

Al-Mustaqbal University College
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Pathophysiology

Lecture \7

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Cardiogenic shock:

▶ Cardiogenic shock occurs when there is cardiac output and evidence of tissue hypoxia in the presence of adequate intravascular volume. The leading cause of death in acute myocardial infarction (MI) is cardiogenic shock. Cardiogenic shock is a physiological state in which inadequate tissue perfusion results from cardiac dysfunction, usually systolic. It is a major and often fatal complication of a number of acute and chronic disorders, occurring most often after acute MI.

Pathophysiology:

When there is failure of the pump action of the heart, resulting in reduced cardiac output, cardiogenic shock has occurred. Cardiogenic shock can be defined as the presence of the following (regardless of adequate left ventricular filling pressure):

Sustained hypotension (systolic blood pressure less than 90 mm Hg for more than 30 minutes) and tissue hypoperfusion (cold peripheries, or oliguria less than 30 ml/hour, or both).

A low cardiac output state secondary to extensive left ventricular infarction, development of a mechanical defect (e.g. ventricular septal defect or papillary muscle rupture) or right ventricular infarction are conditions that can result in the acute deterioration of cardiac function. This can lead to cardiogenic shock, including MI or myocardial ischaemia, acute myocarditis, sustained arrhythmia, severe valvular dysfunction and decompensation of end-stage cardiomyopathy as a result of multiple etiologies.

Those who develop cardiogenic shock from acute MI regularly have evidence of progressive myocardial necrosis with infarct extension (myocardial pathology). Decreased coronary perfusion pressure and increased myocardial oxygen demand play a role in the vicious cycle that leads to cardiogenic shock. There is usually multi-vessel coronary artery disease, with limited coronary blood flow reserve.

Tissue hypoperfusion, with resulting cellular hypoxia, results in anaerobic glycolysis, the accumulation of lactic acid, and intracellular acidosis (cellular pathology). If ischaemia is severe and protracted, myocardial cellular injury becomes irreversible, leading to myonecrosis, which includes mitochondrial swelling, the accumulation of denatured proteins and chromatin and lysosomal break down. These acts induce fracture of the mitochondria, nuclear envelopes and plasma membranes.

Signs and symptoms:

These are hypotension, absence of hypovolaemia and clinical signs of poor tissue perfusion, including oliguria, cyanosis, cool extremities and confusion. Physical examination includes cool, ashen or cyanotic skin and extremities are mottled. Peripheral pulses are rapid and faint, and may be irregular if arrhythmias are present. Jugular venous distention and crackles in the lungs may be present; peripheral oedema can also be present. Heart sounds are distant and third and fourth heart sounds may be present.

Pulse pressure may be low, and patients are usually tachycardic. There is hypoperfusion, altered mental status and decreased urine output.

Investigations:

First-line investigations can help to determine the underlying cause of cardiogenic shock. **Table 5.1** outlines some of these investigations.

Table 5.1 First-line investigations for suspected cardiogenic shock

- Blood pressure measurement
- Urea and electrolytes, and creatinine
- Liver function tests and full blood count FTs
- Cardiac enzymes, including troponins
- Arterial blood gases
- Brain natriuretic peptide
- Electrocardiogram
- Chest X-ray
- CT pulmonary angiography (CTPA) or ventilation/perfusion lung scan
- Echocardiography
- Coronary catheterization (angiogram)

Management:

Management is based on an individual assessment of each patient. Cardiogenic shock treatment focuses on repairing the damage to heart muscle and other organs caused by lack of oxygen. Emergency life support is a necessary treatment for most people who have cardiogenic shock.

Symptom relief may be needed, for example opiate analgesia. Treat any electrolyte abnormalities. Treat any cardiac arrhythmias. *See Table 5.2.*

Medication	Medical procedures	Surgery
<ul style="list-style-type: none">• Analgesia• Aspirin• Thrombolytics• Platelet glycoprotein IIb/IIIa receptor blockers• Anticoagulants• Vasopressor/inotropic agents	<ul style="list-style-type: none">• Angioplasty and stenting• Revascularization• Intra-aortic balloon pump counter pulsation	<ul style="list-style-type: none">• Coronary artery bypass surgery• Surgery to repair an injury to the heart (i.e. a tear in the heart, valve replacement)• Ventricular assist devices (heart pumps)• Heart transplant

Any Question?