



SHOCK

By Tess Warchalowski

Definition

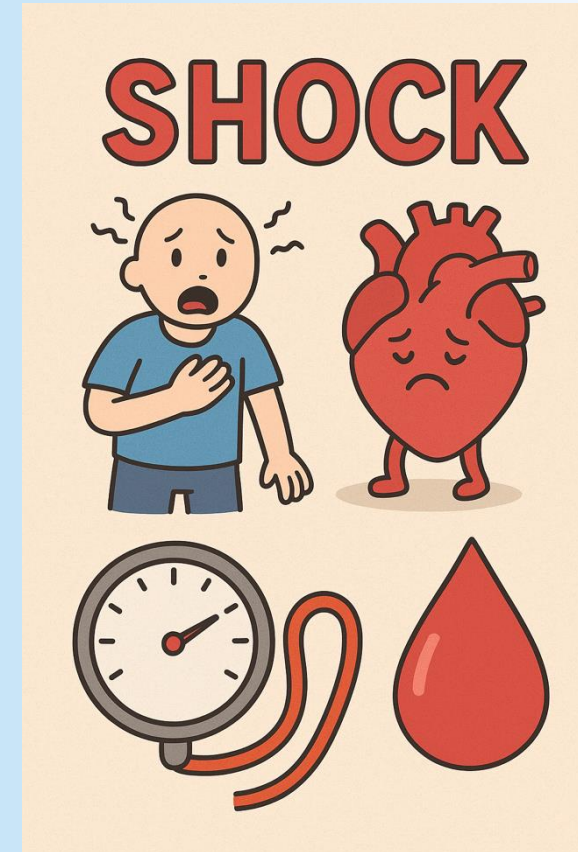
- **O₂ DELIVERY < O₂ REQUIRED**

Less oxygen
delivery (dec
tissue perfusion)

More oxygen consumed

Oxygen is utilized
ineffectively

- LIFE threatening circulatory failure
 - Initially reversible, wait too long= multiorgan failure
 - Types include Hypovolemic, Cardiogenic, Obstructive & Distributive



Some fun Hemodynamics



Estimator of tissue perfusion! (and BP)

$$\text{MAP} = \text{CO} \times \text{SVR}$$

Measure of resistance that circulatory flow has to overcome to flow throughout the body

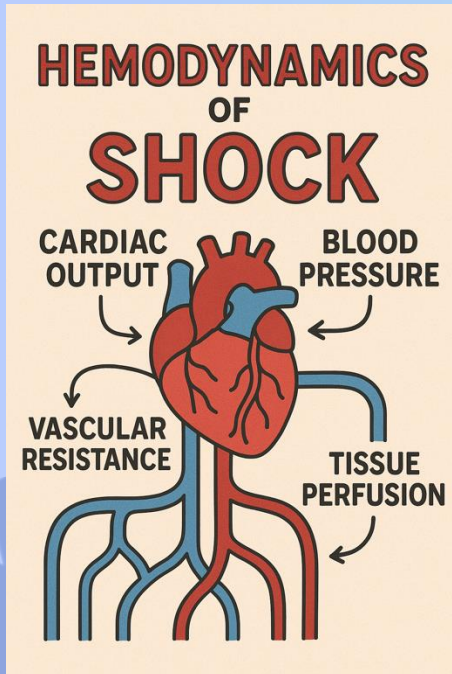
HR

SV

Volume of blood pumped by the left ventricle in a single heartbeat

Preload

Contractility



Case 1: Mr UWAGA



Case 1: Mr UWAGA

Mr Uwaga presents after a motorcycle accident. He has multiple abrasions and a distended abdomen. Vital signs are:

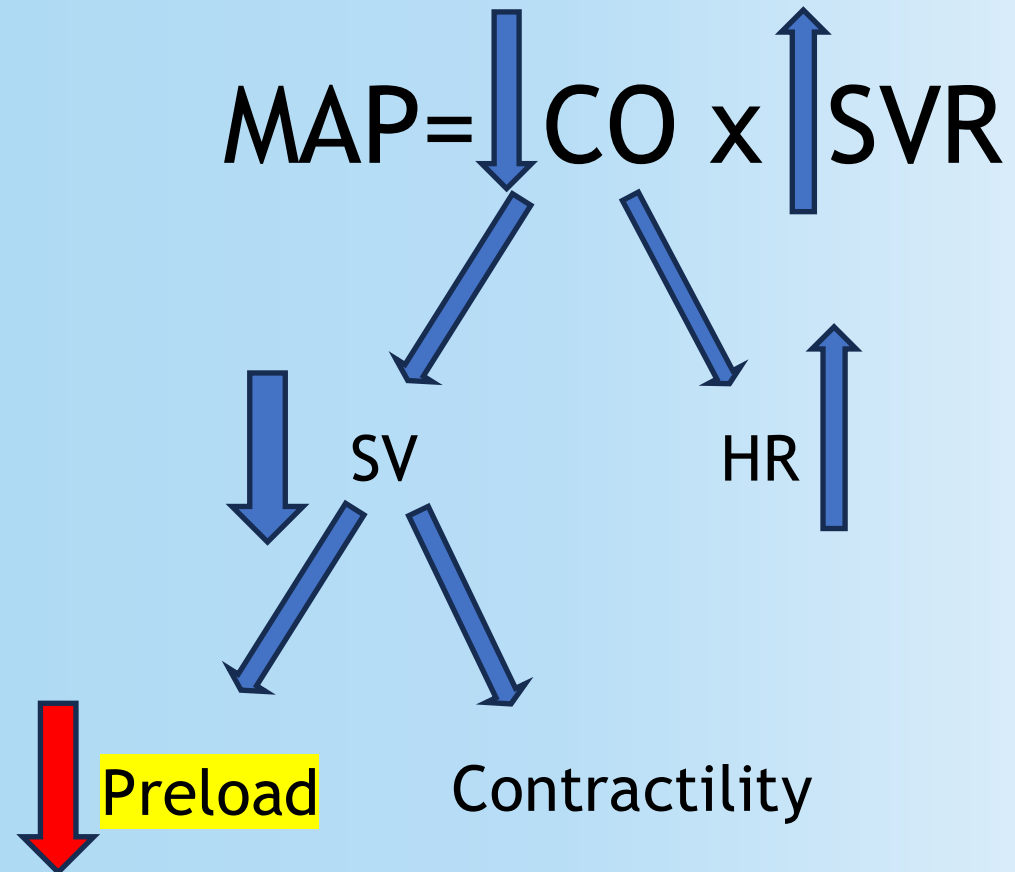
BP 85/60 mmHg, HR 110 bpm, RR 28/min.

Jugular venous pressure is low, and his skin is cool and pale.

What type of shock is the most likely diagnosis?

Mr UWAGA

- Mr UWAGA is in hypovolemic shock!
 - Hypovolemic shock= fluid loss
- Clues
 - Hypotensive, low JVP
 - Tachycardia!
 - Cool and clammy skin
 - Trauma (source of fluid loss!)
 - $MAP = DP + \frac{1}{3} (SP - DP)$, Norm is (70-100mg)



Compensatory Mechanism
HR and SVR

Hypovolemic Shock

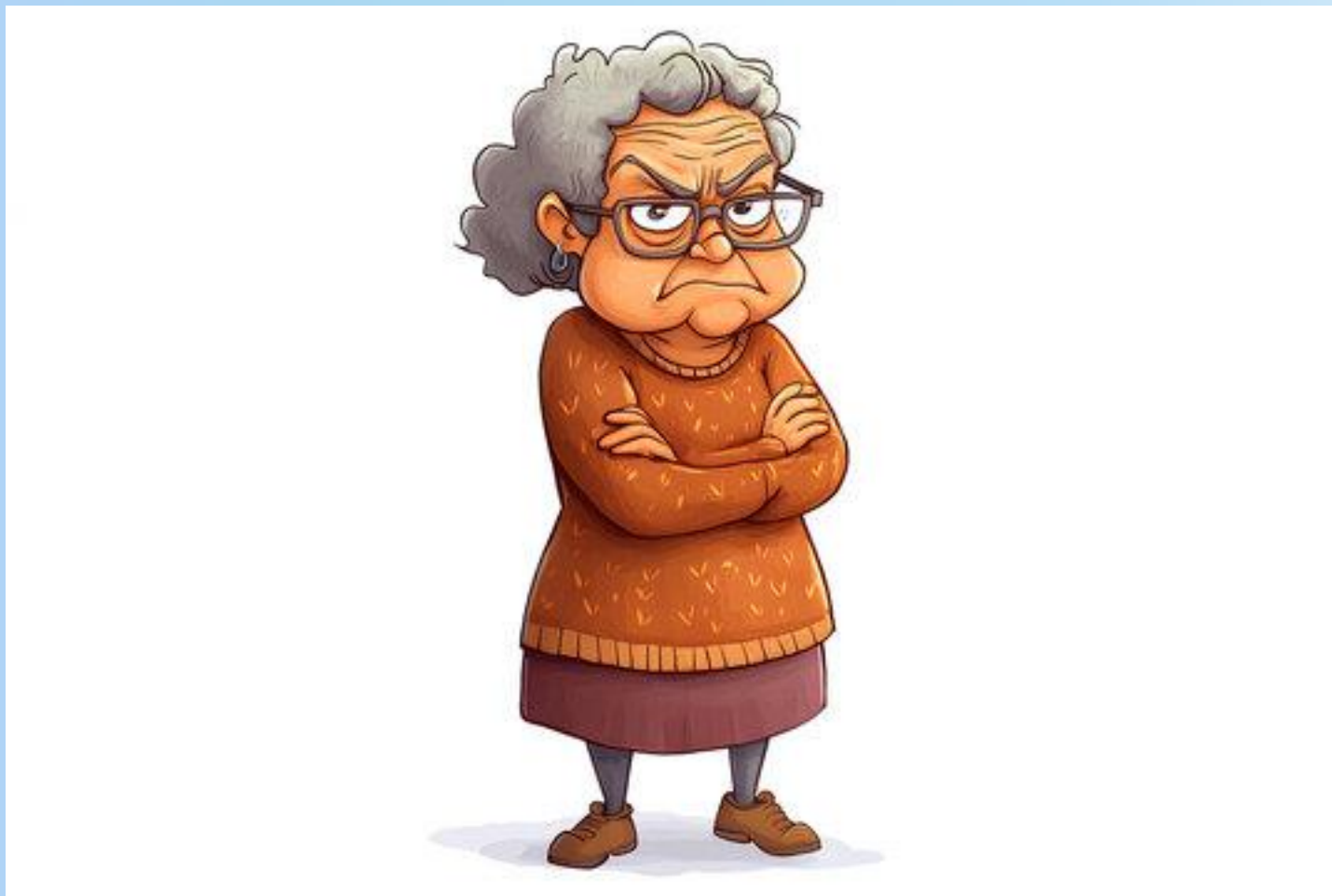
- **Hemorrhagic**

- Trauma
- Upper GI bleeds
- Lower GI bleeds
- Aortic Injury

- **Non-hemorrhagic**

- GI tract
- Skin (burns)
- Third spacing!
(ascites)
- Excessive urination

Mrs Zubrowka



Mrs Zubrowka

Mrs Zubrowka presents to the emergency department with chest pain and shortness of breath. She has a history of myocardial infarction and heart failure.

On examination, she appears pale and sweaty.

Vital signs:

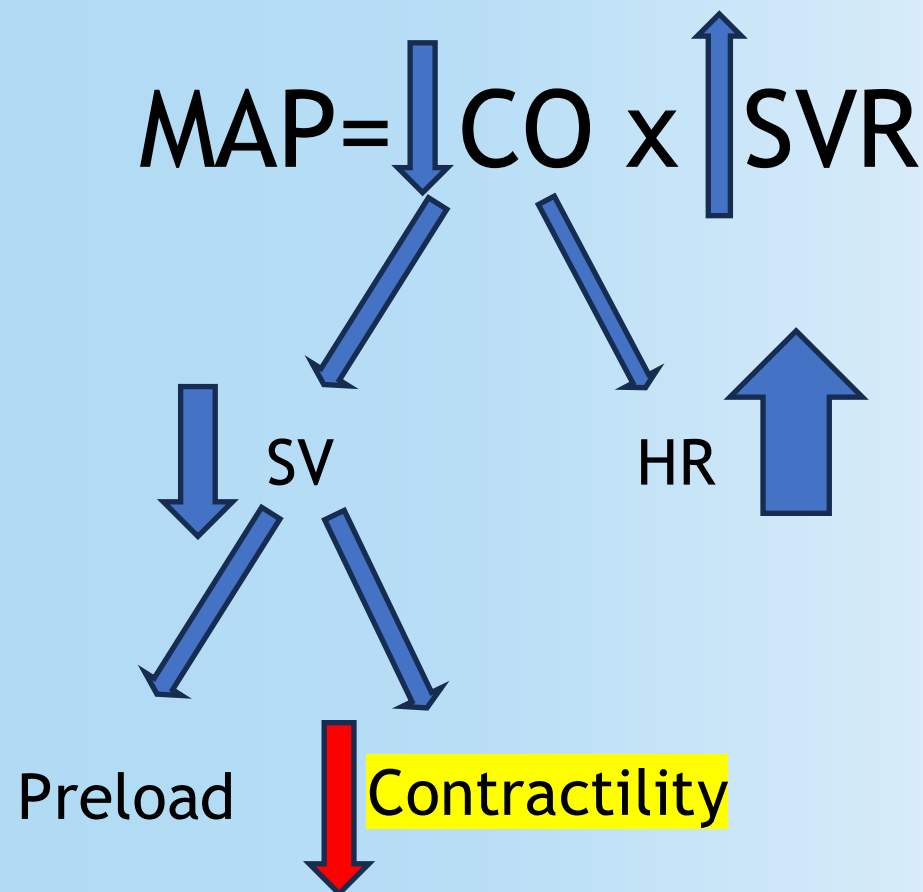
- Blood pressure: 80/55 mmHg
- Heart rate: 150 bpm

Physical examination reveals **jugular venous distention**, **bilateral crackles in the lungs**, and **cold hands and feet**.

Which type of shock is most likely?

Mrs Zubrowka

- Mrs Zubrowka is in cardiogenic shock!
- Clues
 - Tachycardia!
 - Previous heart problem
 - JVD, patients often present with signs of heart failure+ shock! (ie pulmonary edema)
- **Problem with the “pump”**
 - Inc in LA and RA pressures
 - Most common cause is MI!



Compensatory mechanism
HR, SVR (RAAS activated)

Mr Zabka



Mr Zabka

Mr Zabka presents to the emergency department with sudden onset shortness of breath and pleuritic chest pain. He recently underwent knee replacement surgery 1 week ago.

On examination, he appears anxious and diaphoretic.

Vital signs:

- Blood pressure: 82/54 mmHg
- Heart rate: 120 bpm
- Respiratory rate: 30/min
- Oxygen saturation: 88% on room air

Physical examination reveals **jugular venous distention**, **clear lung fields**, and **cool extremities**.

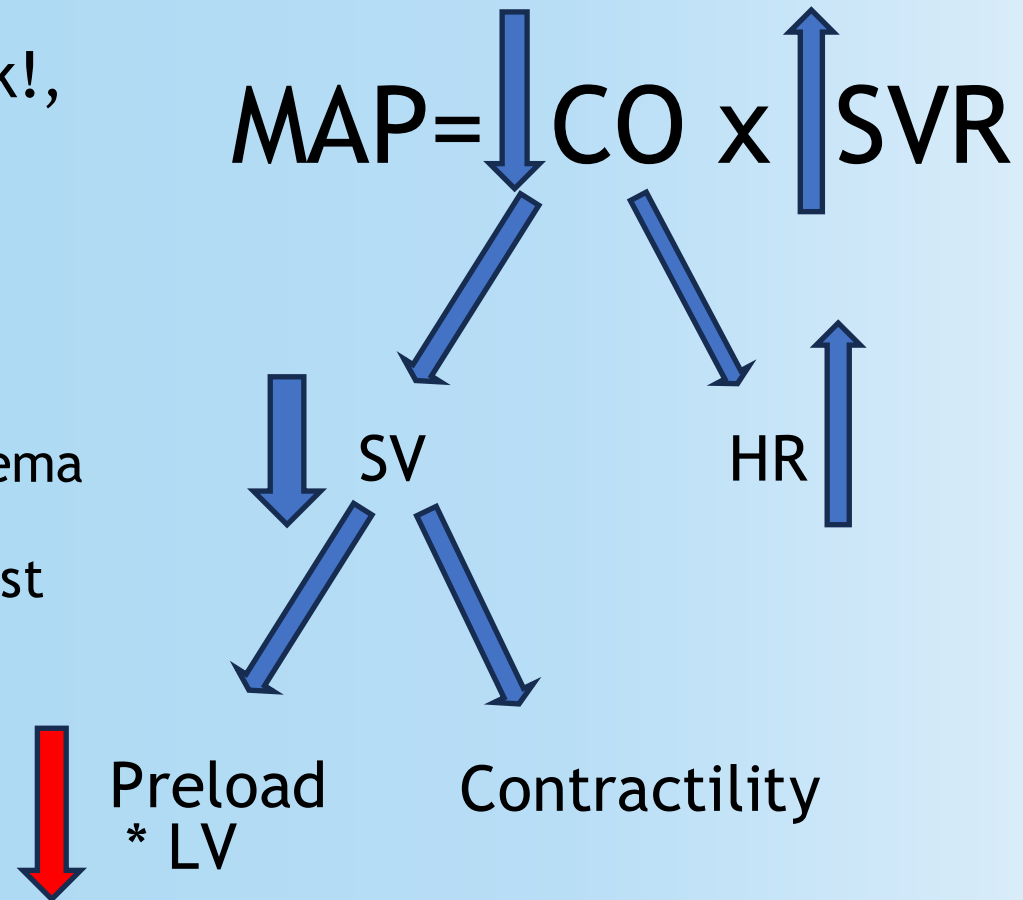
Which type of shock best explains this patient's presentation?

Afterload: Resistance ventricles must overcome to eject during systole

Mr Zabka

- Mr Zabka is in obstructive shock!, caused by a PE
- Clues
 - Pulmonary > shock symptoms
 - Hypotension (Low CO)
 - Increased PVR, NO pulmonary edema
 - Tachycardia
 - Risk factors for PE (surgery), chest pain

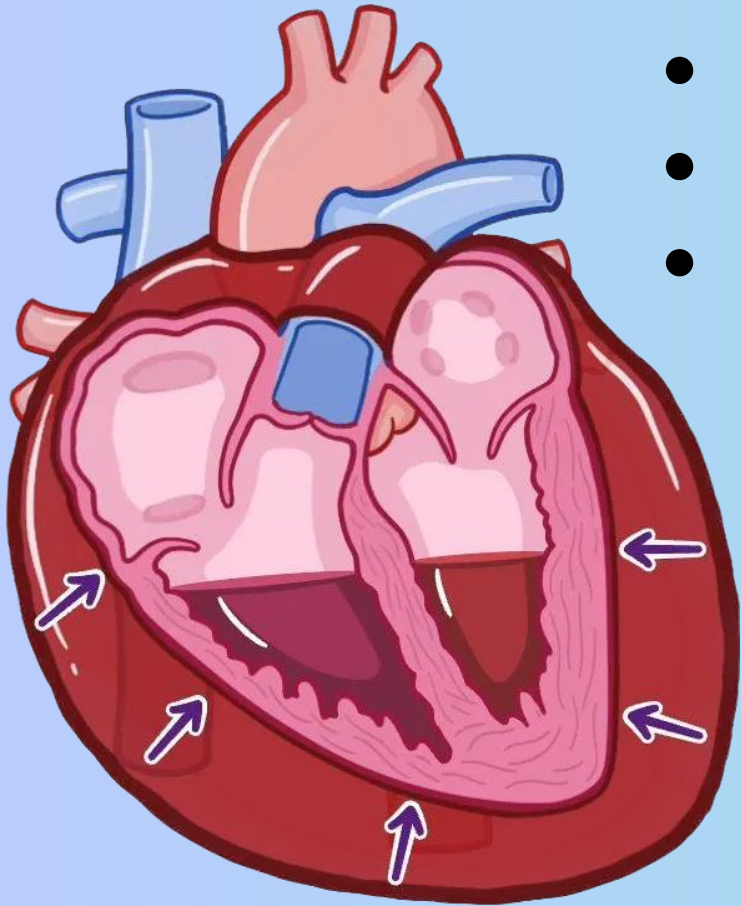
- **Extracardiac cause of pump failure!**



Compensatory Mechanism
HR, SVR & afterload increase

Mechanical Obstructive Shock

- Limitation in the area the heart can expand
- Preload cannot compensate the external pressure
- le Pericardial tamponade, tension pneumothorax
 - **Pericardial tamponade**
 - Bleeding into the pericardial space
 - Increased pressure on the ventricles decreasing diastolic filling
 - Increased LV pressures increases PCWP further increasing RV pressure
 - Equalization of pressures in the cardiac chambers is unique to PT vs any other form of obstructive shock



**Becks Triad: Hypotension,
JVD, Distant heart sounds**

Mrs. Wino and Mr. Piwo



Mrs. Wino

Mrs Wino is brought to the emergency department with Mr Piwo after a car accident. Mrs. Wino explains she was driving Mr Piwo to the hospital because he hasn't been feeling well the past few days. It is noted on exam Mrs. Wino has a cervical spine injury.

On examination, her vital signs are:

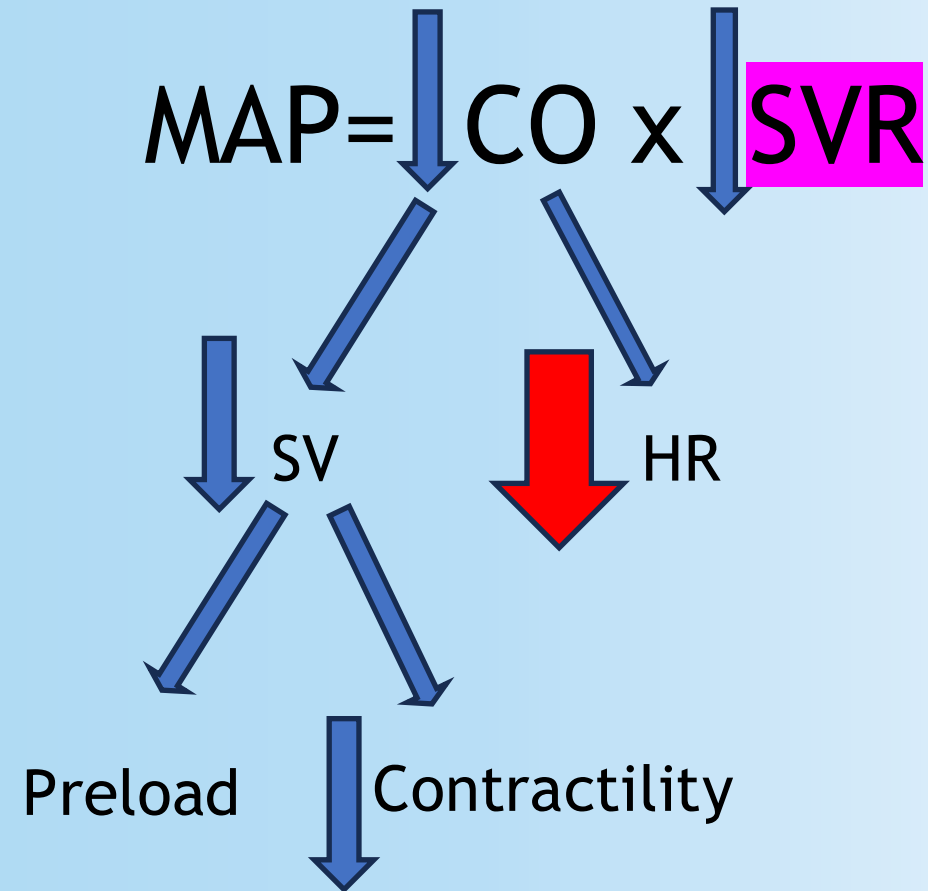
- Blood pressure: 82/50 mmHg
- Heart rate: 48 bpm
- Respiratory rate: 18/min

Her skin is warm and dry

What type of shock is most likely?

Mrs. Wino

- Mrs Wino is in neurogenic shock! A form of distributive shock
- Clinical clues:
 - Bradycardia,
 - Spinal cord injury!
 - Hypotension
 - Warm Dry skin! (lack of vasoconstriction)
- Loss of Sympathetic tone, blood pools, less catecholamines secreted



Mr. Piwo

Mr Piwo has been complaining of fever, chills, and confusion. He has a history of intravenous drug use.

On examination, he appears ill and flushed.

Vital signs:

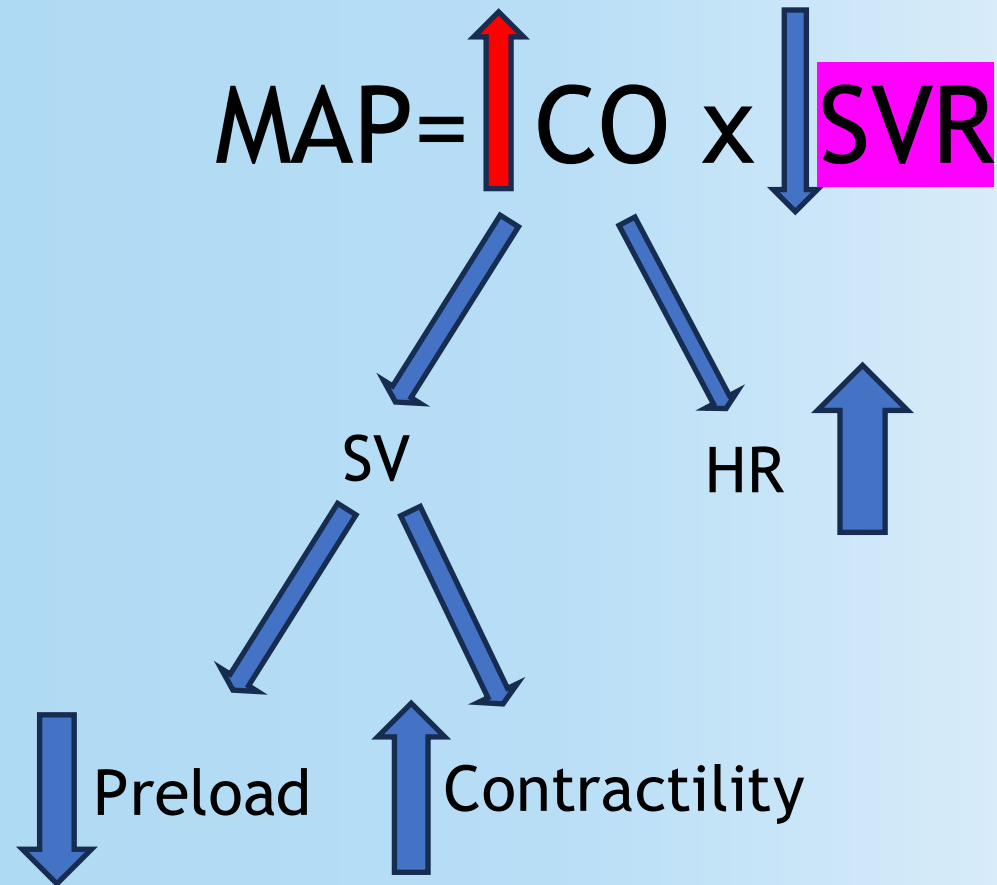
- Temperature: 39.4°C (103°F)
- Blood pressure: 84/50 mmHg
- Heart rate: 118 bpm
- Respiratory rate: 24/min

His skin is warm, and capillary refill is brisk. Laboratory studies show leukocytosis.

Which type of shock is most likely?

Mr. Piwo

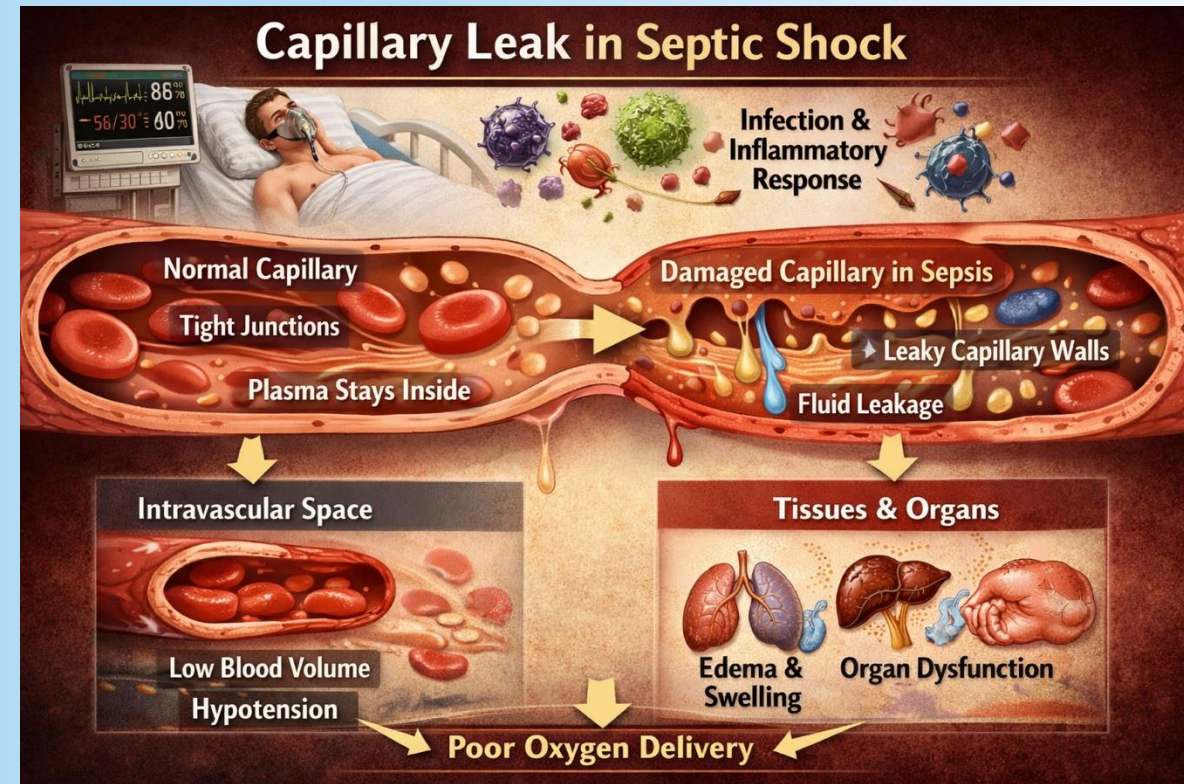
- Mr Piwo is in septic shock! A form of distributive shock
- Clinical clues:
 - Warm skin (early)
 - Signs of infection, fever
 - Hypotension
- Blood pools, but still have SNS effect on HR



Compensatory Mechanism
Early inc in HR & CO (warm state)

Sepsis

- Dysregulated immune response to infection
 - Activation of inflammatory mediators results in vessel dilatation
 - Vessel disruption results in capillary leak, intravascular fluid leaks out of the vessels
 - Septic shock= Sepsis+ Hypotension & changes in perfusion despite receiving adequate fluid



Septic shock

Warm phase

- Early
- Compensated (Via inc in HR & CO)
- vasodilation
- “warm” skin
- ”Bounding pulses”

Cold phase

- Late
- Uncompensated. (CO begins to dec)
- ”cold skin”

MODS (Multi organ dysfunction syndrome)

- Clinical syndrome of failure of 2 or > organ systems in critically ill patients

Distributive Shock

Shock	Etiology	Mechanism of vasodilation
Septic	Severe disseminated infection or disruption of walled-off infection.	Bacterial products and proinflammatory cytokines
Anaphylactic	Severe allergic reaction to food, medication, or insect bites.	Mast cell and basophil release of histamine
Neurogenic	Severe spinal cord injury or traumatic brain injury.	Autonomic disruption of vascular tone

Primary change

Compensatory response

Summary of Shock

Shock	Cause	Skin	Preload (PCWP)	Cardiac output	Afterload (SVR)
Hypovolemic	Hemorrhage, dehydration, burns	Cold, clammy	↓↓	↓	↑
Cardiogenic	MI, HF, valve dysfunction, arrhythmia	Cold, clammy	↓ or ↑	↓↓	↑
Obstructive	Tamponade, massive PE, tension pneumothorax	Cold, clammy	↓ or ↑	↓↓	↑
Distributive	Sepsis, anaphylaxis	Warm	↓	↑ In early!	↓↓
	CNS injury	Dry	↓	↓	↓↓

Quiz time 😊



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QUESTIONS?