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Foot Health and Wellness

Poor Arterial & Venous Circulation

Your muscles, skin, bones, nerves & organs need adequate oxygen & nutrition.

Learn how the circulatory systems work; how and why damage happens; and that medical care, treatments, and/or life-style changes often are needed.

Good nutrition is important for the health of your whole body.

Oxygen is necessary for life in the vascular tissue cells, such as organs, muscles, bones, skin, and nerves. Complete depletion of oxygen will cause the tissue cells to die.

How does the circulatory system work: The **arterial circulation** starts when the hemoglobin in the red blood cells picks up oxygen from the lungs. The blood returns to the heart that pushes the arterial blood, under pressure from the heart contractions, into the biggest artery, the aorta, from where smaller arteries branch out to the vascular tissues. Along the way, the blood enters the smallest arteries, the arterioles, that each becomes a **blood capillary** at the end. The **venous circulation** starts at the other end of the blood capillaries with the smallest veins, the venules. The venous blood then enters the bigger veins, and eventually ends up in the vena cava, the biggest vein, that returns the blood to the heart. The venous circulation has one-way valves that prevent back-flow of the blood. Finally, the heart pushes the venous blood into the lungs where it releases carbon dioxide. This is where the blood cycle ends and repeats itself.

The blood capillaries have very important roles. Through their walls they are connected to the vast space between the blood vessels and the body tissues, called the **interstitial space.** The fluid in the blood is called plasma, but once plasma enters the interstitial space, it becomes interstitial fluid; and visa versa.

The interstitial fluid has access to every cell in the vascular body tissues. It picks up elements, including nutrition, in various places and delivers them to other places. Sometimes the blood capillaries are involved; other times not.

The blood capillaries are always involved when the end of the arterial blood releases oxygen, and the beginning of the venous blood picks up carbon dioxide. The venous blood also picks up waste products at the capillary level, and the waste is processed and eliminated by the kidneys and liver.

What is in the blood: Besides the **red blood cells** with hemoglobin, where both oxygen and carbon dioxide can be attached and released in the lungs and blood capillaries, the **circulating blood** also contains the **fluid plasma**; **white blood cells** that can move through the vessel walls and travel through the interstitial fluid to places in the body with bacterial infections or foreign objects to destroy them; as well as **platelets** that remain in the blood vessels to build a protective layer over uneven surfaces or actual injuries.

How does the body maintain a healthy fluid environment: There is a lot of fluid movement at the capillary level between the blood plasma and the interstitial fluids that can alter the amounts of plasma and interstitial fluids. There are also **lymph**

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capillaries within the interstitial fluid. They are called lymph capillaries because interstitial fluid that enters them becomes **lymph fluid,** that is transported through a passageway of lymph vessels, lymph ducts, and lymph nodes back to the venous blood circulation at the vena cava. The continuous uptake of interstitial fluid moves the lymph fluid forward. Lymphocytes in the nodes destroy cancer cells and other damaging elements.

Poor life-style choices are often a cause for medical issues!

- **Arteries** are thick elastic blood vessels. **Atherosclerosis** causes too much plague on the surface of the inner vessel layer, usually due to high cholesterol and triglycerides. **Arteriosclerosis** causes hardening of the middle layer of the arterial wall. Smoking is a big factor. Diabetes is a factor for both. Both can create **thickened arterial blood vessels**, resulting in: **high blood pressure** and weak areas of the arteries that can bulge out and become **aneurysms** that can rupture with fatal results. **Narrowed or blocked arterial blood vessels** have limited or no arterial blood flow and oxygen. **Arterial or diabetic foot ulcers** can develop.
- **The amount of oxygen picked up by the hemoglobin** can be decreased due to smoking-related **emphysema** that makes breathing difficult. **Pernicious anemia** is inadequate hemoglobin that reduces the arterial oxygen. See your MD for this.
- **Swelling in the body is usually in the interstitial fluid. Congestive heart failure** causes a back-flow of venous blood and increases the amount of interstitial fluid. So does damage to the **liver** and **kidneys**. **Venous plasma** can leak out of the blood capillaries and increase the interstitial fluid in the lower legs and feet due to **gravity.** The constant high pressure in those veins can gradually damage the small vessels in the skin and make it fragile. The fragile skin easily breaks from a tear or bump and forms a **venous ulcer** in the lower part of the leg.
- **A DVT (deep vein thrombosis=clot)** can be caused by inactivity. The blocked large vein causes redness, pain, and increased interstitial fluid. Pieces of the clot can dislodge and travel to the heart, lungs, and brain with severe consequences.

Even in the absence of the above conditions, the feet and lower legs can still swell up due to **bulging veins as a result of leaky one-way valves in the deep thin veins** that transport most of the venous blood back to the heart. **Gravity** is the additional factor. **Resting with the legs up** and **walking,** that causes the calf muscles to contract and exert external pressure to move the venous blood toward the core of the body, are both helpful. **Compression stockings** are also helpful if used correctly. **Varicose veins** in the smaller veins by the skin are also caused by leaky valves in the smaller veins. They can hurt; they are not essential; and they can be surgically removed.

See the handouts on *Healthy Nutrition and *Compression Stockings