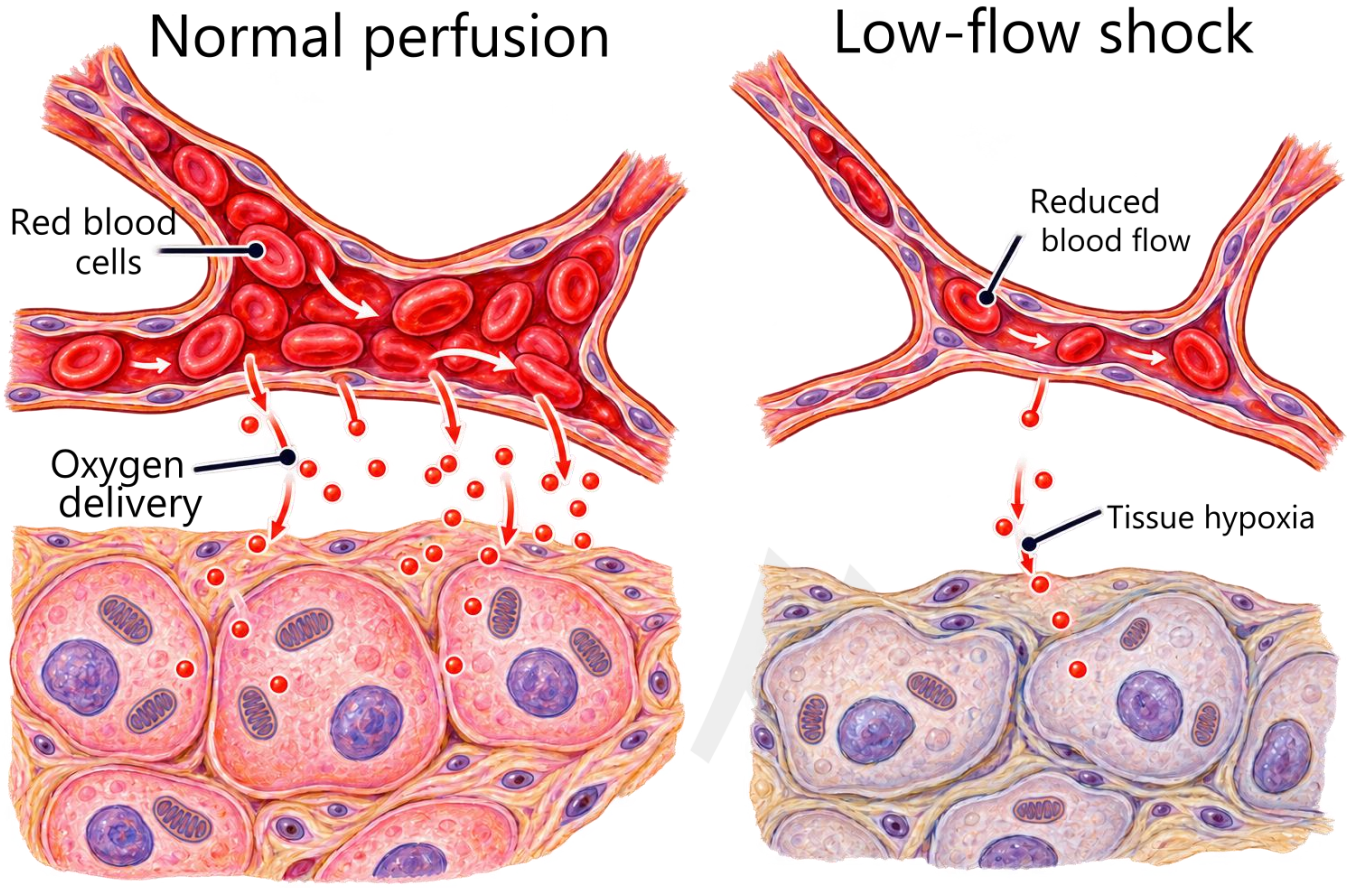
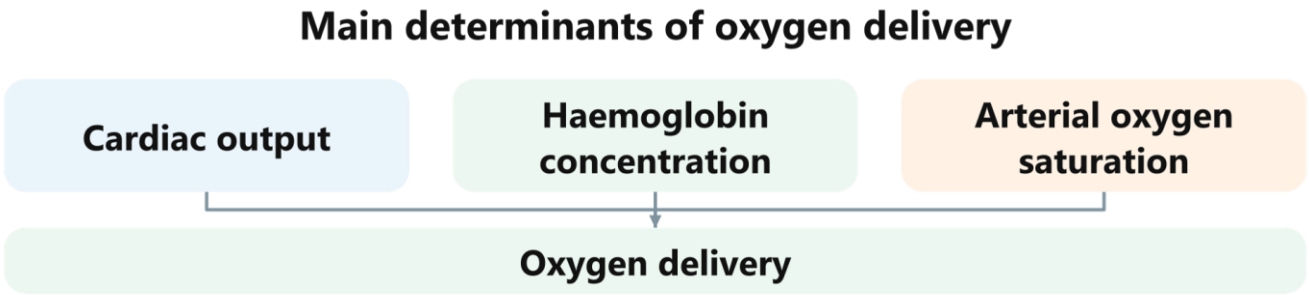
General Surgery - Topic 2 - Shock

Shock

- **Shock** is a life-threatening state in which the circulation does not provide adequate effective tissue perfusion and cellular oxygen use.



Reduced capillary blood flow can limit oxygen delivery to tissues in low-flow shock



Meaning of Shock and Blood Pressure Limitations

- Blood pressure may be normal early because compensatory mechanisms temporarily maintain it.
- Conversely, an isolated low blood pressure does not describe the cause or severity of shock without a clinical assessment.

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Oxygen Delivery and Circulatory Mechanisms

- Oxygen delivery depends mainly on cardiac output, haemoglobin concentration and arterial oxygen saturation.
- Cardiac output depends on heart rate and stroke volume, which are affected by filling, contractility and resistance to ejection.
- Severe loss of blood volume, pump failure, vascular dilatation or mechanical obstruction can disrupt this system.
- Septic shock can have a normal or high cardiac output while microcirculatory flow and cellular oxygen use remain abnormal.

From Compensation to Organ Failure

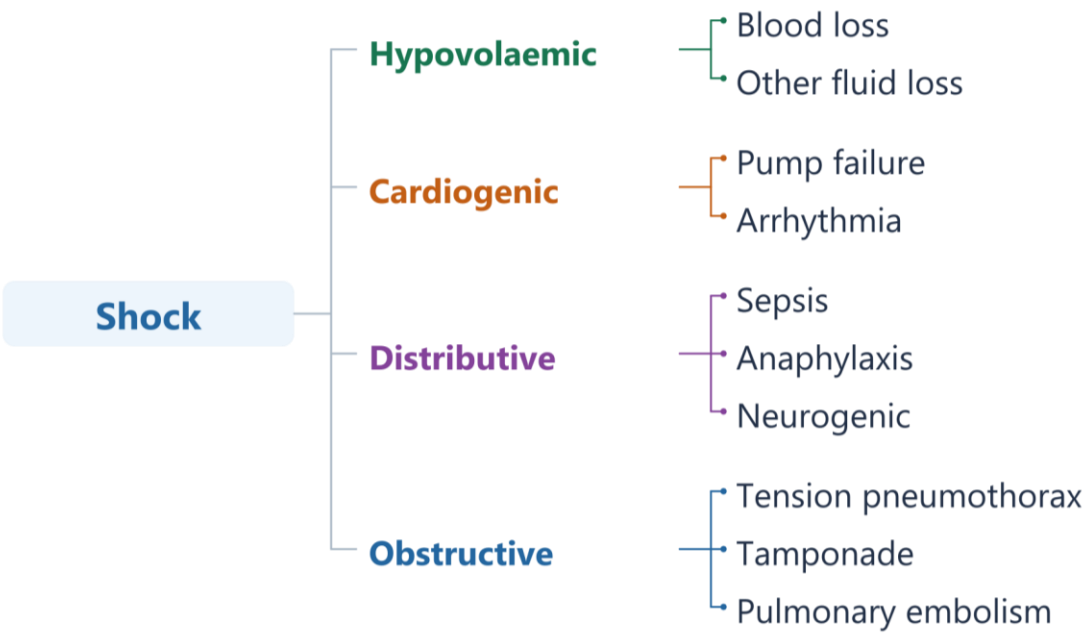
Compensatory Responses

- Sympathetic activation initially increases heart rate and redirects blood toward the heart and brain.
- Renal and hormonal responses conserve salt and water.

Cellular Injury and Organ Dysfunction

- Continued hypoperfusion reduces cellular energy availability and may increase lactate production.
- Endothelial injury, inflammatory activation and disturbed coagulation can worsen microcirculatory flow.
- Persistent injury can produce acute kidney injury, myocardial dysfunction, liver injury, respiratory failure and altered consciousness.
    - Lactate is useful for risk assessment and trends, but it can rise for reasons other than tissue hypoxia.

Classification by Mechanism



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1. Hypovolaemic Shock

Mechanism and Causes

- Hypovolaemic shock results from reduced circulating volume and inadequate cardiac filling.
- Haemorrhagic causes include trauma, gastrointestinal bleeding, ruptured aneurysm and operative bleeding.
- Non-haemorrhagic causes include severe vomiting, diarrhoea, burns and large fluid losses into injured tissues.

Clinical Pattern

- The patient commonly has tachycardia, cool extremities, weak pulses and reduced urine output.

2. Cardiogenic Shock

Mechanism and Causes

- Cardiogenic shock results from failure of the heart to maintain effective forward flow.
- Causes include a large myocardial infarction, severe ventricular dysfunction, dangerous arrhythmia and acute mechanical valve problems.

Clinical Pattern and Fluid Caution

- Breathlessness, pulmonary congestion, raised venous pressure and cool peripheral perfusion may occur together.
- Large unassessed fluid boluses can worsen pulmonary oedema when the main problem is pump failure.

3. Distributive Shock

- Distributive shock involves abnormal vascular dilatation and an ineffective distribution of blood flow.
- Sepsis, anaphylaxis and loss of sympathetic tone after selected spinal cord injuries are important causes.

A. Septic Shock

- Early septic shock may produce warm extremities and bounding pulses rather than the cold limbs expected in haemorrhage.
- Inflammatory vasodilatation and capillary leak may coexist with myocardial dysfunction, so septic shock is not simply a problem of low circulating volume.

B. Anaphylactic Shock

- Airway swelling, bronchospasm, skin changes or gastrointestinal symptoms may accompany the circulatory collapse, although skin signs can be absent.

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C. Neurogenic Shock

- Bleeding must still be excluded in an injured patient even when a neurogenic mechanism is suspected.
- A high spinal cord injury can interrupt sympathetic pathways and produce hypotension with relative bradycardia and warm skin.

4. Obstructive Shock

- Obstructive shock occurs when blood cannot enter or leave the heart normally because of a mechanical barrier.
- Tension pneumothorax, cardiac tamponade and major pulmonary embolism are important causes.
- Treatment must relieve the obstruction or remove its cause; fluid alone is not definitive treatment.

5. Mixed Shock

- More than one mechanism may be present in the same patient.
- A patient with sepsis may also be dehydrated or have myocardial dysfunction.
- A trauma patient can have bleeding and tension pneumothorax at the same time.
- Repeated assessment is essential because the dominant mechanism may change during treatment.

Progression of Shock

1. Compensated Stage

- Tachycardia, vasoconstriction and redistribution of blood flow initially help maintain arterial pressure despite impaired perfusion.
- A normal pressure therefore does not exclude early shock, and changes in mental state, skin perfusion and urine output remain important.

2. Progressive Stage

- Continuing oxygen-delivery failure causes cellular dysfunction, metabolic acidosis and worsening organ perfusion.
- Hypotension and organ dysfunction become more apparent as compensatory mechanisms fail.

3. Refractory Stage

- Severe prolonged shock can cause profound cellular and organ injury that responds poorly despite appropriate treatment.
- The term irreversible shock is mainly retrospective and must not be used to withhold timely resuscitation from a potentially salvageable patient.

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Recognising Shock and Finding the Cause

Focused History and Examination

History During Resuscitation

- Ask about the event, onset, blood or fluid loss, pain, fever, allergic exposure and relevant medication use.
- Obtain information from relatives, witnesses or ambulance staff if the patient cannot give a history.
- Ask about anticoagulants, beta blockers, heart disease, pregnancy possibility and recent surgery where relevant.
- Do not delay treatment of an immediate threat while completing the history.

Clinical Signs

Perfusion and Possible Bleeding

- Assess consciousness, respiratory effort, pulse rate and character, blood pressure, skin temperature and capillary refill.
- Look for pallor, mottling, sweating, weak peripheral pulses and reduced urine output.
- Inspect for external bleeding and consider concealed bleeding into the chest, abdomen, retroperitoneum, pelvis or long-bone injury sites.

System Examination and Interpretive Limits

- Examine the chest for asymmetry, absent breath sounds, crackles or signs of a mechanical obstruction.
- Assess jugular venous pressure when feasible, but do not use one bedside sign to exclude shock.
- Check for abdominal tenderness, distension, peritonism, an infected wound or another possible source.
- A beta blocker, pacemaker or neurogenic mechanism may prevent the expected tachycardia.
- A normal heart rate therefore does not safely exclude severe circulatory compromise.

Investigations That Change Management

1. Bedside Tests

Immediate Bedside Measurements

- Measure oxygen saturation, obtain an ECG and check capillary glucose early.
- Blood gas analysis helps assess lactate, acid–base disturbance and ventilation when clinically needed.

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