. Papillary muscle rupture → severe mitral regurgitation
 2. Ventricular septal rupture → left-to-right shunt
 3. Free wall rupture → cardiac tamponade



Signs

General

- Hypotension: SBP < 90 mmHg or MAP < 65 mmHg
- Tachycardia (unless bradyarrhythmia is the cause)
- Cool, clammy, mottled skin (due to peripheral vasoconstriction)
- Altered mental status (confusion, agitation, drowsiness, coma)



Signs

Cardiac

- Elevated jugular venous pressure (JVP)
- Weak, thready pulse
- Gallop rhythm (S3, S4)
- New murmur → suggests mechanical complication (MR, VSD)
- Arrhythmias may be present (VT, VF, heart block)

Signs

Respiratory

- Tachypnea
- Pulmonary crackles / rales (pulmonary edema)
- Frothy pink sputum in severe pulmonary edema

Renal

- Reduced urine output (< 0.5 mL/kg/hr)

Symptoms

- Dyspnea / orthopnea → from pulmonary congestion
- Chest pain → if due to ongoing MI
- Palpitations → arrhythmias
- Lightheadedness, dizziness, syncope → due to low cerebral perfusion
- Oliguria → from poor renal perfusion
- Fatigue, weakness → systemic hypoperfusion



Classic Triad (for cardiogenic shock)



Hypotension (low BP)



Signs of hypoperfusion (cold, clammy skin; oliguria; confusion)



Pulmonary congestion (dyspnea, crackles, elevated JVP)



Clinical Features

- ♥ Hypotension: SBP < 90 mmHg, MAP < 65 mmHg, or need for vasopressors
- ♥ Signs of poor perfusion: cold, clammy skin; oliguria; confusion/altered mental status
- ♥ Signs of congestion: dyspnea, pulmonary crackles, elevated JVP, peripheral edema
- ♥ Tachycardia (compensatory, unless bradyarrhythmia is cause)

Investigations

- ECG → MI or arrhythmias
- Echocardiography → wall motion abnormalities, EF, valvular/mechanical complications
- Cardiac enzymes (troponin)
- Blood tests: lactate, renal/liver function, ABG (metabolic acidosis, hypoxemia)
- CXR → pulmonary edema



Management (Emergency!)



Supportive

- Oxygen, mechanical ventilation if needed
- IV fluids cautiously (small bolus if hypovolemic, avoid overload)



Pharmacologic

- Inotropes: dobutamine, milrinone
- Vasopressors (if severe hypotension): norepinephrine preferred



Definitive treatment

- Revascularization: PCI or CABG in MI
- Treat mechanical complications (surgery for papillary rupture, VSD, tamponade drainage)
- Antiarrhythmic therapy or pacing if arrhythmia-related



Mechanical circulatory support (if refractory)

- Intra-aortic balloon pump (IABP)
- Impella, ECMO



Thank You

