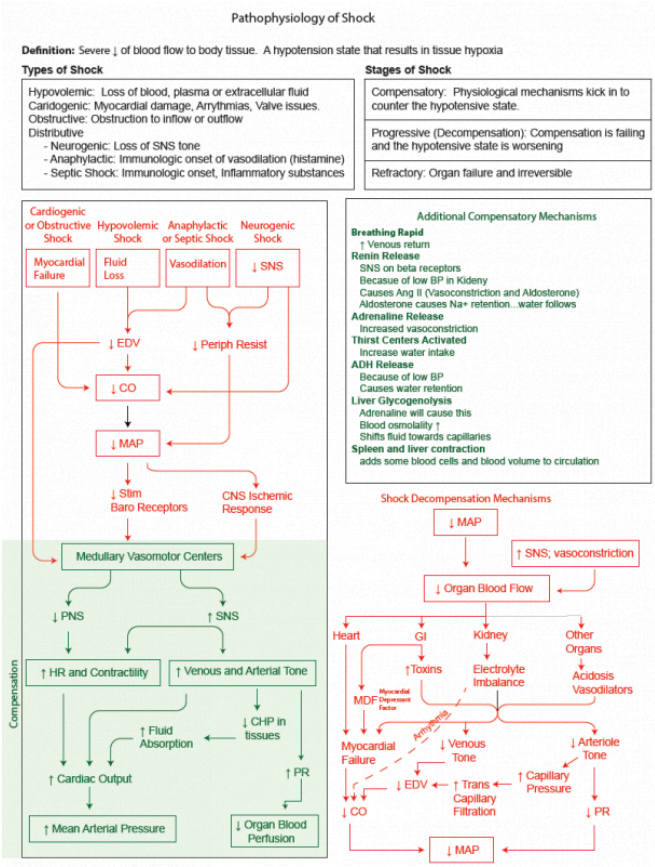
4.2.5

Shock



Shock Image Acronym Key: SNS = sympathetic nervous system, EDV = end diastolic volume, CO = cardiac output, MAP = mean arterial pressure, CNS = central nervous system, PNS = peripheral nervous system, HR = heart rate, CHP = capillary hydrostatic pressure, PR = peripheral resistance, BP = blood pressure, MDF = myocardial depressant factor, GI = gastrointestinal

Study the image above on shock and use the study guide to know what is important to focus on. The text below will have information to help you understand.

Shock is sometimes also called circulatory failure because it is defined as failure of the circulatory system to supply tissues and organs with sufficient amounts of blood. This failure results in cellular hypoxia.

Common manifestations of shock include thirst, tachycardia, cool and clammy skin, decreased blood pressure, oliguria, and changes in mental state. As shock progresses, respiration becomes rapid and deep to compensate for the increased production of acid (due to cells making lactic acid in the absence of oxygen) and decreased oxygen availability. The skin will often be cool and mottled (blotchy) because of the collapse of peripheral veins.

There are four main types of shock:

1. **Hypovolemic shock** occurs when there is an acute loss of 15% or more of the circulating blood volume. Some common causes of hypovolemic shock are loss of whole blood, loss of plasma, or loss of extracellular fluid. Treatment measures for hypovolemic shock strive to restore vascular volume through the administration of intravenous fluids, blood, and blood products.
2. **Cardiogenic shock** occurs when the heart fails to pump enough blood for the needs of the body. Cardiogenic shock is most commonly caused by an acute myocardial infarction, but it may also occur from non-ischemic causes including myocardial contusion (bruising of the heart due to trauma like a car accident), acute mitral valve regurgitation, sustained arrhythmias, CHF, and cardiac surgery. Common manifestations for cardiogenic shock include cyanosis, decreased blood pressure, and oliguria.
3. **Obstructive shock** describes shock that results from mechanical obstruction of the flow of blood through central circulation. This obstruction can greatly decrease venous return and reduce the stroke volume of the heart. Causes for this type of shock include dissecting aortic aneurysms (tearing of the inner surface of aorta through which blood bulges), cardiac tamponade, and pneumothorax.
4. **Distributive shock** is caused by a loss of vessel tone that makes it difficult for blood pressure to be maintained and for blood to continue to surge through the vessels. This loss of vascular tone can be due to a decrease in the sympathetic control of vasomotor tone or the release of excessive vasodilating substances. There are three shock states that fall under distributive shock:

    a. **Neurogenic shock** is due to dysfunction of the vasomotor center of the brain or sympathetic outflow through the blood vessels. Spinal cord injury, brain injury, and general or spinal anesthesia can bring about this type of shock. The skin will be dry and warm with neurogenic shock because of interference with sympathetic nervous function.
    b. **Anaphylactic shock** is caused by an immunologically-mediated reaction where vessels become dilated and leaky because of increased amounts of histamine. There is a threat of laryngeal edema and bronchospasm with anaphylactic shock that can cut off airways. Some frequent causes for anaphylactic shock include allergies to medications, allergies to foods, and insect venom.
    c. **Septic shock** (or **sepsis**) is the most common type of distributive shock. It is associated with a systemic immune response to severe infection where microorganisms have compromised the blood. Fungi and bacteria can release toxins when alive and some bacteria release lipopolysaccharide when they die which can activate an inflammatory response that causes vasodilation, leaky vessels, and a pro-coagulative state. This reduces blood pressure and increases the risk for microvascular thrombi, both of which reduce the oxygen delivery to tissues and organs. This can lead to multiple organ failure.

Complications of Shock

Acute lung injury/acute respiratory distress syndrome (ALI/ARDS) may be either the cause for or result of shock. ALI/ARDS can be caused by shock, trauma, aspiration of foreign substances, pancreatitis, and many other contributors. ALI/ARDS results in severe pulmonary edema that brings about hypoxemia due to reduced diffusion of blood gasses across the thickened alveolar membranes. The pathogenesis of this severe edema is believed to be caused by neutrophils that accumulate in the pulmonary vasculature and cause damage that brings about fluid leakage into the interstitial and alveolar spaces. The lungs become less compliant due to the fluid buildup and the decreased ability to produce surfactant. ALI/ARDs leads to inadequate oxygenation, which in turn can lead to decreased cardiac output and shock. Patients with this condition are often refractory to supplemental oxygen and remain hypoxic despite intervention. Death is often the outcome.

Acute kidney injury (AKI) is another complication of shock. The kidneys receive 20% of cardiac output and the renal tubular cells are especially prone to ischemia. Most cases of AKI are from impaired renal perfusion due to a decreased intravascular volume. In severe cases of inadequate blood supply, acute tubular necrosis can be the result. It is very important to monitor urine output during shock because it is a means to assess renal blood flow. It's also important to monitor serum creatinine and blood urea nitrogen to assess renal status.

Gastrointestinal complications can also occur because of shock. When the body is experiencing shock, it prioritizes blood flow to the brain, heart and kidneys by vasoconstricting vessels to other areas. This means that the blood that supplies oxygen and nutrients to the mucosal surface of the gastrointestinal tract will be shunted to other areas. Due to hypoxia in GI tissues, mucus production decreases and patients become more prone to developing ulcers and to bleed internally.

Disseminated Intravascular Coagulation (DIC) is a complication that can arise with shock, most commonly in persons with gram negative sepsis. Slow moving blood combined with the release of inflammatory mediators from the bacteria can activate the coagulation cascade throughout the body and result in the formation of thrombotic occlusions that cut off the blood supply to organs. Platelets become trapped in the thrombi, thrombocytopenia develops, and patients become prone to bleeding. Mortality rates are quite high in patients that develop DIC.

Treatment for Shock

A person in shock should be laid down and their legs elevated to help more blood return to the heart to increase cardiac output. Tight clothing should be loosened to avoid any restriction of venous return. Placing a blanket over the person helps diminish any reflexive need of the body to increase metabolism for heat (and thus increased demand for cardiac output). They shouldn't be given any food or drink as this would just increase cardiovascular demand to the GI tract. Finally, it is imperative to call 911 and get the person immediate medical help. Medical professionals will examine the patient and apply lifesaving strategies that involve protecting the airway and improving cardiac output. Treatments will likely include efforts to restore vascular volume through the administration of intravenous fluids, blood, and blood products. Dopamine may be used as well because it has a strong effect on the adrenergic receptors of the sympathetic nervous system to increase heart rate and contraction strength while also promoting strong vasoconstriction. Dobutamine may also be used. It is like dopamine, but does not have the vasoconstricting effect. In cases of more mild shock, it helps protect vital organs from severe vasoconstriction.