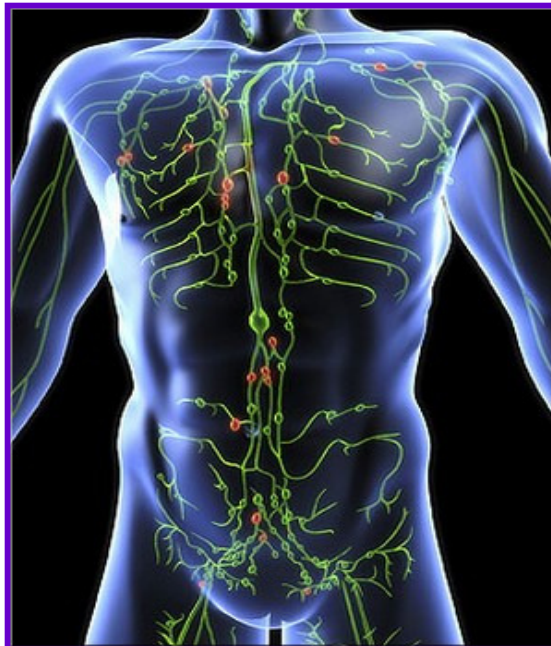


# The Lymphatic System and Manual Lymph Drainage



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## **Introduction**

There is a system in the body that is so crucial to its survival, and yet for hundreds of years went undiscovered by the great physicians of the world. This subtle system of the body is called the lymphatic system. The lymph system is a network of thin vessels, ducts and nodes that are responsible for the nourishment of cells and removal of waste from the body. The lymph system is a critical component of the immune system, delivering white blood cells and antibodies to fight bacterial infections throughout the body. All our cells are bathed in lymph fluid and therefore life, health, and youth are all dependent on the movement and constant renewal of this fluid. We will explore the history and discovery of the lymph system, its function and structure, as well as the effects of manual lymph drainage (MLD). Knowledge of the lymphatic system and proper MLD technique gives the esthetician and massage therapist a very powerful healing skill to employ with clients.

## History of the Lymph System

The earliest reference to the lymph system was made by Hippocrates in the Fifth Century BC in his work “On Joints” where he briefly mentions the lymph nodes in one sentence. Subsequent to that reference, Rufus of Ephesus, a Roman physician (First to Second Century AD), identified the axillary, inguinal and mesenteric lymph nodes as well as the thymus. Then, in the Third Century BC, Herophilus, a Greek anatomist, was the first to note the lymph vessels of the intestinal system called the lacteals. He erroneously concluded that the “absorptive veins of the lymphatics” or lacteals drained into the hepatic portal vein and then into the liver for purification. The Greek physician Galen (Second Century AD) further promoted the findings of Rufus and Herophilus. Galen studied apes and pigs and furthered the research of the lacteal and mesenteric lymph nodes. However, at this time it was believed that blood was produced by the liver from chyle, a milky fluid produced during digestion containing lymph fluids and fats. It was believed that various organs added nutrients to the chyle mixture to produce blood, and then the blood went to various parts of the body to be consumed by all the organs of the body. In this case, blood would have to be produced and consumed many times over. The erroneous belief that blood was produced in the liver from chyle was unchallenged until the seventeenth century.

In 1563 Bartolomeo Eustachi, a professor of anatomy, studied the thoracic

duct in horses and named it *vena alba thoracis*. Furthering the knowledge of the network of lymph vessels was based on the work by a physician named Gasparo Aselli who in 1622 identified the lymph vessels in the intestines of dogs and named them *venae alba et lacteae* (now known simply as the lacteals). It was only with his discovery that the lymph system as separate from the arteries and veins came into existence. This assertion disproved Galen's theory that chyle was carried by the veins. However, Gasparo still believed that chyle was carried to the liver (as taught by Galen). He also discovered the thoracic duct, but never made the connection between the lacteals and the thoracic duct. This critical connection was made by Jean Pecquet in 1651, who discovered the chyli receptaculum (now known as the cisternae chyli) and the discovery that the lacteals' contents enter the venous blood system via the cisternae chili and the thoracic duct and not the liver.

The idea that blood *re-circulates* rather than the earlier idea of blood being produced by the liver and the heart gained acceptance because of the work by William Harvey in 1628. This furthered the knowledge of the lymph system as a separate system that supported the vascular system. Then in 1652, a Swede named Olaus Rudbeck, discovered a network of vessels in the liver that he named the hepatico-aqueous vessels and again, like Jean Pecquet, learned that they emptied into the thoracic duct and that they had valves. He announced his findings in

the court of Queen Christina of Sweden. Before Rudbeck published his discoveries on the lymph system, similar findings were published by Thomas Bartholin, who made the final discovery that lymph vessels were throughout the whole body and not just the liver and intestinal area. He is also the one to give the name “lymphatic vessels” to the entire network of vessels.

It wasn't until the work of Dr. Emil and Estrid Vodder in 1932, that the scope of the effect of the lymph system on various ailments would be completely explored. While working as massage therapists along the French Riviera, the Vodders were making the connection between lung congestion, chronic colds and the presence of swollen lymph nodes. The majority of their patients with lung and respiratory disorders came from Northern Europe where the climate was damp. They developed a method of stimulating the lymph flow through a gentle manipulation that reduced inflammation of the lymph nodes thereby resolving the upper respiratory problems. The Vodders were the first to term this type of massage as Manual Lymph Drainage. The Vodders' understanding and manipulation of the lymph system led to the discovery of its effectiveness in treating systemic and local edema, acne, rosacea, cellulite, toothaches, healing post surgery and more. For the next forty years Dr. Vodder and his wife worked as practitioners of MLD providing training worldwide and making knowledge of the lymph system mainstream and accessible to the health care and wellness practitioner.

## Functions of the Lymph System: Immune System

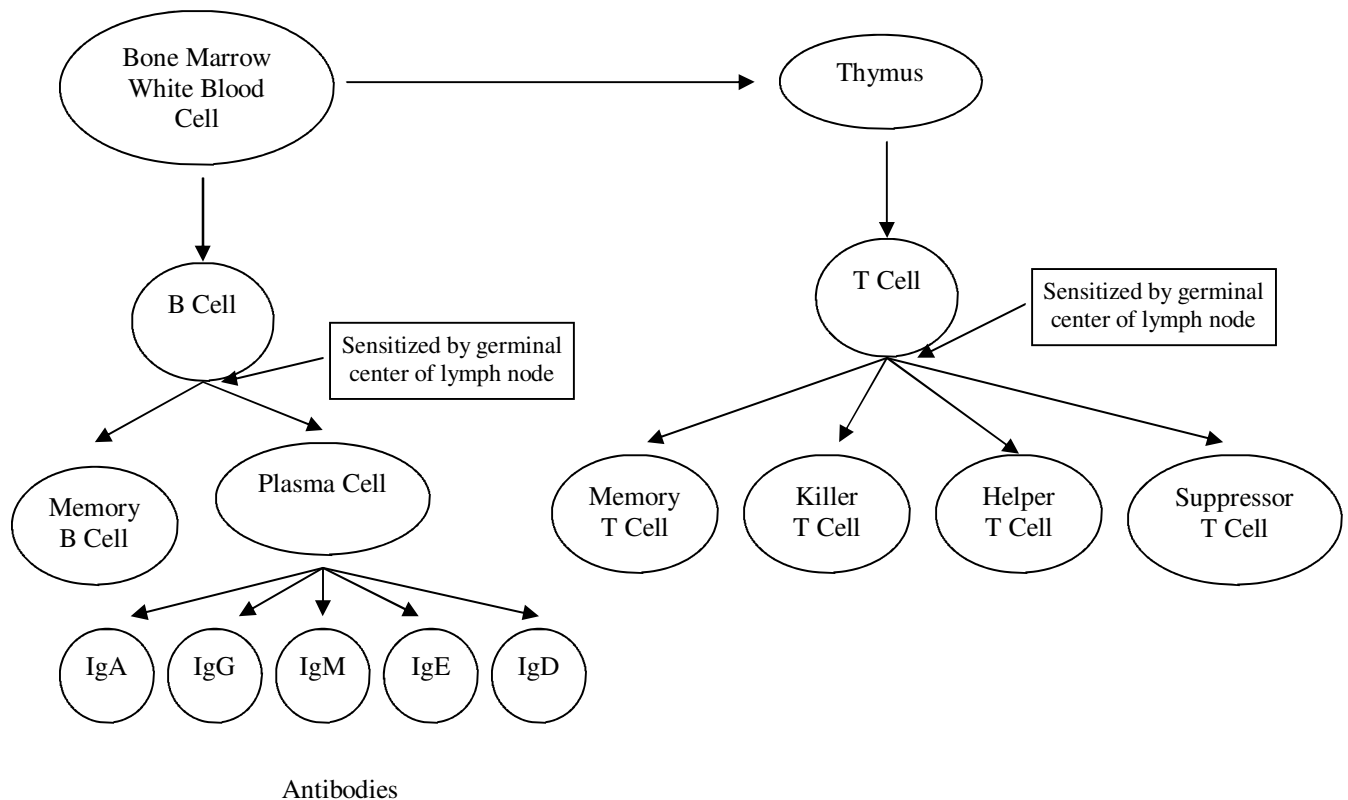
The lymphatic system aids the immune system in destroying pathogens so that the lymph can safely be returned to the venous blood and circulatory system. This is done through the production of B Lymphocytes from the red bone marrow and T Lymphocytes from the thymus.

The B Lymphocytes produce antibodies that target pathogens in the body. The B lymphocytes are *sensitized* in the germinal center of the lymph node. The B Lymphocyte will create memory B cells that will remember a pathogen if there is a re-occurrence. A second exposure to a known invading body has a much faster response by the immune system. There are five different antibodies or immunoglobins (Igs) that are produced by the plasma cell from the B Lymphocyte sensitization as outlined below:

- **IgA**—found in the mucous membranes and protects against pathogens at the point of entry;
- **IgG**—Gamma globulin—found in the blood and protects against viruses, bacteria, and mutant cells.
- **IgM**—Macro globulin—rapid response antibodies that quickly target the pathogen.
- **IgE**—Allergies—Interacts with mast cells and basophils—creates an allergic reaction.
- **IgD**—flags identity—Notifies B & T Lymphocytes of antigen's presence.

The second type of immune cell is the T Lymphocyte which is produced by the thymus and is released into the blood stream. Similar to the B Lymphocyte, it is sensitized by the lymph node. The T Lymphocyte also produces memory T Cells to remember invading foreign bodies. The different types of T Lymphocytes are as follows:

- **Killer or Cytotoxic T Cells**—Kill on contact; direct attack cells.
- **Helper T Cells**—Helps support and amplify B Lymphocyte production of antibodies.
- **Suppressor T Cells**—Regulates immune response by suppressing the functions of both the Killer and Helper T cells; inhibits production of antibodies by B Lymphocytes; Ratio of Helper T Cells to Suppressor T Cells is 2:1.



## **Functions of the Lymph System: Nourishment, Waste Removal & Fluid Balance**

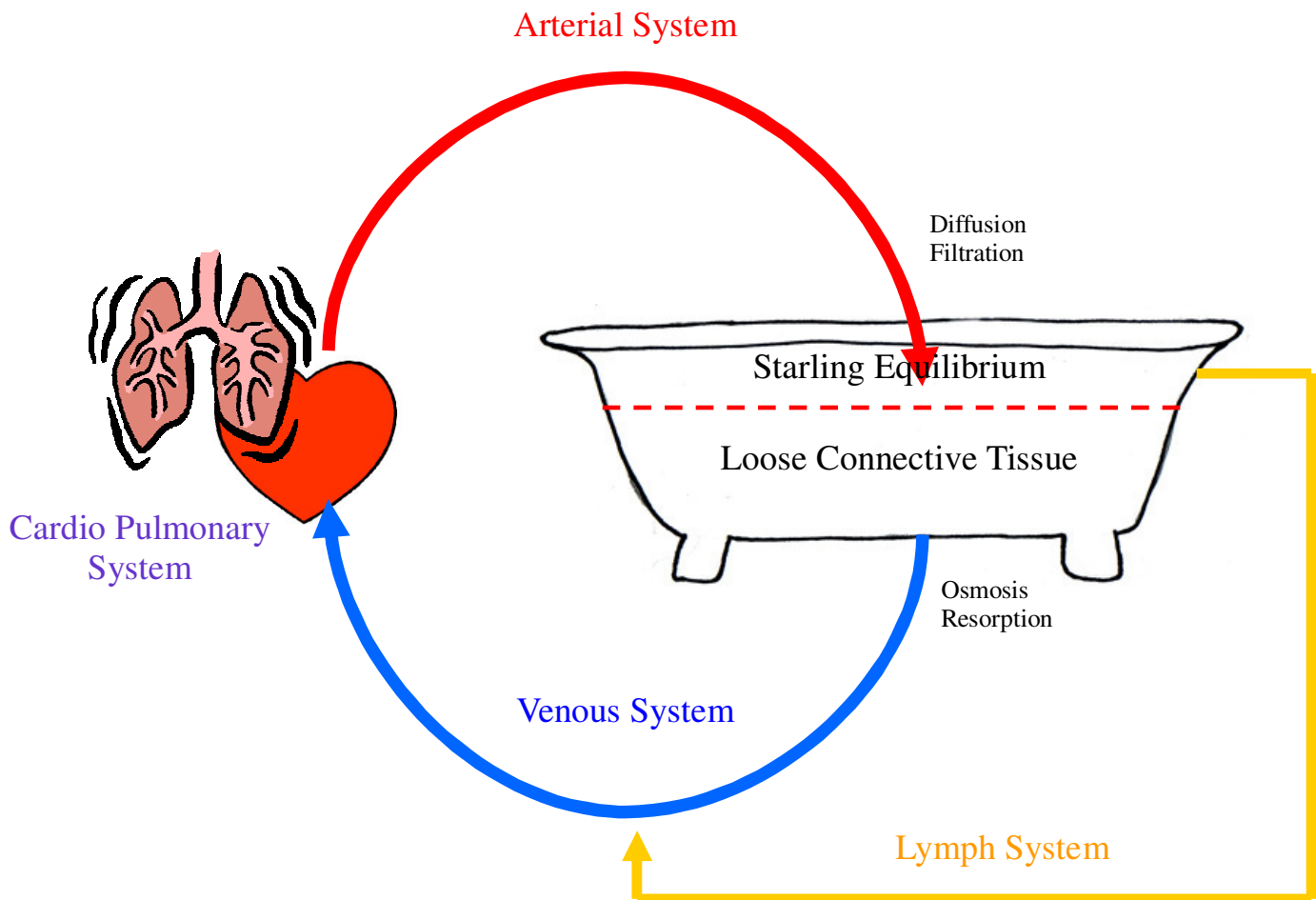
Lymph (also referred to as intercellular or interstitial fluid) comes from the fluid portion of the blood or plasma. The oxygenated arterial blood flows from the arteries out into smaller capillaries where it slows down. Because the pressure inside the blood capillaries is higher than in the surrounding loose connective tissue (LCT), water, protein and other substances are pushed out into the LCT through the process of diffusion. Once in the LCT, the intercellular fluid delivers nutrients, oxygen and hormones to the tissues and cells. Health is dependent on the circulation of nutrients for metabolism. Since all substances must pass through connective tissue to reach the cells, the lymph system plays a key role in the delivery of these nutrients.

Lymph re-enters the venous capillary system through the process of osmosis. Osmosis is the diffusion of water across a semi-permeable membrane. Because there is more protein in the venous blood than in the interstitial fluid, water is attracted to the area of higher concentration and leaves the LCT and is reabsorbed into the blood stream. However, since not all of the fluid is reabsorbed back into the venous system, the fluid left behind is considered the Lymph Obligatory Load (LOL). An important function of the lymph system is protein circulation. Protein can leave blood capillaries but can not re-enter them. The

lymph system is responsible for transporting protein from the LCT and returning it to the circulatory system via the LOL. The LOL consists of large protein molecules created by cells and tissues, water, long chain fats, dead cells, viruses, bacteria, lactic acid, hormones and foreign substances such as wood, glass, dust and dye. The LOL is taken up by the initial lymph vessels and carried into the lymph system for purification by the lymph nodes. The lymph system is the waste removal system for the body.

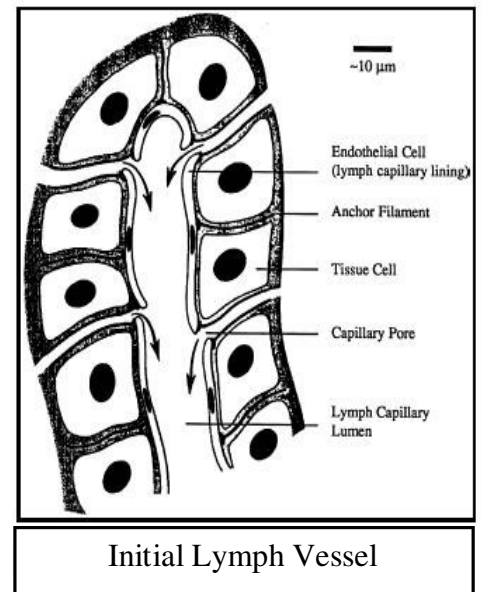
Another important task of the lymph system is fluid balance. The body is two-thirds liquid consisting of 5% blood, 15% connective tissue fluid and 40-45% intercellular fluid. This fluid is the medium through which all nutrients must pass. If the lymph system is inadequate then fluid movement is compromised and an imbalance can occur. The best illustration of the mechanism of fluid balance in the body is the bathtub analogy based on the Starling Equilibrium developed in 1896 by British physiologist Ernest Starling. The contents of the bathtub are the intercellular tissues. Water flowing into the bathtub is the fluid filtering in from the arterial system. The outflow is the reabsorption back into the venous blood system. If the venous blood system is compromised and can not reabsorb as quickly as the inflow from the arterial system, the bathtub water level begins to rise. The only mechanism that keeps the bathtub from overflowing is the lymph system which plays the role of the over flow drain. The lymph system takes all

the fluid not picked up by the venous system and circulates it into the lymph system for purification and ultimately back into the venous blood stream via the main lymph ducts. If the lymph obligatory load exceeds the normal transport capacity of the lymph system due to a chronic breakdown of the venous circulatory system, then edema develops.



## Structure of the Lymph System

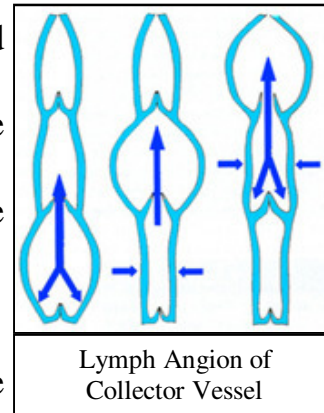
The lymph leaves the loose connective tissue through the initial lymph vessels (ILV). ILV's are small tubes that are the thickness of one cell. The ILV is lined with endothelial cells and surrounded by fibrous reticular tissue. They are anchored to the loose connective tissue (LCT) by an anchoring filament. When there is excess protein in the LCT, less water can flow out of the tissue via the blood capillaries because protein binds water. And since the protein molecule is too large to exit via the venous capillary, the pressure builds and the surrounding tissue swells. When this happens, the fibrous connective fibers are separated thereby pulling open the anchoring filaments and the LCT drains into the ILV and the lumen of the structure.



The precollector vessels collect lymph from several ILV's and transport it to the collector vessels. Precollectors rely on extrinsic forces to move the lymph along the vessel such as the contraction of skeletal muscle. There are a series of valves that keep the lymph flowing forward toward the collector lymph vessels. Lymph naturally flows in the direction of least resistance forming watershed areas which will be discussed later.

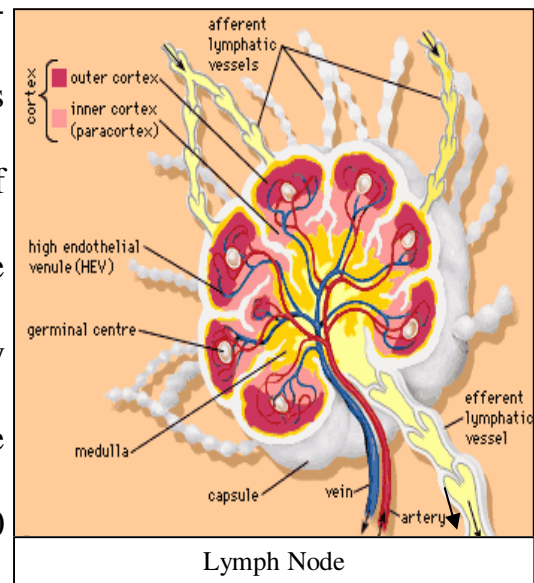
The collector lymph vessels are made of lymph angions that also contain

one way valves that prevent back flow. The angions give the lymph collectors the appearance of a chain of pearls. An angion is a segment of the vessel created by the space between two valves. Smooth muscle called *media* surrounds the collector lymph vessels and cause the valves to contract sequentially to move lymph toward the thoracic region.

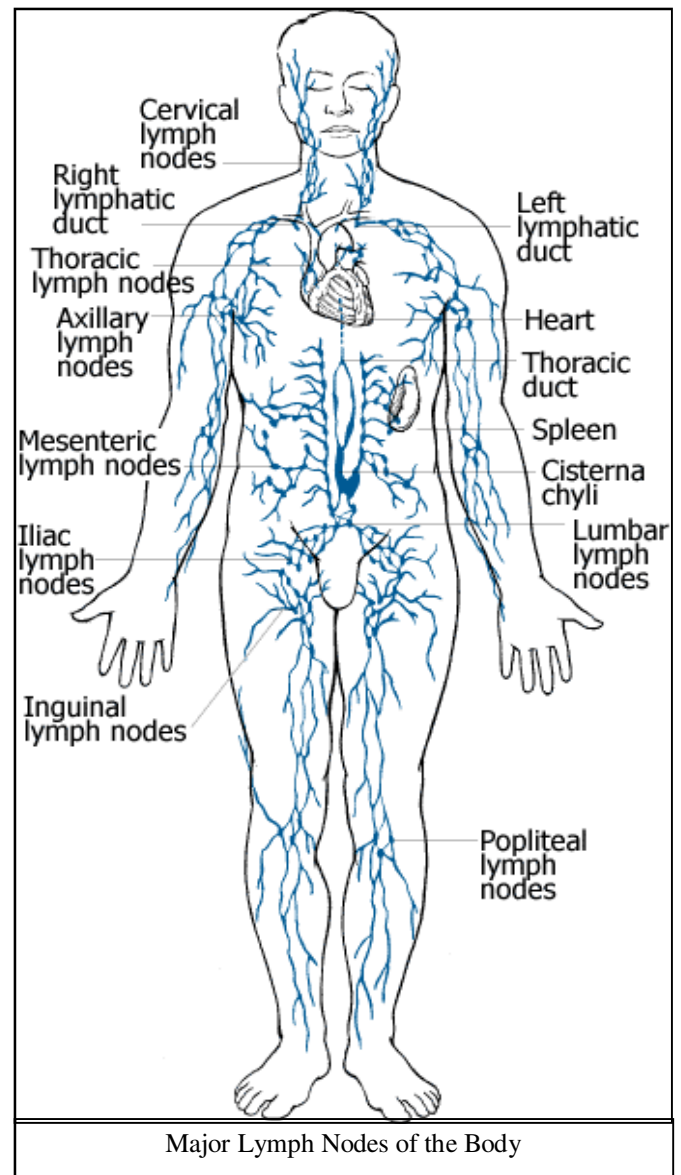
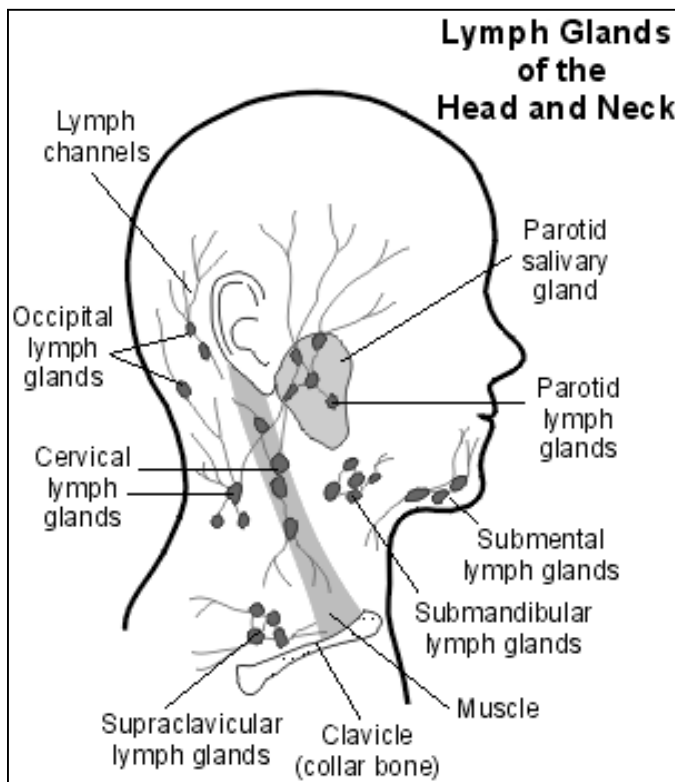


All collector valves lead to a lymph node where the

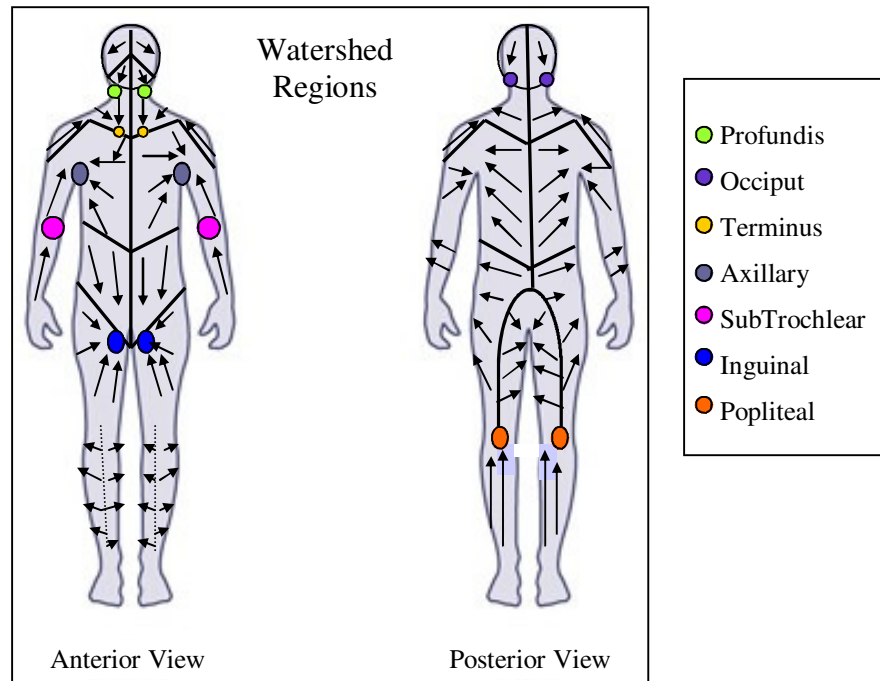
lymph fluid is filtered. The node contains sinuses where many scavenging white blood cells or macrophages destroy and breakdown bacteria, viruses and foreign material. The structure is made up of connective tissue surrounding sinuses and at the interior germinal centers. As discussed in the immune section, the germinal centers are where lymphocytes are activated to become plasma cells that create antibodies to attack invaders. The lymph nodes serve the purpose of isolating harmful material from the body. When an infection occurs and the lymph node is activated, there is inflammation and swelling of the node. Afferent vessels bring lymph to the node, and efferent vessels carry clean fluid away from the node and ultimately back into the venous circulatory system. There are over 600



lymph nodes in the body of which most are located in the head neck and thoracic region. The major superficial lymph nodes that the massage therapist is working with are the cervical nodes in the neck, the thoracic nodes in the chest, the axillary nodes in the underarm area, the sub-trochlear nodes in the bend of the elbow, the inguinal nodes in the groin area, and the popliteal nodes on the back of the knee. During a facial treatment, the esthetician will massage to drain the lymph nodes of the face, neck and chest.



## Pathways of the Lymph System



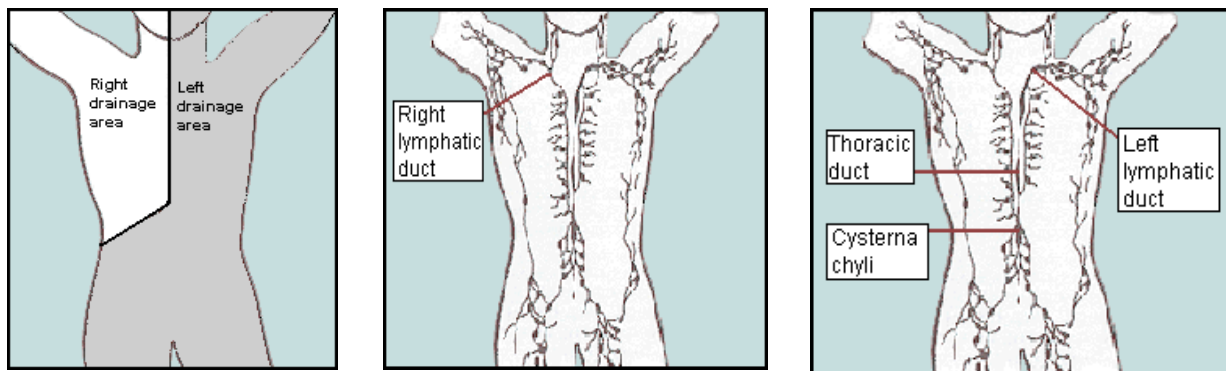
The lymphatic system has a precise way of flowing and territories that the lymph vessels serve. These territories are called watersheds. The body is divided by borders that lymph will not flow across. The upper and lower body are divided into two major regions by the Navel-lumbar line. Another horizontal border divides the neck and head from the lower region by a line that follows along the clavicle and the spine of the scapula. The legs are separated from the trunk by a border running along the top of the anterior thigh. Likewise, the body is divided into vertical watersheds. On the anterior body there is a dividing line that runs from the jugular fossa to the pubic bone, and on the posterior side the border runs down the spinal column. Also on the posterior side there is a “saddle of the thigh”

watershed that starts at the sacrum and extends on both sides to the middle of the posterior thigh then extends down to the popliteal region. On the upper arm the vertical watershed starts at the lateral upper arm and around the deltoid. The head is divided into quarters vertically, one line from ear to ear, and the other from the mid occipital ridge to the front along the ridge of the nose and the hyoid bone. There is an additional border on the face running from the bridge of the nose to the angle of each jaw of the side of the face. It is important to know the watershed regions and the direction of lymph flow, especially when performing manual lymph drainage.

Once the lymph vessels have collected and filtered lymph to the various nodes where it has been cleansed of debris and pathogens, it is now safe to deposit back into the venous circulatory system. The largest lymph vessel in the body is the thoracic duct which empties into the left subclavian vein. The thoracic duct begins at the cisterna chyli where many pathways converge from the lower legs and organs of the pelvis region. The iliac node group drains the urogenital organs, bladder, prostate, urethra and ureter. The iliosacral lymph nodes drain the anus and rectum. The lumbar lymph tracts drain the kidneys, testicles, ovaries, oviduct and uterus. The abdominal lymph nodes drain the spleen, pancreas, stomach, duodenum, gallbladder, upper colon and lower liver. All these lymph pathways from the organ systems drain into the cisterna chyli and then move up through the

thoracic duct of the terminus where it rejoins the venous system via the left subclavian vein. The thoracic duct collects lymph from nodes on the left side of the head and neck, left arm and left upper quadrant of the body before joining the left subclavian vein.

The right lymphatic duct empties directly into the right subclavian vein and is responsible for draining the areas of the right side of the head and neck, right arm, upper right quadrant of the body. This includes the liver capsule and upper liver, the heart, the right lung and lower lobe of the left lung.



## **Manual Lymph Drainage: Effects**

The main purpose of manual lymph drainage is to stimulate the flow of lymph fluid. The lymph system has no pump of its own and relies on the contraction of the skeletal muscles, the pressure of blood in the vascular system, and gravity to move it along. As we age, the ability of the lymph to maintain a healthy flow diminishes greatly as the venous blood flow and pressure weakens, the immune system diminishes, and the ability to process proteins is compromised. This all leads to an increased load on the lymph system. Unless an individual exercises regularly, strengthening the heart and vascular systems and stimulating skeletal muscle contractions, it is beneficial to support the body with manual lymph drainage. When properly performed, manual lymph drainage increases the contraction of lymph vessels, which increases the transport of the lymph obligatory load and siphoning at the site of the initial lymph vessels. MLD also promotes an increase in blood flow without raising blood pressure.

Another important role of MLD is balancing the autonomic nervous system. The sympathetic nervous system is active during the day and comes into play for the flight or fight response, and gives us energy for the daily needs of work and activity. The parasympathetic system is active at night and is all about restoring, repairing, and renewing the body. The parasympathetic system is active during times of rest. In a healthy person, these two branches of the autonomic

nervous system are balanced. But in current times, people more often than not find themselves stressed with work and worry and dominated by the sympathetic nervous system. When the therapist performs MLD with a light pressure, slow repetitive strokes and rhythmical movement, the sympathetic (flight or fight response) nervous system is sedated, and the parasympathetic (rest and renewal) nervous system is activated. This effect reduces hypertension, muscle tension, and promotes relaxation. Promoting the parasympathetic state enhances the flow of lymph in the body.

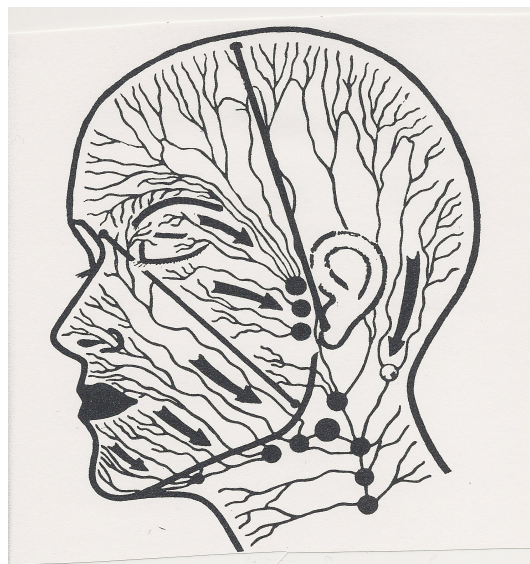
MLD also has an analgesic effect on the body by stimulating the inhibitory cells. Inhibitory cells interrupt the pain impulse between the pain receptors and the brain. The Pain/Gate theory is based on the fact that only one impulse can get through to the brain at a time. When MLD is being performed the signals from the nociceptors (detect harmful physical or chemical change to tissue and illicit a pain response in the brain) are bypassed because the mechanoreceptors (detect stimuli related to touch, pressure and vibration) are constantly being stimulated by the MLD movement. MLD's continually changing pressure activates the inhibitory cells and provides an analgesic effect.

## **Manual Lymph Drainage: Technique**

Manual lymph drainage, unlike typical massage, must be done with a light pumping pressure. The pressure should not exceed 1 to 8 ounces per square inch. The lymph vessels are very delicate and lie superficially under the skin. The key is to create a rhythm that is slow enough to push the fluid along like a river. The Vodder method incorporates stationary circles with an increase in pressure on the downward stroke going in the direction of the efferent vessel, and a release of pressure on the upward continuation of the circle. It is important to perform the stationary circles at least five to seven times at each location to ensure that the fluid maintains a momentum. The stationary circles are performed with the pads of the fingertips and there should be no gliding over the skin. This technique is used on the face and neck areas. For larger areas of the body the pump technique is used with the palm face down. The wrist acts like a hinge moving up and down to create a light pressure. In this technique the fingers are relaxed and outstretched and the pressure is applied by the fingers and thumb as the wrist descends. With these techniques it is important that the skin is moved rather than stroked as in a massage.

In all universal methods of drainage, it is important to drain the areas proximal to the nearest lymph node before moving distal. This ensures that the proximal area is emptied to make room for fluid flowing in from the distal

regions. The direction of the pressure depends on the direction of flow of the efferent vessels as laid out by the watershed areas. The pressure on the downward phase of the circular motion should last longer than the relaxation phase. Also, there should be no reddening of the skin which indicates too much pressure. As Dr. Vodder states in his text book on MLD “the drainage must be performed softly, harmoniously, rhythmically, and with supple hands. Hard massage, or spasm-like tension can give rise to local constriction of lymph capillaries with the formation of new infiltrations.” This technique is gentle enough to be used post-surgery to help with edema that arises as part of the healing process.



Watershed Regions of the Face

## **Manual Lymph Drainage: Applications & Contraindications**

Cosmetic indications for MLD are acne and congestive conditions such as rosacea, facial erythrosis, facial edema, and hematomas (post surgery). In general facial lymph massage helps bring nourishment to the skin cells, helping new healthy tissue to form. It also detoxifies the skin, helping remove bacteria that causes acne and removes foreign matter that causes inflammation.

MLD also helps with the general health of the body by draining stagnant interstitial fluids, toxins, and proteins, helping the body remove toxins and waste. Therefore, this therapy is ideal for treating adipose tissue and cellulitis since it brings circulation to the area which helps break down protein and fatty deposits for removal from the body. Adipose tissue often collects and forms at the inner thigh and upper arms where the axillary and inguinal lymph nodes are located. Lymph drainage helps eliminate the collection of adipose tissue in these areas.

MLD is most commonly used for edemas. Edemas develop as a result of the lymph obligatory load exceeding the capacity of the lymph system to transport it away. This happens as a result of the failure of another system in the body such as high blood pressure or when the heart and heart valve are not functioning properly. Another cause of edema may be thrombosis which creates an obstruction in the venous system which causes a backup of the circulatory system. And lastly,

general venous insufficiency causes congestion of fluid in the loose connective tissue. If the lymph system can compensate for the increased lymph obligatory load, then no edema develops. Manual lymph drainage performed on a regular basis can restore the balance of fluids in the body.

Contraindications for MLD are high fever, acute infections, inflammation, cardiac problems, congestive heart failure, uncontrolled high blood pressure, general cardiac insufficiency, phlebitis, thrombosis, bleeding, hemorrhage, or open sores. Also clients with malignant diseases such as active cancer (when the tumor is still present) should not be treated. However, once the tumor has been removed, post surgery treatment has proven beneficial to reduce swelling and promote healing of the tissues.

## **Conclusion**

The lymph system is an intricate structure that is key to the health of the body. The lymph system supplies the fluid of life to nourish the cells as well as defend them. Through a healthy lifestyle, good hygiene and exercise, we can minimize the load on our lymph system and help facilitate it's movement. However, even a healthy person can benefit from manual lymph drainage. There will always be a time in our lives when the lymph system will be taxed, due to inactivity, sickness, or surgery. It is advantageous to give the immune system a boost by treating yourself to a full body lymph drainage and experience the detoxification it offers. At the same time, you will be experiencing the peace and stress-free state that arises from engaging the parasympathetic state.

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