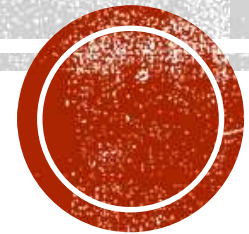


# PHARMACOTHERAPY OF SHOCK



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# SHOCK

It is abnormal physiological state resulting from widespread and serious reduction of tissue perfusion that if prolonged will lead to generalised impairment of cellular function.



# ■ Types of shock

HYPOVOLEMIC SHOCK

CARDIOGENIC SHOCK

DISTRIBUTIVE SHOCK

SEPTIC SHOCK

NEUROGENIC SHOCK

ANAPHYLACTIC SHOCK



# HYPOVOLEMIC SHOCK

Improper tissue perfusion as a result of severe loss of blood or other fluid from the body or inadequate fluid intake , any of which decrease intravascular volume.

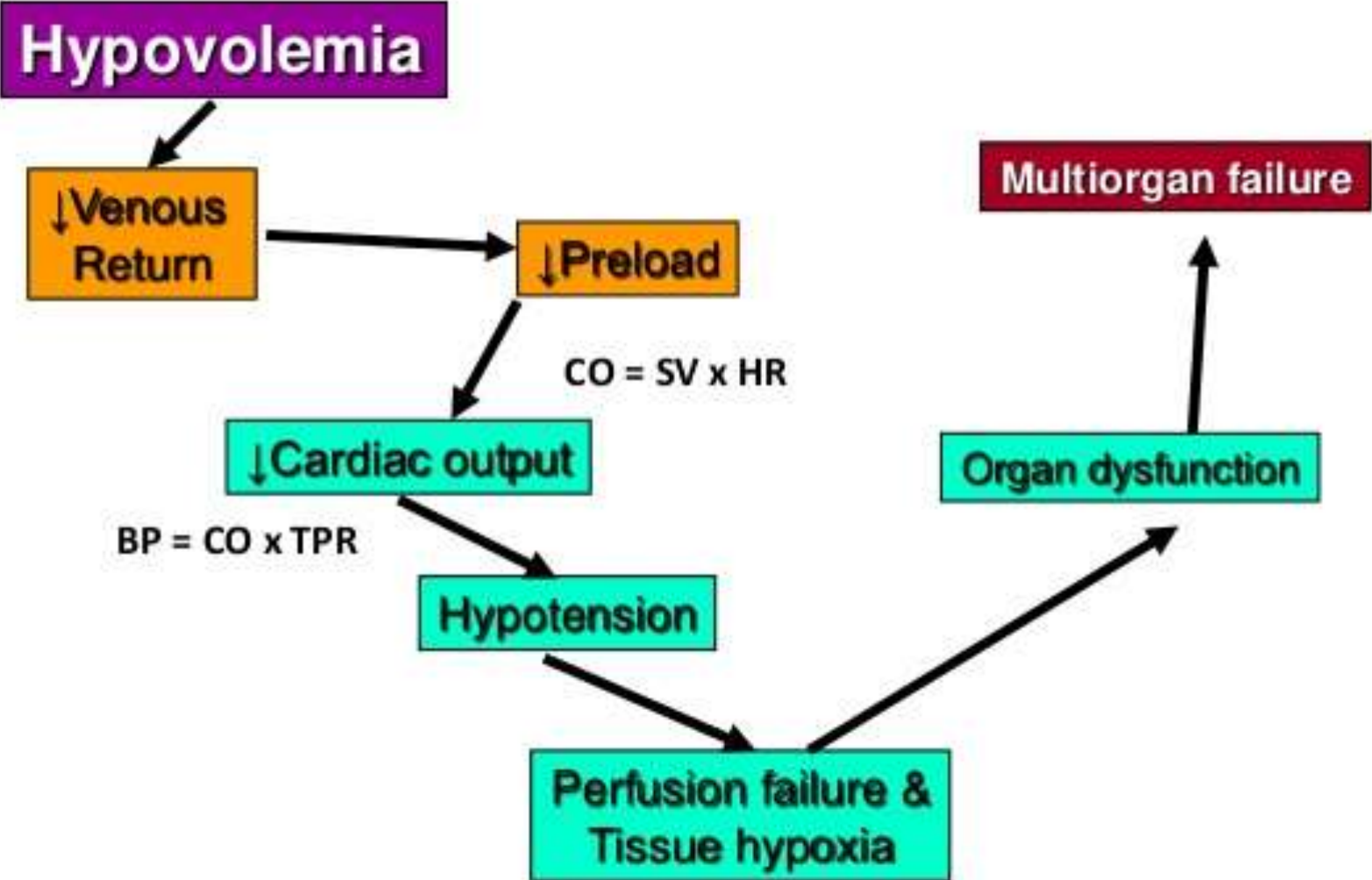


# Causes of Hypovolemic shock

- Haemorrhagic (acute blood loss)
- Burns
- Excessive vomiting & diarrhea



# Pathophysiology of Hypovolemic shock



## Grades of hypovolemic shock

<b>Mild (&lt;20% Blood Volume)</b>	<b>Moderate (20–40% Blood Volume)</b>	<b>Severe (&gt;40% Blood Volume)</b>
Cool extremities Increased capillary refill time Diaphoresis Collapsed veins Anxiety	Same, plus: Tachycardia Tachypnea Oliguria Postural changes	Same, plus: Hemodynamic instability Marked tachycardia Hypotension Mental status deterioration (coma)



# MANAGEMENT OF HYPOVOLEMIC SHOCK





## Fluid replacement in hypovolemic shock

Initiate IV therapy 6ml/kg/hr

crystalloid for 1-2 hrs



-----  
Improvement

No improvement

Reduce IVF 3ml/kg/hr  
(6-12 hrs)

Increase IVF 10ml/kg/hr  
(2 hrs)

Further improvement

Discontinue after 24hrs

-----  
Improvement

No improvement

Reduce to 6ml/kg/hr

3ml/kg/hr

Discontinue after

24 hrs

Hematocrit rise

IV Colloid

10 ml/kg/hr

Haematocrit falls

Blood Transfusion

10ml/kg/hr

Improvement

IVF crystalloid

Reduce to 10-6,6-3 & discontinue after 24hrs



**Inotrope** : an agent that changes myocardial contractility.

**Vasopressor** : an agent that increases blood pressure

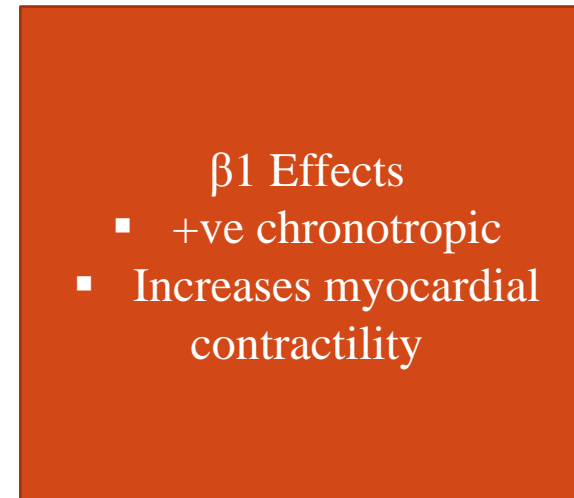
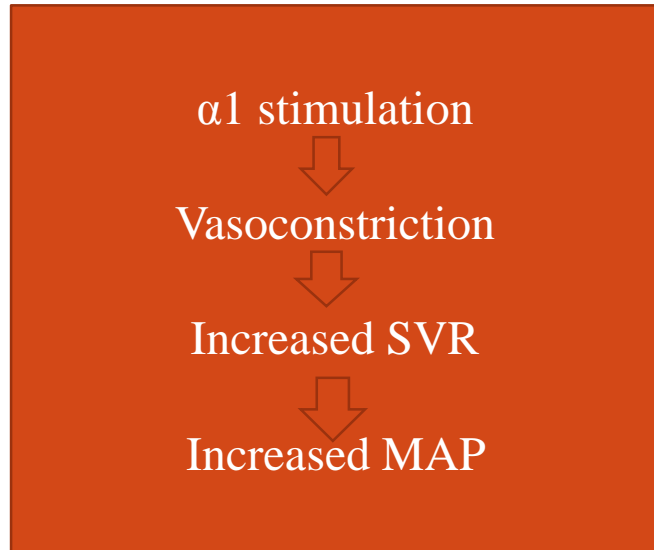
**Chronotrope** : an agent that changes heart rate

**Dromotrope** : an agent that increases cardiac conduction velocity.



# NOREPINEPHRINE

- Most widely used vasopressor
- Potent  $\alpha_1$  agonist causing vasoconstriction in tissue beds.
- Resultant increase in SVR causes rise in blood pressure.



Standard dose : 4 mg in 50 ml (0.08 mg/ml)



# EPINEPHRINE

- Nature's vasopressor
- Most commonly used during resuscitation cardiac arrest and anaphylaxis.
- $\alpha_1$  : increases SVR
- $\beta_1$  : increases HR and myocardial contractility.
- $\beta_2$  : bronchial smooth muscle relaxation.

Standard dose : 10 mg in 50 ml(0.2mg/ml)



# DOPAMINE

- Vasopressor agent.
  - Use in cardiogenic & septic shock.
  - Receptor stimulation depend on dose given
    - ❖ Low dose :  $D_1$ ----- ↑ renal perfusion
    - ❖ Medium dose :  $\beta_1$ ----- ↑ CO
    - ❖ High dose :  $\alpha_1$ ----- vasoconstriction, ↑ PVR
- Standard dose : 0.2-1 mg/min



# DOBUTAMINE

- A synthetic catecholamine
- An inodilator
- $\beta_1$  stimulation: increase HR and increase cardiac contractility.
- $\beta_2$  mediated vasodilatation.
- Reduction in MAP is common with dobutamine.
- NE usually needed to offset vasodilatation.

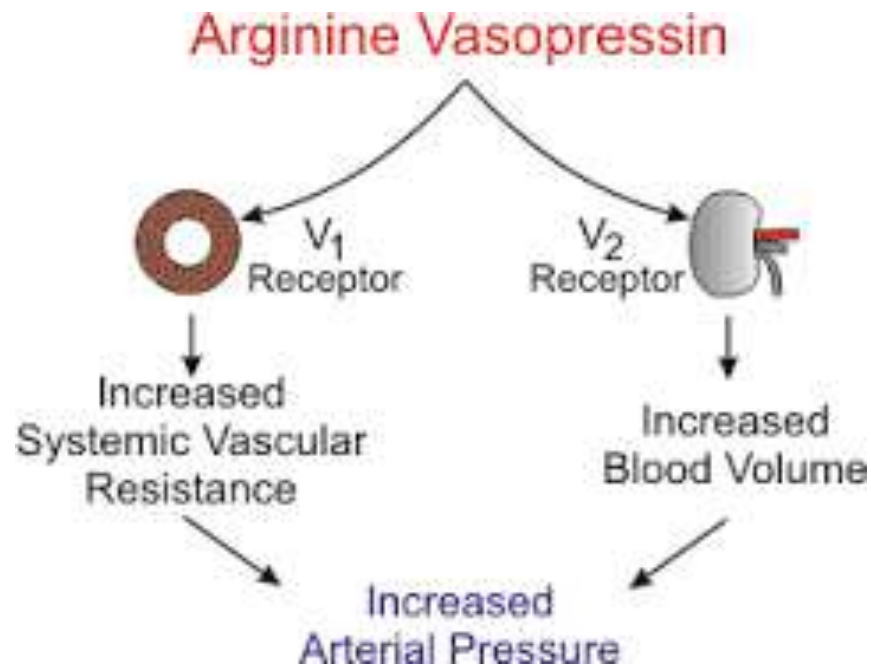
Standard dose : 250mg in 50 ml(5mg/ml)



# VASSOPRESSIN

- Peptide hormone released from posterior pituitary.
- Causes increase permeability of DCT & CT, increases water retention. ( $V_2$  receptor)
- $V_1$  receptor present in the smooth muscle of a arteriolar wall & stimulation causes smooth muscle contraction & vasoconstriction.





- Use to augment NE action in ionotrope resistant shock.

Standard dose : 60 units in 60 ml of 0.9% NaCl  
,2.4ml/hr ,fixed rate.





# CARDIOGENIC SHOCK

A state of inadequate cardiac output despite of adequate intravascular volume , resulting in hypoxia.

- Cool, mottled skin
- Tachypnea
- Hypotension
- Altered mental status
- Narrowed pulse pressure
- Rales, murmur



# Causes of cardiogenic shock :

- Acute myocardial infarction
- Myocarditis
- Myocardial contusion
- Aortic or mitral stenosis
- Acute aortic insufficiency



# Pathophysiology of cardiogenic shock:

- Often after ischemia, loss of LV function
- CO reduction = lactic acidosis, hypoxia
- Stroke volume is reduced
- Tachycardia develops as compensation
- Ischemia and infarction worsens



# Treatment of cardiogenic shock :

- Aspirin, beta blocker, morphine, heparin
- If no pulmonary edema, IV fluid
- If pulmonary edema
  - Dopamine – will ↑ HR and thus cardiac work
  - Dobutamine – May drop blood pressure
  - Combination therapy may be more effective
- Thrombolytics(streptokinase, rt-PA)
- IABP



# DISTRIBUTIVE SHOCK

A form of shock in which severe vasodilatation, despite normal blood volume, results in improper distribution of blood flow.

- Septic shock
- Neurogenic shock
- Anaphylactic shock

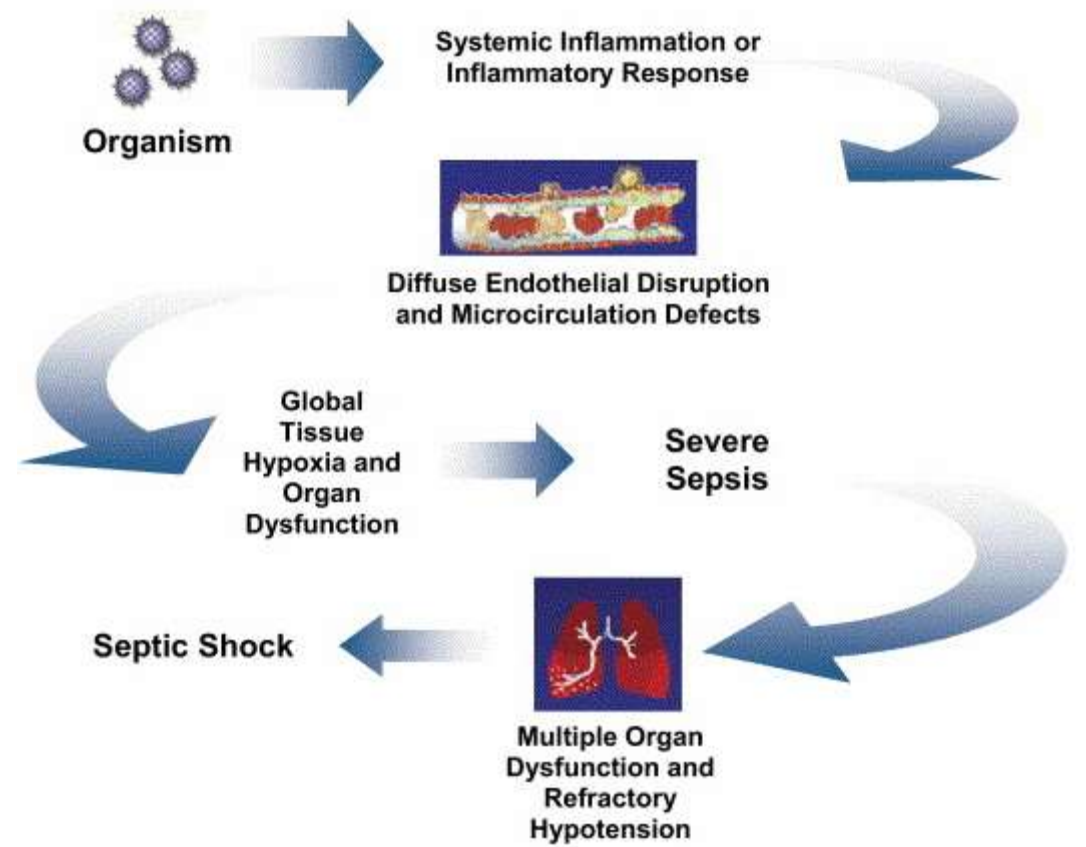


**Septic shock:** a type of distributive shock resulting from sepsis.

**Sepsis :** an abnormal body wide inflammatory response to an infection that can result in death.



# Pathophysiology of septic shock



## Clinical signs:

- Hyperthermia
- Tachycardia
- Wide pulse pressure
- Low blood pressure (SBP<90)
- Mental status changes





## Treatment of septic shock:

- Fluid replacement
- Supplemental oxygen
- Antibiotics: Survival correlates with how quickly the correct drug was given



Cover gram positive and gram negative bacteria-

- Ceftriaxone 1 gram IV BD or
- Imipenem 1 gram IV TDS.

Add additional coverage for -

- Pseudomonas- Gentamicin or Cefepime
- MRSA- Vancomycin



**Anaphylactic shock** : develops following exposure to allergen & cross links IgE on mast cells causing mediator release

Histamine

Eicosanoids-LTs,PGs

Clinical presentation:

- Urticaria & angioedema
- Bronchospasm
- Hypotension & CV collapse



Treatment : Epinephrine is 1<sup>st</sup> line drug

Standard dose : Inj. 0.5 ml (1:1000) IM

repeat every 5-10 mins if not improve

Inj. 0.5 ml (1: 10000),(1:100000) IV



## Antihistaminic :

- Diphenhydramine (H<sub>1</sub>), administered IV
- Ranitidine (H<sub>2</sub>), administered IV

β<sub>2</sub> agonist: salbutamol

**IV Corticosteroid:** Hydrocortisone 200 mg IV followed by oral prednisolone for 3 days.



**Neurogenic shock** : develops secondary to a sudden loss of ANS functions following spinal cord injury resulting in vasomotor tone & impaired cellular metabolism.

Features :

- Hypotension
- Bradycardia
- poikilothermia



## Management :

- Airway support.
- Fluid replacement.
- Dopamine (>10mcg/kg/min)
- Ephedrine (12.5-25mg IV every 3-4 hr)
- Atropine for bradycardia.(0.5mg IV every 3 to 5 mins—  
3mg)
- Treatment of the underlying cause.



