Anatomy of the circulatory system

There are two blood vessel systems in the body, arterial and venous. Arteries are tasked with carrying blood away from the heart and to all reaches of the body, from the top of your head to the tips of your toes. Veins transport the blood from the body's tissues back to the lungs to become re-oxygenated again via pulmonary circulation. This blood is then sent to the heart to be pumped back into the arterial vascular system.

The anatomy of the circulatory system consists of a network of blood vessels that resembles the branches of a tree, extending to every corner of the human body. None of this would be useful, however, without the pumping action of the heart, as it works to make sure blood is pumped with enough force to reach the most remote places in the body.

The human heart is made up of four chambers: the right and left atriums and the right and left ventricles. Each one of these compartments helps to pump deoxygenated blood from the venous system of the body to the lungs to become oxygenated; then pump it back out through the main aorta. This then travels through some larger and smaller arteries into the capillary network (fine branching blood vessels). The heart plays a vital role in the circulatory system with any abnormality potentially being life-threatening.

What causes circulatory system diseases?

Diseases of the circulatory system can present in many different forms. The most common diseases of the circulatory system tend to be a result of longstanding poor health and metabolic disease that take a toll on blood vessels over the years, only to create complications later in life. These may include diseases such as diabetes, atherosclerosis, and high blood pressure (hypertension). Common causes of circulatory problems can be classified into the five following groups:

Trauma

An example of trauma may involve penetrating injuries from knife wounds that damage blood vessels. This type of injury can cause major damage depending on the location of the cut. Blunt force trauma, as in the case of being hit by an object like a bat, can bruise blood vessels to the extent that a blood clot is formed, prohibiting blood flow and causing additional pain. Due to the abundance of varying kinds of blood vessels in the body, collateral circulation helps to still provide the affected part of the body receive oxygenated blood, but this does depend on the severity of the injury.

Aneurysms

Healthy blood vessels contract and expand to better handle varying blood flows. However, sometimes a localized weakness of the vessel wall can cause a portion to expand like a balloon, creating an aneurysm. If an aneurysm were to rupture, severe hemorrhaging will likely result and require immediate surgical repair.

Vascular malformation

A vascular malformation is characterized by an abnormal connection between veins and arteries. Knowing how the circulatory system operates, having such a connection shunts excess blood though small connecting vessel into the arterial system, flooding it with de-oxygenated blood. Depending on the severity of the case, vascular malformation can lead to patients experiencing pain, heaviness, increased temperature, and spontaneous bleeding.

Raynaud's phenomenon/disease

This is a condition in which, during times of stress or in response to cold temperature, the blood vessels in the hand narrow or spasm, restricting blood flow. This is often seen as blue discoloration of the fingertips. The sensation of coldness, numbness, and tingling may also be present. Raynaud's symptoms may also be seen in other distant parts of the body, such as the nose or toes.

Risk factors for circulatory system diseases

Some individuals are more likely to be at risk for developing circulatory system disease. The following are some of the risk factors that lead to the development of these conditions:

Modifiable risk factors (can be controlled, changed, or treated):

- Lack of exercise
- Being overweight
- Smoking
- Overuse of alcohol
- Elevated levels of stress
- Poor diet

Non-modifiable risk factors (cannot be controlled, changed, or treated):

- Advanced age
- Being male
- Family history of heart disease, stroke, high blood pressure, or high cholesterol
- Certain ethnicities

21 circulatory system diseases

High blood pressure

Also going by the term hypertension, this is a condition that is defined by the increased force required to pump blood through your arteries. It is often described as a disease without any presenting symptoms, but over time this excessive force can damage the heart and lead to stroke, heart disease, or kidney problems. High blood pressure does not always have to begin at the heart, as seen with atherosclerosis.

Atherosclerosis and coronary artery disease

Here, blood vessels narrow due to cholesterol plaque buildup on the walls of your arteries, eventually restricting blood flow. This means greater force is required for blood to pass through these narrow areas to be able to deliver adequate blood supply, causing increased blood pressure. If this blood vessel narrowing occurs in the vessels supplying the heart, it can trigger a heart attack.

Heart attack

This occurs when the heart does not receive enough blood due to a blocked coronary artery. If not remedied in time, the heart muscle can become permanently damaged and subsequently lead to heart failure or even sudden death. Typical symptoms of a heart attack include pain in the center or left side of the chest, pain that radiates to the jaw, shoulder, or arm, shortness of breath, nausea, sweating, irregular heartbeat, and/or loss of consciousness.

Heart failure

Also known as congestive heart failure, this condition occurs due to weakened or damaged heart muscle. This causes inefficient pumping of blood throughout the body, as the heart is not strong enough. Early symptoms of heart failure include fatigue, ankle swelling (edema), and an increased need to urinate at night. Later symptoms may include rapid breathing, chest pain, and loss of consciousness.

Stroke

A stroke occurs due to the blockage of a blood vessel within the brain reducing oxygenated blood supply and possibly causing permanent brain damage. It is most commonly caused by a blood clot that originated in another part of the body, such as the heart, then travelling through the arterial system to the brain and causing a blockage (embolic stroke) there. Strokes can also occur due to excessive bleed (hemorrhagic stroke), as seen in the case of brain aneurysms. Strokes are a serious condition, with every minute upon onset proving vital for reversing the symptoms of blood clots in the brain.

Related: Understanding stroke rehabilitation: Exercise tips for stroke recovery

Aortic Aneurysm

This is a condition involving the major artery stemming from the heart, called the aorta. When part of the aorta weakens, it can bulge and potentially rupture. The aorta is the largest blood vessel in the body and carries blood to your abdomen, legs, and pelvis. Rupturing aortic aneurysms can cause heavy bleeding and require immediate medical attention.

Peripheral artery disease (PAD)

Occurring in the peripheral extremities, such as the arms and legs, this condition is essentially atherosclerosis. PAD is characterized by reduced blood flow leading to symptoms such as leg cramps, a foot or leg sore that doesn't heal, and redness or other skin color changes.

Mitral prolapse

The mitral valve separates the left atrium from the left ventricle in the heart. It is a one-way valve that allows a certain volume of blood into the left ventricle in tandem with the heartbeat. Mitral prolapseoccurs when the flaps of the valve do not close properly, allowing for blood to regurgitate backward into the left atrium. While the condition is mostly harmless, some cases may require surgical correction. Mitral prolapse can be distinguished by a unique heart murmur.

Angina pectoris

Referring to pain in the chest, this condition is a specific type of chest pain that is related to the heart. It is often accompanied by shortness of breath, fatigue, and nausea. A diagnosis of angina signifies that not enough blood is reaching the heart muscles. Angina pain patients often take nitroglycerine pills, which help to dilate blood vessels, to relieve the pain.

Arrhythmia

The heart follows a certain rhythmic action that is required to adequately ensure enough blood is pumped out of it. The classic "lub-dub" sounds that emanate from the heart are actually caused by contacting heart muscles and closing of heart valves. If the heart loses this rhythmic action, due to any number of different heart pathology, it will be unable to pump blood out effectively. Arrhythmias often present with fatigue, shortness of breath, and chest pain.

Ischemia

This medical term refers to tissue not getting enough oxygenated blood supply, which leads to tissue damage. This can occur in the heart or any other type of bodily tissue.

Most of the time, ischemia is a temporary problem leading to pain and discomfort. However, there are cases where ischemia occurring over a longer period of time can cause serious tissue damage and dysfunction, sometimes even irreversible.

Varicose veins

Varicose veins are visible veins that may look dark purple or blue in color, usually in the legs and feet. These enlarged and discolored veins may not pose any immediate health concerns to some patients and can be more of a cosmetic problem, looking unsightly or unattractive. However, some individuals experience aching pain and discomfort and this could signal a higher risk for other circulatory problems. Varicose veins are thought to be a result of prolonged standing or walking that increases the pressure in the veins of the lower body, with the effects of gravity mostly to blame. Dysfunction of tiny valves in the blood vessels themselves has also been seen to play a role. Other risk factors include age, sex, family history, and obesity.

Related: Varicose veins natural treatment: How to get rid of spider veins naturally

Chronic venous insufficiency

This condition is characterized by pooling blood in the lower extremities, as it has become difficult for the blood vessels to return blood to the heart. Chronic venous insufficiency can be the result of obesity, a history of varicose veins, deep vein thrombosis, sedentary lifestyle, long periods of sitting or standing, being over 50 years old, being female, or being pregnant. Symptoms often include swelling in the lower legs or ankles, aching feeling in the legs, and development of varicose veins.

Endocarditis

Endocarditis is the result of an infection of the endocardium layer of the heart, which lines the heart chambers and heart valves. The condition occurs when bacteria infect another part of your body and spread to your bloodstream, granting access to infect the heart. If not promptly treated, endocarditis can damage or destroy the heart valves and can even lead to life-threatening complications.

Acute coronary syndrome

This syndrome consists of a range of different conditions associated with sudden restricted blood flow to the heart muscle. These may include myocardial infarction (MI) and unstable angina. Acute coronary syndrome may not only lead to cell death, but also, because it reduces blood flow, it can alter heart function drastically. This is a medical emergency. Symptoms include difficulty breathing, feeling nauseous, sweating, tightness, pressure, or pain in the chest, and pain in the jaw, neck, back, arms, and/or stomach.

Pulmonary valve stenosis

This is a condition of the valve that separates the pulmonary artery from the right ventricle. It is the access pathway for deoxygenated blood to reach the heart to become reoxygenated again. Deformity of the pulmonary valve can cause blood to back up in the heart and the venous circulatory system, leading to symptoms such as shortness of breath, chest pain, and loss of consciousness.

Thrombophlebitis

This inflammatory process causes the development of blood clots that block one or more veins. The legs are usually the most common extremity involved. Superficial thrombophlebitis often appears as redness and swelling in the affected area. If the condition occurs deeper beneath the skin, it may trigger a condition called deep vein thrombosis.

Temporal Arteritis

This condition affects the arteries that supply the head and brain with blood. They can become inflamed and damaged, leading to symptoms, such as a severe headache or blurry vision. Nearly a quarter-million Americans are thought to have the condition, with almost all patients being over the age of 50 years. If temporal arteritis is left untreated, it can cause an aneurysm, a stroke, or even death.

Ventricular tachycardia

This is a type of arrhythmia caused by an abnormal electrical signal to the lower chambers of the heart. The condition is often characterized by irregular ventricular contraction, causing a heartbeat of greater than 100 beats per minute that throws it out of sync with the rest of the heart. Ventricular tachycardia can lead to sudden cardiac arrest.

Related: Ventricular arrhythmia: Meaning, types, causes, treatment, and complications

Congenital heart defects

In the womb, a baby's heart may develop incorrectly, leading to heart dysfunction and additional health problems early in life. There are several types of congenital heart defects, ranging from mild to severe in symptomatology.

Cardiomyopathy

This condition affects the muscles of the heart. There are four main types of cardiomyopathy: dilated; hypertrophic; ischemic; and restrictive. These variations all

cause the heart to have difficulty pumping and delivering blood to the rest of the body, often leading to heart failure.