Mean Arterial Pressure (MAP) per Shock Type

The **Mean Arterial Pressure (MAP)** is a critical parameter in shock management, representing the average blood pressure during a single cardiac cycle. It is calculated as:

MAP=DBP+13(SBP−DBP)\text{MAP} = \text{DBP} + \frac{1}{3} (\text{SBP} - \text{DBP})

where DBP is diastolic blood pressure, and SBP is systolic blood pressure. The normal MAP is approximately **70–100 mmHg**. In shock states, MAP is typically reduced, with varying mechanisms contributing to this reduction based on the type of shock.

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1. Hypovolemic Shock

- **Cause**: Decreased blood volume due to blood loss, dehydration, or burns.
- **MAP**: ↓ (significantly low, typically <60 mmHg if untreated).
- **Mechanism**: Loss of blood volume reduces preload and stroke volume, leading to decreased cardiac output and MAP.
- **Compensatory Response**: Increased systemic vascular resistance (SVR) attempts to maintain MAP initially.

Symptoms:

- Rapid, weak pulse (tachycardia).
- Low blood pressure (hypotension).
- Cold, clammy skin (due to vasoconstriction).
- Decreased urine output (oliguria).
- Altered mental state (e.g., confusion, restlessness).
- Flat neck veins (reduced venous return).

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2. Cardiogenic Shock

- **Cause**: Heart failure (e.g., after a myocardial infarction, severe cardiomyopathy, or valve dysfunction).
- **MAP**: ↓ (typically <60 mmHg if severe).
- **Mechanism**: The heart’s impaired pumping ability reduces cardiac output, which directly lowers MAP.
- **Compensatory Response**: Increased SVR attempts to sustain MAP, but the heart's inability to pump effectively limits compensation.

Symptoms:

- Weak, thready pulse (due to low cardiac output).
- Hypotension (despite compensatory SVR).
- Cold, clammy skin (peripheral vasoconstriction).
- Shortness of breath (pulmonary edema from high PCWP).
- Jugular venous distension (JVD, due to venous congestion).
- Cyanosis (poor oxygenation).
- Chest pain (if caused by myocardial infarction).
- Decreased urine output (renal hypoperfusion).
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3. Obstructive Shock

- **Cause**: Mechanical blockage of blood flow (e.g., pulmonary embolism, tension pneumothorax, cardiac tamponade).
- **MAP**: ↓ (moderately to severely low, depending on the severity of the obstruction).

- **Mechanism**: A physical blockage (e.g., pulmonary embolism, tamponade) decreases cardiac output, reducing MAP.
- **Compensatory Response**: Increased SVR helps stabilize MAP but cannot fully compensate for the obstruction.

Symptoms:

- Rapid, weak pulse (tachycardia).
- Hypotension (depending on the severity of obstruction).
- Jugular venous distension (JVD, from impaired venous return).
- Muffled heart sounds (in cardiac tamponade).
- Tracheal deviation (in tension pneumothorax).
- Chest pain and dyspnea (in pulmonary embolism).
- Cyanosis (due to poor oxygenation).

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4. Distributive Shock

- **Cause**: Insufficient vascular tone, often due to sepsis, anaphylaxis, or neurogenic shock.
- **MAP**: ↓ (low, often <60 mmHg without treatment).
- **Mechanism**:
    - Massive vasodilation reduces SVR and redistributes blood flow, which decreases MAP.
    - Cardiac output may initially increase (e.g., in sepsis) but cannot sustain normal MAP in prolonged states.
- **Compensatory Response**:
    - Attempts to increase cardiac output (in the hyperdynamic phase, particularly in sepsis or anaphylaxis).
    - In neurogenic shock, reduced sympathetic tone limits compensation, leading to persistently low MAP.

Symptoms (varies by cause):

- **Sepsis**:
    - Fever or hypothermia.
    - Warm, flushed skin (early phase).
    - Rapid pulse (tachycardia).
    - Altered mental state (e.g., confusion, agitation).
    - Hypotension (despite high cardiac output initially).
- **Anaphylaxis**:
    - Swelling (angioedema), rash, and urticaria.
    - Wheezing or difficulty breathing.
    - Rapid, weak pulse.
    - Nausea, vomiting, or diarrhea.
- **Neurogenic**:

- Bradycardia (from loss of sympathetic tone).
- Warm, dry skin (due to vasodilation).
- Hypotension (significant).

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Maintaining a MAP of **≥65 mmHg** is often the target in treating shock to ensure adequate tissue perfusion. This is achieved with interventions like fluid resuscitation, vasopressors, and treating the underlying cause.

Summary Table

Type of Shock	MAP	CO	SVR	PCWP	Key Symptoms
Hypovolemic	↓ (<60 mmHg)	↓	↑	↓	Tachycardia, hypotension, cold skin, oliguria.
Cardiogenic	↓ (<60 mmHg)	↓	↑	↑	Dyspnea, JVD, cyanosis, weak pulse, chest pain.
Obstructive	↓ (variable)	↓	↑	Variable	JVD, muffled heart sounds, cyanosis, dyspnea.
Distributive	↓ (<60 mmHg)	↑ or ↓	↓	Normal/↓	Flushed skin (sepsis), rash (anaphylaxis), bradycardia (neurogenic).

Type shock	Central veneus pressure (CVP/CVD)	Heart rate	Contractility	Cardiac output (CO)	Mean art. pressure (MAP)	Systemic vascular resistance (SVR), afterload	Pulmonary capillary wedge pressure (PCWP), meet linker atriumdruk, preload	O2 saturatie
Obstructief (tamponade, pneumothorax, PE)	Stijging	Stijging	Stijging	Daling	Daling	Stijging	Stijging	Daling
Hypovolemie (dehydratie, hemorrhage)	Daling	Stijging	Stijging	Daling	Daling	Stijging	Daling	Daling
Cardiogeen (myocarditis, arritmie, MI, kleplijden)	Stijging/normaal	Stijging	Daling	Daling	Daling/normaal	Stijging	Stijging	Daling
Distributief: Anafylaxie Neurogeen Septisch	Daling	A= stijging N= daling S= stijging	Stijging	A= daling N= daling S= stijging	Daling	Daling	Daling	A= daling N= daling S= stijging
Dissociatief (anemie, hypothyroidie, CO		Stijging	Stijging	Stijging	Stijging	Daling of stijging	Daling of stijging	