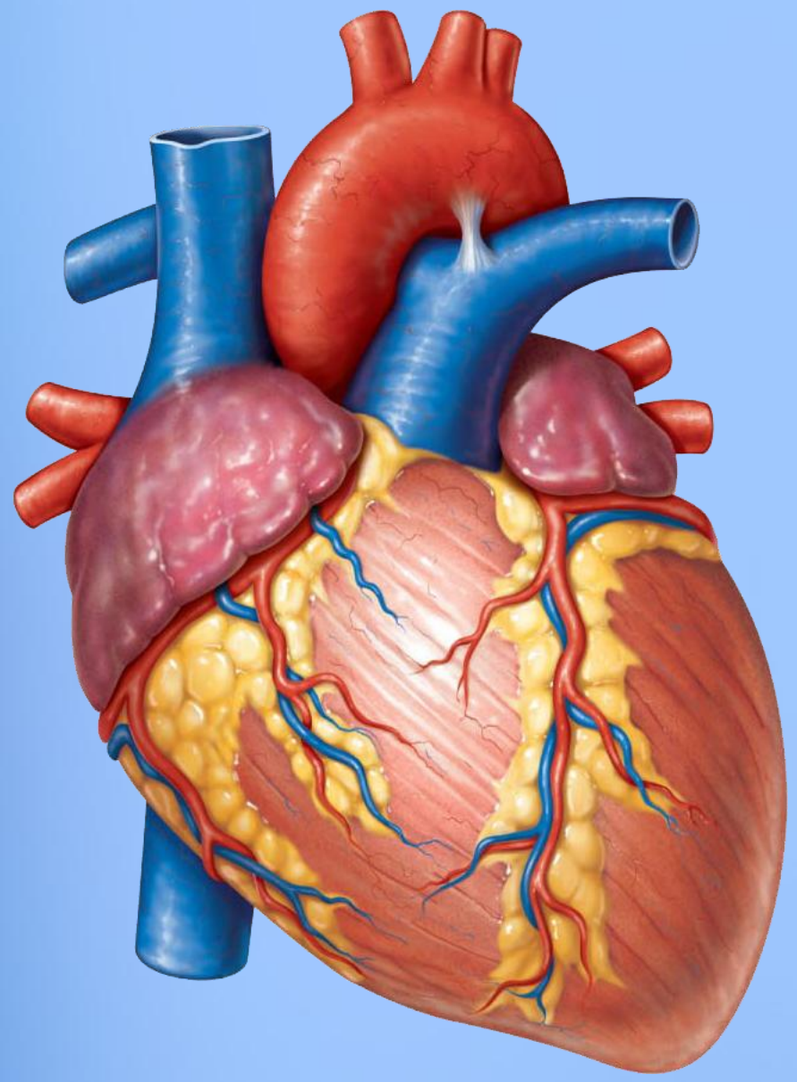
12

SHOCK



Cardiovascular Block

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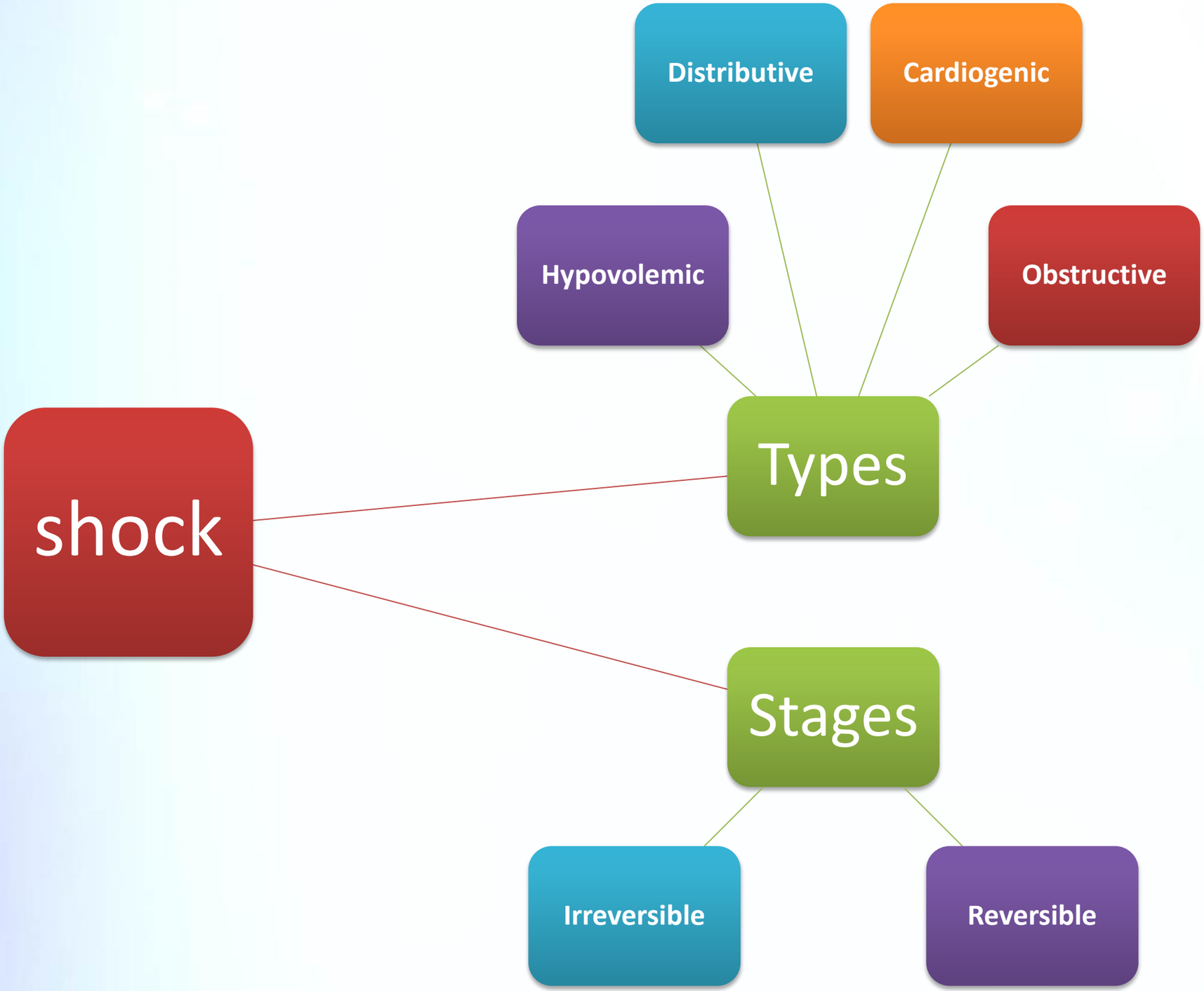
Objectives

- **Define circulatory shock.**
- **List types and causes of shock.**
- **Understand the body compensatory mechanisms during the reversible phase of hemorrhagic shock.**
- **Understands the mechanisms responsible for the irreversible phase of hemorrhagic shock**


shock
Types
Distributive
Cardiogenic
Hypovolemic
Obstructive
Stages
Irreversible
Reversible

Definition of shock

❖Inadequate tissue perfusion with relatively or absolutely inadequate cardiac output.

TYPES AND CAUSES

- Hypovolemic shock.
- Distributive shock.
- Cardiogenic shock.
- Obstructive shock.

Type of Shock	Features and causes		
Hypovolemic shock	**-Loss of blood volume due to:** 1. Hemorrhage. 2. Trauma. 3. Surgery.	**-Fluid loss due to:** Severe vomiting or diarrhea.	**-Plasma loss;** As in burns.
Distributive shock (also called vasogenic, low resistance shock)	**There is marked vasodilation caused by:** 1. Anaphylaxis (due to antigen-antibody reaction, e.g drug –induced..) 2. Sepsis. 3. Neurogenic: Vasovagal, acute venous dilation		
Cardiogenic shock	**Results from inadequate output caused by diseased heart:** 1. Myocardial infarction. 2. Congestive heart failure. 3. Arrhythmias.		
Obstructive shock	**Due to obstruction to the flow of the blood:** 1. Tension pneumothorax. 2. Pulmonary embolism.		

Pathophysiology of hypovolemic shock

Characterized by

- Hypotension
- Rapid thready (weak) pulse
- Cold, pale skin
- Intense thirst
- Rapid respiration
- Restlessness

hypovolemic shock is subdivided into

- hemorrhagic
- traumatic
- surgical
- burn shock

Stages of hypovolemic shock

Reversible stage

In which compensatory reactions and appropriate treatment help restoration of blood pressure and blood loss.

Reversible stage

Characterized by compensatory reactions:

- **Rapid compensatory Reactions** **(sec- min)**
- **Responses activated (hours)**
- **Responses activated from (hours-days)**

Irreversible stage

In which series of positive feed back mechanisms take place leading to further deterioration & tissue hypoxia.

- This depends on amount of blood lost.
- When blood loss is excess and not immediately replaced and proper treatment is delayed, this stage is reached and **patient die**.
- There is also failure of compensatory mechanisms.

Reversible stage

A.Rapid compensatory reactions

I. VASOCONSTRICTION:

this increases TPR and hence ABP.

It is produced by:

* Baroreceptor reflexes.
* Chemoreceptor reflex.
* Vasopressin-vasoconstrictor mechanism.
* Noradrenalin-adrenaline vasoconstrictor mechanism (due to activation of adrenal medulla).

Vasoconstriction is marked in:

- Skin: cold, pale.
- kidneys: drop in GFR & urine volume.
- Viscera.

Heart and brain are spared.

TPR :total physical response
ABP :Arterial blood pressure
GFR: glomerular filtration rate
Spared =safe

II. TACHYCARDIA:

(due to drop in BP)

Produced by:

- Baroreceptor reflex.
- Chemoreceptor reflex.
- Increased sympathetic activity.

III. VENOCONSTRICTION:

Caused by sympathetic activity.

It is important to:

- Maintain filling pressure of the heart.
- Shift blood from reservoirs into the circulation

IV. TACHYPNEA:

Caused by activation of chemoreceptor reflex and sympathetic over activity.

It is important to:

Increase O2 delivery.

Increase thoracic pump activity (help in increase VR).

VR =Venous return
Venoconstriction = constriction of a vein

V. RESTLESSNESS :

due to sympathetic over activity.

This increases skeletal Muscle Pump activity (help in increase VR).

VI. RELEASE OF VASOCONSTRICTOR FACTORS/HORMONES:

- **Catecholamine** by adrenal medulla.
- **Vasopressin** (antidiuretic hormone) by posterior pituitary : causes vasoconstriction and restores fluid volume by reducing urine output.
- **Renin-angiotensin-aldosterone.** (preserve salt and water).

Preserve= protect
Catecholamine ➔ Adrenaline

Reversible stage

B. Responses Activated within hours:

1. **Increased movement of interstitial fluid into capillaries** (capillary fluid shift).
2. **Increased secretion of glucocorticoids by adrenal cortex** (help to maintain blood sugar).
3. **Increased 2,3 DPG concentration in RBCs**: important to help HB deliver more O2 to tissues (shift O2 dissociation curve to the right).

C. Responses activated in hours-days:

1. **Restoration of circulatory plasma volume**. Takes 12-72 hrs after moderate hemorrhage.
2. **Restoration of plasma proteins**: occur in 2 stages:

a- Rapid entry of performed albumin from extracellular stores.

b- Hepatic synthesis of proteins over 3-4 days.

3. **Restoration of RBCs**

Restoration of RBCs: Increase RBCs count in response to erythropoietin within 10 days, the duration of the restoration is within 4-8 weeks

Irreversible stage

+VE FEEDBACK MECHANISMS LEAD TO DROP IN CO:

Cardiac depression

- Atrial premature beats = ↓ coronary flow = ↓ heart = ↓ CO

Vasomotor failure

- Results from depression of vasomotor center, the heart becomes depressed and CO drops.

Release of toxins by ischemic tissues

- e.g. histamine, tissue enzymes, potassium, ...

Endotoxin

- Released from gram +ve bacteria when blood flow to intestine decreases lead to absorption of toxins and that will lead to Cardiac depression.

Generalized cellular deterioration

- II.stop of mitochondrial activity inside the cells lead to decrease in ATP.
- II. drop of cellular metabolism, especially glucose.
- III.Rupture of many lysosomes.
- IV. Drop in active transport of Na+ and K+ across the cell lead to Na+ accumulate inside the cell.

Summary

DEFINITION

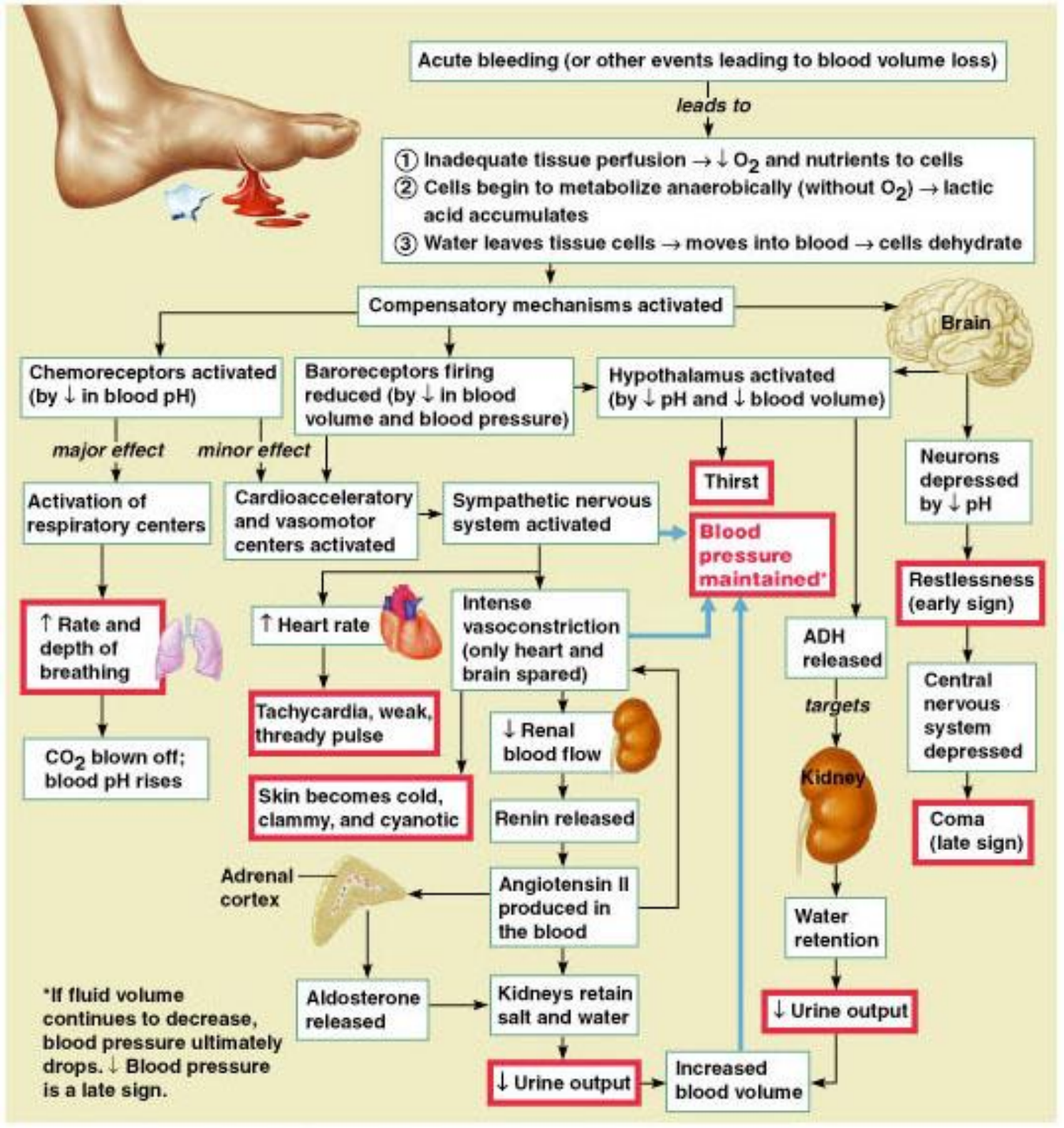
Inadequate tissue perfusion with relatively or absolutely inadequate cardiac output.

TYPES

- Hypovolemic shock.
- Distributive shock.
- Cardiogenic shock.
- Obstructive shock.

STAGES

- **Reversible stage**
  - **Responses activated (hours)**
  - **Responses activated from (hours-days)**
  - **Rapid compensatory Reactions(sec- min)**
- **Irreversible stage**



MCQs

1-In almost all patients who have severe burns or other denuding conditions of skin, so much plasma lost, the resulting condition is:
A-Neurogenic shock
B-Hypovolemic shock
C-Septic shock
D-Histamine shock

2-One type of shock that due to Loss of blood volume:
A-Obstructive shock
B-Cardiogenic shock
C-Distributive shock
D-Hypovolemic shock

3-One of these factors will not cause circulatory shock:
A-Cardiac abnormality
B-Decrease venous return
C-Increase venous return
D-Diminished blood volume

4-An increase in a vascular capacity because of venous dilation, thus causing a marked decrease in:
A-Venous return
B-Capillary permeability
C-Histamine
D-Antigen-antibody reaction

1-B **2-D** **3-C** **4-A**

MCQs

5-Positive feed back mechanisms take place leading to further deterioration & tissue hypoxia:
A-Reversible stage
B-Irreversible stage

6-Function of Renin-angiotensin-aldosterone:
A-Increase preload and decrease afterload
B- Inhabit secretion of aldosterone
C-Preserve salt and water
D-None of above

7-Sympathomimetic drug have proved to be especially beneficial in :
A-Septic shock
B-Hypovolemic shock
C-Hemorrhagic shock
D- Neurogenic shock

8-When the pressure falls too low in most types of shock, This……. is first essential step in the treatment of many type of shock:
A-Oxygen therapy.
B-Head down position.
C-Drug include Norepinephrine
D-Glucocorticoids

5-B **6-C** **7-D** **8-B**

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