Ballooned, enlarged, puffy, unbalanced, or disproportionate-looking CRPS-affected areas are a regular occurrence in the experience of those with Complex Regional Pain Syndrome—whether that is to mild or extreme degrees and whether it is come-and-go, was highly visible close to onset and became less visible over time, or is a 24/7-round-the-clock symptom. Let's discuss what's going on beneath the surface and some practical ways it can be addressed to reduce the negative impact it can have on a person's quality of life and condition management.

What's Going On

A usual occurrence in CRPS is swelling or edema;[1] it is considered so commonplace and cornerstone that it is one of the four signs and symptoms of the Budapest Criteria,[2] and it is particularly notable during the acute phase of CRPS. This swelling is thought to be the result of vasodilation and plasma extravasation—or the watery part of blood (without red blood cells, white blood cells, and platelets) slipping outside of the vascular system into the surrounding area, usually through gaps in the walls of small veins due to vasomotor dysfunction in the case of CRPS.[3,4,5,6,7] Another thought process for the source of this swelling is neurogenic inflammation (the activation of immune cells, glial cells, and inflammatory mediators within the nervous system) causing localized fluid build up.[8] Regardless of what is the root mechanism for causing the plasma to move outside of the blood vessels, it needs to be addressed now that it is there and accumulating.

This extravasated plasma moves into the interstitial space (which is the fluid-filled space between the vessels and the other cells that receive oxygen and nutrients from those blood vessels). The more fluid that fills this interstitial space, the more pressure is applied to the surrounding structures like muscles, organs, and blood vessels. The extravasated plasma takes on a new name as it settles into the interstitial space: lymphatic fluid. This is because the lymphatic system is now responsible for picking up this fluid and returning it to the circulatory system to be reincorporated into the blood after it has been cleaned.[9]

Due to the ischemia-reperfusion injury cycles that are a core component in CRPS,[5] the build up of this lymphatic fluid can apply pressure to blood vessels that forces them either fully or partially closed, particularly in small arteries and capillaries that can be affected by only small amounts of external pressure. This can negatively impact circulation and perfusion (which is the delivery of oxygen and nutrients and the removal of waste products via blood as it leaves the circulatory system and reaches body tissues).

In CRPS, this swelling has a tendency to start in deeper tissues and move towards the surface as more fluid accumulates, which also applies ever increasing pressure to the surrounding structures. As it gets closer to the surface, it can be very visible with the area ballooning out; this is particularly the case during the acute, hot, reperfusion-dominant phase of the condition. However, during the persistent, cold, ischemia-dominant phase, swelling has a tendency to be less visible in many individuals; this is due to a combination of the swelling remaining deeper in the tissues and/or the circulation in smaller vessels being so impaired

that there is no plasma flowing through the small arteries and capillary beds to fall out of the gaps in the walls of the small veins.[5]

This lymphatic fluid can apply mechanical pressure to local nerves in the affected area, causing them to fire spontaneously and create a pain response.[5] The more swelling and pressure there is, the more often and intensely the nerves can send off pain signals. Reducing the amount of lymphatic fluid in the interstitial space, and thereby reducing the amount of pressure being applied to surrounding structures, can help reduce the amount of pain signals the nerves in that area are sending off to the brain; it also can increase circulation and help break the ischemia-reperfusion injury cycle by reducing the amount of external force being applied to (particularly small) vasculature so that more blood—with its oxygen and nutrients and ability to remove waste products—can disperse through the capillary beds into the surrounding tissues.

When small arteries and capillary beds are blocked by vasospasms and blood cannot get through to properly circulate and perfuse in the tissues, what happens instead is vascular shunting. During vascular shunting, arteries connect to veins directly without having a distributary capillary bed in between where blood can perfuse into the tissues, so they can be oxygenated and nourished. This allows blood to continue to circulate through the body and make it back to the heart and lungs, but it does not address the needs of the body parts that get shunted over to avoid the vasospasm blockage. (This is not the same thing as a biocompatible shunt implanted by a medical professional to move fluid or maintain circulation; this is a naturally occurring process, though the purpose is the same.)

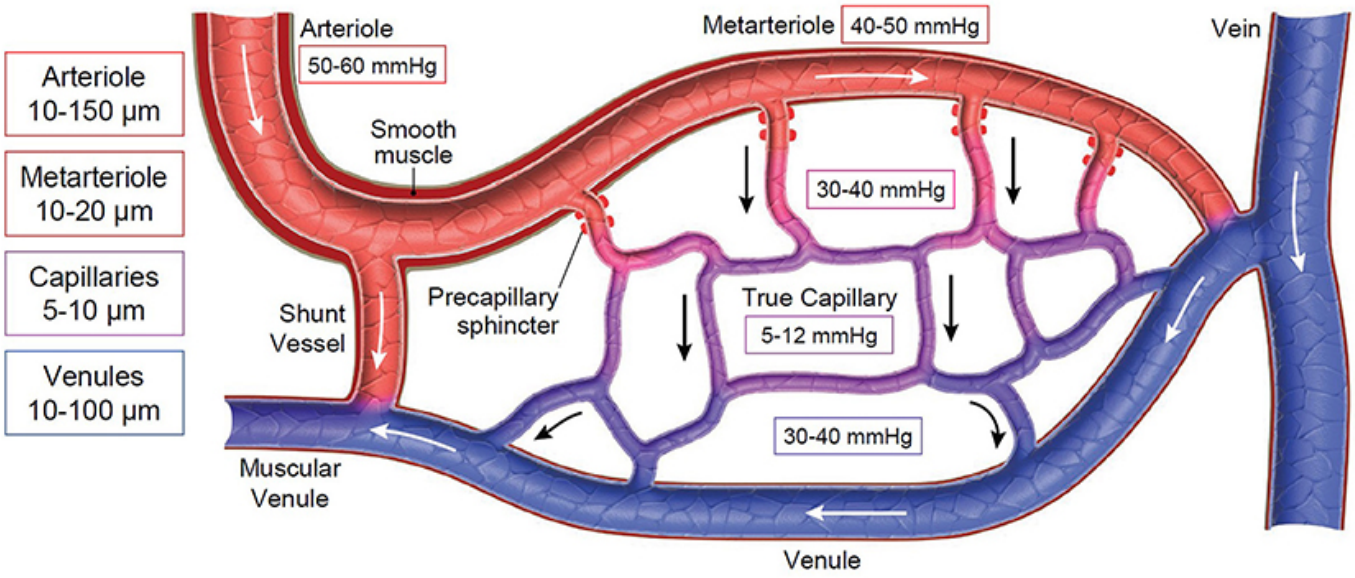

Image Credit: Cooper, Silverstein, Fluid Therapy and the Microcirculation in Health and Critical Illness (Frontiers in Veterinary Science, 2021)[10]

The shunt vessels have a much higher resistance than capillaries to external pressure collapsing them. By reducing the amount of pressure lymphatic fluid applies on the small

arteries and capillary beds so that they can open and be conduits for blood again, perfusion to surrounding tissues can increase dramatically, and the circumstances for which the shunt vessel is present are not as immediate and relevant to current circulation.

In CRPS, the lymphatic system can get overwhelmed and struggle to keep up with clearing all the fluid the vascular system leaks out, especially when the area that is accumulating that fluid is a far distal area that has to fight against gravity, like a hand or a leg, especially a foot. Additionally, the sympathetic nervous system, which is dysfunctional in CRPS, is the dominant innervation for the lymphatic system and regulates its contractions and synchronicity.[11] The lymphatic system heavily relies—for about one-third of its pumping power—on activity from surrounding muscle tissue to help move lymphatic fluid through its system;[11] when individuals are less active, and therefore have less muscle activity, the lymphatic system takes a hit as a large part of its extrinsic pump system is diminished.[12]

Steps that we can take to assist the lymphatic system in clearing the swelling created by the leaking plasma that becomes lymphatic fluid will help reduce the frequency and/or intensity of pain signals firing from nerves spontaneously and improve our circulation, which can have broad impacts in other areas of life.

Practical Application

- There are two main stages in addressing lymphatic swelling: reduction in the amount of edema in the interstitial space, and maintenance to prevent / reduce the edema from returning to the previous level.
- Manual lymphatic drainage is a non-invasive physical therapy modality that helps activate the lymphatic system to pick up more lymphatic fluid, particularly in areas where the lymphatic system is overwhelmed and not sufficiently operating.[13] This approach can be done by a physical therapist; it is also fairly easy to learn and can be self-administered or done by a trusted other if circumstances do not align for regular physical therapy appointments for any number of reasons.
- If physical touch is too intense and painful for those with allodynia, let gravity work with you instead of against you. Raising legs or arms even slightly above the heart, such as by raising the end of one's mattress a few inches or laying on the floor or couch with pillows under one's limbs, can have a cumulative effect of assisting in gradually driving the lymphatic fluid back towards the heart and surrounding lymph nodes. For those willing to attempt raising their legs over their heads/chest for a few minutes, such as by resting their legs on the wall or the edge of their bed, the force of gravity will be even greater and the downward path more direct.
- While there are many online resources and videos demonstrating manual lymphatic drainage techniques, often put out by trained healthcare professionals, (which I recommend you research if interested in exploring more about self-administered MLD) one key element to remember is to use a light touch.[14] Less is more in lymphatic drainage. If you can feel your muscles, you are using too much force and need to ease up the amount of pressure you are applying with this technique.

- If you overstretch your skin, you are using too much force and need to ease up. Skin should only be stretched as far as it naturally wants to extend and no further. These two components of Light Touch and Light Stretch make this approach non-aggressive for those with CRPS who are very sensitive to touch.
- For those who prefer to use tools, Gua Sha tools are easily applicable to lymphatic drainage techniques; dry brushing is another approach for lymphatic stimulation. Pneumatic compression devices look like big mechanical socks, though they can also be built for other body areas; they help circulate lymph fluid and prevent blood clots, especially for those with severely reduced mobility or who are bedbound.
- Compression garments and tapes or wraps are an approach meant to prevent lymph fluid from accumulating in the interstitial space so that swelling does not occur, or at least so that it is not as severe as it would have been without wearing the compression socks. Some people with CRPS find compression garments to be immensely assistive while others find the amount of pressure applied or other factors associated with wearing clothing intolerable due to allodynia. General recommendations across the board for lymphatic swelling is to search for compression garments with 30-40mmHg or moderate compression; however, some individuals with CRPS who still consider compression garments useful may find this amount of pressure is not best suited to their needs and some trial and error may be in order to determine the most appropriate fit. For those who prefer the taping method, the adhesive can cause irritation during use or skin issues upon removal for some users.
- Deep, diaphragmatic breathing is recommended to be utilized in concert with lymphatic drainage to assist in further activating the lymphatic system.[15]

Closing

The leaking blood plasma that becomes lymphatic fluid and accumulates in the interstitial space can increase pain and dysfunction for those with CRPS by applying pressure to surrounding structures, especially small blood vessels and nerves. Finding effective, efficient ways to clear this accumulated fluid, reduce the amount that lingers in spaces it should pass through, and prevent fluid from being able to gather in these spaces in the first place can increase quality of life and independence for activities of daily living while reducing the CRPS symptoms that are caused or exacerbated by this deep tissue swelling.

Thanks for sticking with me, I hope you learned something, and I hope to see you next time.

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