**Lecture:4**

**Circulatory shock**means generalized inadequate blood flow through the body, to the extent that the body tissues are damaged because of too little flow.

Types of shock according to their underline cause:

1-**Hypovolemic shock**: which include

I-**Hemorrhagic shock:** Hemorrhage is the most common cause of hypovolemic shock. Hemorrhage *decreases the filling pressure of the* *circulation* and, as a consequence, decreases venous

return. As a result, the cardiac output falls below normal.

II-**Hypovolemic caused by plasma loss**: Loss of plasma from the circulatory system, even without loss of red blood cells, can sometimes be severe enough to reduce the total blood volume. Severe plasma loss occurs in the following conditions:

*A-Intestinal obstruction* is often a cause of severely reduced plasma volume.

*B-severe burns cause loss of large amount of plasma from the burned areas.*

*C-Dehydration:* Some of the causes of this type of shock are (1) excessive sweating, (2) fluid loss in severe diarrhea or vomiting, (3) excess loss of fluid by nephrotic kidneys, (4) inadequate intake of fluid and electrolytes, or (5) destruction of the adrenal cortices, with loss of aldosterone secretion and consequent failure of the kidneys to reabsorb sodium, chloride, and water.

III-**Traumatic shock:** caused by extensive contusion of the body can damage the capillaries sufficiently to allow excessive loss of plasma into the tissues. This results in greatly reduced plasma volume, although there might also be a moderate degree of concomitant neurogenic shock caused by the pain.

**2-Cardiogenic shock.** This circulatory shock caused by inadequate cardiac pumping. after acute heart attacks and often after prolonged periods of slow progressive cardiac deterioration, the heart becomes incapable of pumping even the minimal amount of blood flow required to keep the body alive. all the body tissues begin to suffer and even to deteriorate. Once a person develops cardiogenic shock, the survival rate is often less than 15 per cent.

**3-Neurogenic shock.** *sudden loss of vasomotor tone* throughout the body, resulting especially inmassive dilation of the veins lead to Diminish venous return cause decrease cardiac output. (Diminished venous return caused by vascular dilation is called *venous pooling* of blood).causes of neurogenic shock include:a-deep general anesthesia. b.Spinal aesthesia. C. Brain damage that cause vasomotor depression.

**4-Anaphylactic shock** is an allergic conditionresults from an antigen-antibody reaction that takes place immediately after an antigen to which the person is sensitive enters the circulation. This antigen-antibody reaction stimulate mast cell and basophiles to release histamine which cause massive vasodilatation and increased capillary permeability, with rapid loss of fluid and protein into the tissue spaces.

**5-Septic shock.** This refers to widely disseminated bacterial infection to many areas of the body by the blood and causing extensive damage. Examples of causes of septic shock include Peritonitis caused by rupture of the gastrointestinal system and spread of a skin infection such as streptococcal or staphylococcal infection .A special type of septic shock is **endotoxin shock** this is caused especially by gram negative bacteria mainly colon bacilli that contain a toxin called endotoxin , as in strangulation of gut, this endotoxin on entering the circulation cause an effect similar to anaphylaxis.

hemorrhagic

Hypovolemic shock

Fig-1 Diagram showing types of circulatory shock

*Dehydration: (e.g)dia*rrhea and vomiting, nephrotic syndrom

*Sever burn*

Plasma loss

Traumatic

*Intestinal obstruction*

**Shock**

Septic shock

Anaphylactic

Neurogenic

Cardiogenic

**Stages of shock**

shock is divided into the following three major stages:

1. A *nonprogressive stage* (sometimes called the *compensated stage*), in which the normal circulatory compensatory mechanisms eventually cause full recovery without help of therapy.

2. A *progressive stage,* in which, without therapy, the shock becomes steadily worse until death.

3. An *irreversible stage,* in which the shock has progressed to such an extent that all forms of known therapy are inadequate to save the

person’s life.

**Nonprogressive Shock** : It is also called *compensated shock,* meaning that compensatory mechanisms are enough to prevent further deterioration of thecirculation.

The compensatory mechanisms include:

1. *Baroreceptor reflexes,* which elicit powerful

sympathetic stimulation of the circulation.

2. *Central nervous system ischemic response,*

3. *Reverse stress-relaxation of the circulatory system,*

which causes the blood vessels to contract around

the diminished blood volume, so that the blood

volume that is available more adequately fills the

circulation.

4. *Renin angiotensin system.*

5. *Formation of vasopressin (antidiuretic hormone)*

*by the posterior pituitary gland,*  increases water retention by the kidneys.

6. *Stimulation of thirst center and increase appetite for salt intake.*

**Progressive Shock***:*

**-Cardiac Depression.** When the arterial pressure falls low enough, *coronary blood flow decreases below that* *required for adequate nutrition of the myocardium.*This weakens the heart muscle and thereby decreases the cardiac output more.

**-Vasomotor Failure** *sever arterial blood reduction cause* vasomotor center depression so no further sympathetic stimulation.

**-Blockage of Very Small Vessels—**due to sluggish blood flow.

**-Increased Capillary Permeability.** After many hours of capillary hypoxia and lack of other nutrients, the permeability of the capillaries gradually increases, and large quantities of fluid begin to transude into the tissues. This decreases the blood volume even more.

**-Release of Toxins by Ischemic Tissue**.

**Irreversible Shock** After shock has progressed to a certain stage, transfusionor any other type of therapy becomes incapableof saving the person’s life.

**Physiology of treatment in shock:**

**-Replacement therapy Blood and Plasma Transfusion.** If a person is in shockcaused by hemorrhage, the best possible therapy is usually transfusion of whole blood. If the shock iscaused by plasma loss, the best therapy is administration of plasma; when dehydration is the cause, administration of an appropriate electrolyte solution can correct the shock.

**-Treatment of Shock with Sympathomimetic Drugs—Sometimes Useful** These drugs include *norepinephrine*, *epinephrine*,  *these drugs can be used in neurogenic shock,* in which the sympathetic nervous system is severely depressed and in *anaphylactic shock,* The

sympathomimetic drugs have a vasoconstrictor effect that opposes the vasodilating effect of histamine.

-**Other Therapy**

**Treatment by the Head-Down Position.** When the pressure falls too low in most types of shock, especially in hemorrhagic and neurogenic shock, placing the patient with the head at least 12 inches lower than the feet helps tremendously in promoting venous return,

**Oxygen Therapy.** Because the major deleterious effect of most types of shock is too little delivery of oxygen to tissue.

**Treatment with Glucocorticoids**.