Perception of Lymphatic System and Their Disorders

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The lymphatic system comprises a set of connections of lymphatic vessels. Lymphatic vessels are crucial to maintain body fluid balance, immune defence and uptake of dietary fats. Furthermore, lymphatic vessels facilitate tumor metastasis. Lymphatic vessels are larger than capillaries and generally are smaller than the smallest veins. Lymphatic vessels drain fluids from tissues all over the body that have diffused throughout the extremely lean walls of capillaries. The fluids encompass proteins, minerals, nutrients, and other substances, which deliver nourishment to tissues. All lymph passes throughout intentionally placed lymph nodes, which gather and transfer damaged cells, cancer cells, and foreign particles (such as bacteria and viruses) out of lymph. Lymph nodes also consist of specialized white blood cells (for example, lymphocytes and macrophages) intended for engulf and wipe out damaged cells, cancer cells, infectious organisms, and foreign particles. Thus, important functions of the lymphatic system are to eradicate damaged cells from the body and to give protection against extend of infection and cancer. This review summarizes critical components of lymphatic system, Interrelationship among Lymphatic system and other body system, functioning of lymphatic system, diseases linked with lymphatic system and drugs used in the treatment of lymphatic disorders.
INTRODUCTION:

Lymphatic system is the network of vessels whereby lymph drains from the tissues into the blood and were shown in figure 1. Fluid leaks out at arterial ends of capillaries while it is absorbed back at the venous end of capillaries. Some of the fluids retain in the tissue spaces and this fluid is known as lymph and the system through which this lymph is turned back to blood is known as lymphatic system [1].

The lymphatic system performs a significant role in circulation and organ perfusion homeostasis [2]. Along with drainage function, lymphatic system is also involved in defence activities of the body [1]. It also transports proteins and macromolecules away from tissue intestinal space [3].

2. Anatomy of lymphatic system

The lymphatic system consists of a one way, open-ended network of lymphatic vessels. The lymph comprises of lymphocytes, macrophages, and small amounts of plasma proteins. The lymphatic circulation initiate from blunt-ended lymphatic capillaries and ends at the subclavian veins [4]. The circulation of lymphatic system was shown in figure 2.

Macroscopically, the blood vascular system is a circulatory system in which the blood leaves the heart; flow through the arteries, arterioles, capillary plexus, and veins; and finally turns back to the heart. In contrast, lymph, in the lymphatic system, are drained into the lymphatic capillary vessels that begin at the interstitial spaces of tissues and organs; are transported to thicker collecting lymphatic, which are embedded with many lymph nodes; and therefore, they comeback to the blood circulation through the thoracic or lymphatic ducts that join to the subclavian veins. Lymphatic vessels can be found in all of the vascularised organs and tissues except retina, bone, and brain [5].

Microscopically, whereas blood capillaries are lined by the innermost blood vascular endothelial cells (BECs), which are covered by the basement membranes and then embedded by smooth muscle-like pericytes, lymphatic capillaries are wrinkled with a single layer of moderately overlapping lymphatic endothelial cells (LECs) without being surrounded by the basement membrane or pericytes. While cross sections of blood capillaries are round and homogeneously shaped due to hemodynamic pressure, lymphatic capillaries are irregularly shaped and usually stay collapsed [5]. The main difference between blood vessels and lymphatic vessels is that blood flow is cyclic, always flow in circular pathway and never leave the vessels. While lymph flow is non-cyclic, have starting point (capillary beds) and a finishing point (subclavian veins) [6]. The difference between Lymphatic capillaries and Blood capillaries was shown in table 1.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Lymph Capillaries</th>
<th>Blood Capillaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Colourless, difficult to observe</td>
<td>Reddish, easy to observe</td>
</tr>
<tr>
<td>2.</td>
<td>Blind (closed at the tip)</td>
<td>Joined to the arterioles at one end and to venules at the another end</td>
</tr>
<tr>
<td>3.</td>
<td>Wider than blood capillaries</td>
<td>Narrow than lymph capillaries</td>
</tr>
<tr>
<td>4.</td>
<td>Contain colourless lymph</td>
<td>Contain red blood</td>
</tr>
</tbody>
</table>

Table 1: Differences between Lymphatic Capillaries and Blood Capillaries [4, 5]
5. Wall consist of thin endothelium and poorly developed basement membrane | Wall consist of normal endothelium and basement membrane

6. Have relatively low pressure | Have relatively high pressure

7. Absorb tissue fluid from intercellular space | Add tissue fluid to intercellular space

Importantly, capillary lymphatic endothelial cells (LECs) are attached by filament bundles and then directly anchored to the extracellular matrices. When interstitial pressure increases, the anchoring filaments are operated to pull the cells and open up the overlapping junctions (or flaps), which allows the lymph fluids to drain into lymphatic capillaries for recirculation. Therefore, these overlapping junctions of capillary LECs mechanically function as primary valves that unidirectionally control lymph fluid drainage and are laced with discontinuous, specialized button-like intercellular adhesion points with proteins found in tight and adherens junctions. In comparison, LECs of the collecting lymphatic vessels, opted for fluid transport rather than drainage, are now seamlessly aligned with each other by more tight, zipper-like junctions and ensheathed with the basement membranes and pericytes smooth muscle cells that propel drained lymph fluids back to recirculation. Like the veins, collecting lymphatic vessels and ducts are equipped with bileaflet secondary valves to prevent retrograde flow of the lymph, and optimal lymph flow is effectively controlled by multiple factors including lymphatic muscle contractions [5, 7].

The lymphatic vascular network includes blind-ended capillaries and larger collecting lymphatic vessels and was shown in figure 2. The lymphatic capillaries are composed of a single layer of overlapping ECs and lack a continuous basement membrane. Collecting lymphatic vessels are covered by smooth muscle cells, and possess a basement membrane and luminal valves that prevent lymph backflow. The unique structure of capillary lymphatic vessels allows for the uptake of interstitial fluid, macromolecules, cells, and lipids that filtrate continuously from the blood capillary network [8]. A silent feature of Lymphatic endothelial cells was shown in table 2.

**Table 2: Salient features of Lymphatic endothelial cells (LEC) [5]**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Parameters</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Origin</td>
<td>Mesoderm (vein) during development, lymphatic progenitor cells from bone marrow for adults</td>
</tr>
<tr>
<td>2.</td>
<td>Gross structure</td>
<td>Open, linear</td>
</tr>
<tr>
<td>3.</td>
<td>Constituents</td>
<td>Lymph (interstitial fluid rich in protein, fat, and lipids, extravasated immune cells, and large extracellular molecules)</td>
</tr>
<tr>
<td>4.</td>
<td>Development</td>
<td>Lymphangiogenesis (budding from cardinal vein)</td>
</tr>
<tr>
<td>5.</td>
<td>Absence</td>
<td>Cartilage, brain, bone, spinal cord, and the retina</td>
</tr>
<tr>
<td>6.</td>
<td>Hierarchical Division</td>
<td>Capillaries, pre-collectors, collecting vessels, thoracic duct, lymph nodes</td>
</tr>
<tr>
<td>S. No.</td>
<td>Components of lymphatic system</td>
<td>Functions</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>7.</td>
<td>Functions</td>
<td>Tissue fluid homeostasis, absorption of large molecules and lipids in the digestive systems, trafficking of lymphocytes and antigen-presenting cells to regional lymph nodes, transport of degraded extracellular molecules</td>
</tr>
</tbody>
</table>

**Table 3: Overview of components of Lymphatic system [1, 6 and 11]**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Components of lymphatic system</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lymph</td>
<td>Contains nutrients, oxygen, hormones, and fatty acids, as well as toxins and cellular waste products, that are transported to and from cellular tissues</td>
</tr>
<tr>
<td>2</td>
<td>Lymph Vessel</td>
<td>Lymphatic Capillaries: Allow diffusion of tissue fluid from intestinal space into lymphatic pathway. Lymphatic Vessels: Carry lymph from tissue spaces to the venous system, starts blindly as lymph capillaries in tissue spaces, their walls are permeable to substances of much greater size Lymphatic Trunks: Transfer lymph to two lymphatic ducts which eventually expel all lymph fluid back to the blood</td>
</tr>
<tr>
<td>3</td>
<td>Central Lymphoid Tissues</td>
<td>Bone Marrow: Produces all potent lymphoid cells, helps in differentiation of B-Lymphocytes Thymus: Helps in differentiation of T-Lymphocytes</td>
</tr>
<tr>
<td>4</td>
<td>Peripheral Lymphoid Organs</td>
<td>Lymph node: Small nodules of lymphoid tissue found in the course of smaller lymph vessels, purify the lymph from harmful agents Spleen: Removes old blood cells from circulating pool, keeps a reserve of blood for emergency, Synthesizes antibodies Epithelio-lymphoid tissues: Lymphoid nodules in places like alimentary canal and respiratory tracts, Works as a security check against all the incoming agents.</td>
</tr>
<tr>
<td>5</td>
<td>Lymphocytes</td>
<td>Mature B- and T-Lymphocytes circulating in blood, protects the body against any infectious agent that enters the blood</td>
</tr>
</tbody>
</table>
Table 4: List of Lymphatic diseases, causative organism, diagnosis and their treatment [19-26]

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Lymphatic disease</th>
<th>Description</th>
<th>Causative organism</th>
<th>Diagnosis</th>
<th>Drug used for Treatment</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acquired Immunodeficiency Syndrome (AIDS)</td>
<td>Infects lymphocytes and suppresses immunity</td>
<td>Human Immuno deficiency Virus (HIV)</td>
<td>Western blot, Enzyme-linked immunosorbent assay (ELISA), Enzyme immunoassay (EIA)</td>
<td>Abacavir, Didanosine, Emtricitabine, Lamivudine, Stavudine, Tenofovir, Zidovudine,</td>
<td>12, 19, 25 and 26</td>
</tr>
<tr>
<td>2.</td>
<td>Hodgkin lymphoma</td>
<td>Cancer of the lymphatic system</td>
<td>HIV, Epstein-Barr Syndrome, age and family history</td>
<td>Complete blood count, Sedimentation rate, Lymph node biopsy, Immunophenotyping</td>
<td>Monoclonal antibody Brentuximab, Chlorambucil, Bleomycin</td>
<td>24, 38</td>
</tr>
<tr>
<td>3.</td>
<td>Lymphadenitis</td>
<td>Infection of the lymph nodes</td>
<td>Virus, bacteria or fungi</td>
<td>Blood tests to look for infection, Computed tomography (CT) scan</td>
<td>Antibiotics, Analgesics, Anti-inflammatory medications</td>
<td>27, 28</td>
</tr>
<tr>
<td>4.</td>
<td>Lymphadenopathy</td>
<td>Enlargement of lymph nodes</td>
<td>Virus and bacterial infection</td>
<td>Excisional biopsy</td>
<td>Prednisone, Methylprednisolone</td>
<td>21, 29 and 30</td>
</tr>
<tr>
<td>5.</td>
<td>Lymphangitis</td>
<td>Inflammation of the lymph vessels</td>
<td>Bacterial infection</td>
<td>Physical exam, biopsy</td>
<td>Intravenous (IV) antimicrobial therapy, Antibiotics, Pain medication anti-inflammatory medication</td>
<td>22, 23 and 31</td>
</tr>
<tr>
<td>7.</td>
<td>Lymphedema</td>
<td>Chronic pooling of lymph fluid in the tissue</td>
<td>Disrupts the lymphatic vessels</td>
<td>Magnetic resonance imaging (MRI), Computed tomography (CT), Ultrasound (US) Compression bandages or pneumatic stockings to alleviate the swelling,</td>
<td>Gold treatment, stockings, Bandages, Massage</td>
<td>24, 32 and 33</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lymph vessel and lymph node imaging</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Lymphocytosis</td>
<td>High lymphocyte count</td>
<td>Infection, blood cancer, lymphoma, or autoimmune disorders</td>
<td>Chronic lymphocytic leukaemia (CLL), Blood analysis, lymphocytes count</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anti-inflammatory drugs, Antibiotics and Antiviral agents, Bone marrow transplant and blood transfusion</td>
<td>34, 35 and 36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Lymphoma</td>
<td>Cancer of lymphatic system</td>
<td>Exposure to radiation and certain chemicals, weak immune system</td>
<td>Tissue biopsy, Blood tests, Bone marrow biopsy, Computerised tomography (CT) scan, Positron emission tomography (PET) scan</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemotherapy, Radiotherapy</td>
<td>9, 37 and 38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chemotherapy, Immunotherapy, Targeted therapy, Radiation therapy, Stem cell transplant</td>
<td>9, 39 and 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Splenomegaly</td>
<td>Enlargement of spleen</td>
<td>Viral infection</td>
<td>Blood tests, Ultrasound or computerized tomography (CT) scan, Magnetic resonance imagining (MRI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Spleen removal surgery, Penicillin or other antibiotics</td>
<td>41, 42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Tonsillitis</td>
<td>Infection of the pharyngeal tonsils.</td>
<td>Bacterial infection</td>
<td>Swollen tonsil region, Blood tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Surgery, Tonsillectomy, Acetaminophen, Ibuprofen, Penicillin or other antibiotics.</td>
<td>43, 44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1: Lymphatic system of human body [1, 19]

Figure 2: Circulation of Lymphatic vessels [16-18]
2.1 Interrelationship of lymphatic system with other body system [7, 9 and 10]

Lymphatic system is related with all other body system i.e., muscular system, skeletal system, cardiovascular system, digestive system, urinary and reproductive system.

1. In skeletal and muscular system, lymphatic vessels drain excess interstitial fluid and leaked plasma protein from connective tissue, bones and muscles.
2. In endocrine system, lymph flow helps in distribution of hormones and cytokines.
3. In cardiovascular system, lymphatic returns excess fluid filtered from blood capillaries and leaked plasma protein to venous blood.
4. In respiratory system, Mucosa- associated lymphatic tissue (MALT) helps the lungs from pathogens. Lymphatic vessels drain excess interstitial fluid from lungs.
5. In digestive system, lymphatic vessels pick up absorbed dietary lipid and fat-soluble vitamins from the small intestine and transport them to the blood and drain excess interstitial fluid and leaked plasma protein from organs of digestive system.
6. In urinary system, lymphatic vessels drain excess interstitial fluid and leaked plasma protein from organs of urinary system. MALT helps defend against toxins and pathogens that penetrate the blood via the urethra.
7. In reproductive system, Lymphatic vessels drain excess interstitial fluid and leaked plasma protein from organs of reproductive system. MALT helps defend against toxins and pathogens that penetrate the blood via the vagina and penis. In females, sperms deposits via vagina are not attacked as foreign invaders due to inhibitions of immune response. IgG antibodies can cross the placenta to provide protection to a developing fetus. Lymphatic tissue provide IgA antibodies in the milk of a nursing mother.

3. Components of lymphatic system

Lymphatic systems are consisting of the following important components. Overview of components of lymphatic system was shown in table 3.

a. **Lymph vessels**: Lymph vessels are byway for flow of lymph around the body. Lymph vessels initiate as lymph capillaries that begin blindly in tissue spaces and lead to larger lymph vessels. Lymph vessels do not arise from a vascular structures, brain, spinal cord, bone marrow and splenic pulp. Larger lymph vessels anatomise freely with one another and they ultimately drain the lymph into the venous system.

b. **Central lymphoid tissue**: Bone marrow and thymus comes under Central lymphoid tissue.

c. **Peripheral lymphoid organs**: Peripheral lymphoid organs are lymph nodes, spleen and epithelio-lymphoid tissues (lymphoid tissue present in epithelium e.g. lymphoid tissue of alimentary and respiratory tracts).

d. **Circulating pool of lymphocyte**: It contains mature progenies of T-lymphocytes and B-lymphocytes. They form the first line of defence of the body during antigenic emergencies [1, 8].

3.1 **Lymph**

Lymph is a fluid connective tissue which is similar in composition to blood plasma but it is very rich in white blood cells [6]. It is mainly composed of water, electrolytes, and some small plasma proteins [12]. Lymph is taken from blood plasma as fluids pass through capillary walls at the arterial end. As the interstitial fluid starts to agglomerate, it is uplift and removed by tiny lymphatic vessels that pass through lymph nodes, which return the fluid to the blood [6, 13]. As the lymph passes through the lymph nodes, lymphocytes and monocytes come into it [14].

At the level of the gastrointestinal (GI) tract, lymph has a milky consistency that is attributable to fatty acids, glycerol, and rich fat content. Lacteals are lymph vessels that transport intestinal fat and are localized to the GI tract. It is pushed out through the capillary wall by pressure exerted by the heart or by osmotic pressure at the cellular level [14].

3.2 **Lymph Node**

Lymph node is a specialized lymphatic organ, attached to lymphatic vessels, which produce and store large numbers of lymphocytes and macrophages for defence of body system. It is mainly found in neck, armpits and abdominal cavity of body.

Each lymph node is attached to an afferent lymphatic vessel where lymph enters the lymph node, and to an efferent lymphatic vessel where lymph exits. Inside each lymph node, connective tissue masses called nodules produce and stores large numbers of lymphocytes and macrophages, while spaces called sinuses allow lymph to pass [12].

3.3 **Lymph capillaries**

Lymphatic capillaries flow along with blood capillaries in body tissues. Lymphatic capillaries allow diffusion of tissue fluid from intestinal space into lymphatic pathway. Lymphatic capillaries are responsible for absorbing fatty acids in intestine through a specified lymphatic capillary known as lacteals [12].

3.4 **Lymphatic vessels**

Lymphatic vessels are identical to blood vessels. It’s composed of 3 main layer of tissue and also contains valves which prevent backflows. Lymphatic vessels form a specialized lymphatic organ called lymph nodes, contains macrophages and lymphocytes, which eliminate foreign substances [12].

3.5 **Lymphatic trunks**
Lymphatic trunks transfer lymph to two lymphatic ducts which eventually expel all lymph fluid back to the blood. It is formed by the combination of larger collecting vessels [12].

3.6 Thymus gland

Thymus gland is an endocrine gland [12]. Thymus is a primary lymphoid organ which is situated in front of or slightly above the heart (mediastinum), between the lungs and behind the sternum. It is active before puberty. After puberty, its shrink and finally become replaced by fat [15]. The organ is called thymus because its shape looks like a thyme leaf [16]. Thymus is made up of two lobes of lymphoid tissue. Each lobes has a medulla surrounded by a cortex the cortex is initially go to become T cells, but their maturation finishes in the medulla [17]. Thymus gland stores a large number of inactive lymphocytes called T-lymphocytes which are activated by a thymus hormone called thymosin in a maturation process to become T- lymphocytes (T-cells) [12]. Main functions of thymus are it produces hormones (like thymosin) to program lymphocytes and at peak levels only during childhood.

3.7 Spleen

Spleen is the largest lymphatic organ situated on the left upper side of abdominal cavity under diaphragm and behind the neck. It is identical in structure to lymph nodes, where nodules (containing macrophages and lymphocytes) and sinuses are present.

The main function of spleen is to filters the blood by allowing the entrance of blood through the splenic artery, and transports the filtered blood to the liver. It removes the old and damage red blood cell, which are phagocytised by macrophages. It also detects virus and bacteria and triggers the release of lymphocytes. The five percent of blood volume enters the spleen, so that it acts as a blood reservoir [12, 17 and 18]. Main functions of spleen are filters blood, destroys worn out blood cells, forms blood cells in the fetus and it acts as a blood reservoir.

3.8 Lymphocytes

Lymphocytes are produced from stem cells known as hemocytoblasts. T-cells are differentiated and mature in thymus. B-cells & NK-Cells are differentiated and mature in bone marrow [18].

4. Physiology of lymphatic system

The physiology of lymphatic system described is as under:

a. **Remove particulate matter**: Lymph capillaries absorb and remove large protein molecules and other particulate matter from tissue spaces. In this way cellular debris and other harmful particles are washed away [19].

b. **Filter the lymph for foreign harmful particles**: Lymph nodes act as filter for the lymph and in this way they purify the lymph flowing through them [20].

c. **Phagocytosis**: Antigens are removed from lymph by phagocytic activity of cells of lymph node [21].

d. **Production of lymphocytes**: Mature B-lymphocytes and mature T-lymphocytes are produced in lymph nodes [22].

e. **Immune responses**: Lymphatic system can induce both cellular and humoral immune responses [23- 24].

5. Diseases of lymphatic system

Lymphatic disease is a class of disorders which directly affect the components of the lymphatic system. Diseases of the lymphatic system include lymphangitis, lymphedema, lymphoma, lymphadenopathy, lymphadenitis, filariasis, splenomegaly, tonsillitis, AIDS and lymphocytosis and were shown in figure 3 [14, 22]. List of lymphatic diseases causative organism, diagnosis and their treatment were shown in table 4.

5.1 Acquired Immunodeficiency Syndrome (AIDS)

AIDS is caused by the Human Immunodeficiency Virus (HIV) that affects lymphocytes and suppresses immunity. HIV deprived lymphocytes (especially helper T-cell) and epithelial cells. However the proper mechanism of pathogenesis
of AIDS is not known, but the most common hypothesis is that HIV directly destroys T-cells, resulting in a strong suppression of the immune system [12, 25 and 26].

### 5.2 Lymphadenitis

Lymphadenitis is an inflammation of the lymph node that is due to a bacterial infection of the tissue in the node. Symptoms include redness, swelling around the lymph node and tenderness of the skin overlying the lymph node [27, 28].

### 5.3 Lymphadenopathy

Lymphadenopathy is a lymphatic disorder in which the lymph nodes become swollen or enlarged as a consequence of an infection. Lymph nodes become swollen/enlarged and may be painful to touch [29, 30].

### 5.4 Lymphangitis

Lymphangitis is an inflammation of the lymph vessels. Causative organism/bacteria are streptococcus pyrogens. Lymph vessels look like red streaks through the skin. Symptoms usually include swelling, redness, warmth, pain and/or red streaking around the affected area [31].

### 5.5 Lymphatic filariasis

Lymphatic filariasis is a disease caused by parasite or nematode. The nematode worms are transmitted by mosquitoes. It is associated with swellings of the limbs and scrotal sac (hydrocele) as a result of damage and dysfunction of the lymphatic system [7, 22].

### 5.6 Lymphedema

Lymphedema is an accumulation of lymphatic fluid in the tissue that causes swelling. In this disease, the lymphatic system is unable to drain lymph adequately. It ordinarily initiates in the feet or lower legs. It may be either primary or secondary lymphedema [32].

Primary lymphedema is a hereditary situation which occurs due to missing or impaired lymphatic vessels. This disease may be exist at birth, may initiate with the onset of puberty, or may develop in adulthood. Secondary lymphedema is non-heritable regional lymphatic insufficiency, which may develop due to infection, trauma or surgical procedure that disrupts the lymphatic vessels. Treatment comprises of pneumatic stockings or compression bandages to detract the swelling after appropriate diagnosis is made [33].

### 5.7 Lymphocytosis

Lymphocytosis is a high lymphocyte count. It is due to lymphoma, infection, blood cancer or autoimmune disorders which are followed by chronic swelling [34, 35 and 36].

### 5.8 Lymphoma

Lymphoma is a cancer of the lymphatic system that originating either from the lymphocytes in the lymph nodes or the lymphatic tissue in organs. Lymphoma is characterized by enlargement of lymph nodes, usually present in the neck [37].

Weight loss, weak immune function, chronic fatigue and night sweats are the symptoms of lymphoma. Hodgkin lymphoma and Non-Hodgkin lymphoma are the main two types of lymphoma [38].

#### 5.9 Hodgkin's Disease/Hodgkin's Lymphoma

Hodgkin's Lymphoma is a type of cancer of the lymphatic system. It can initiate any parts in the body. It's supposed to be caused by family history, HIV, Epstein-Barr Syndrome.

Swollen lymph nodes, weight loss, night sweats, itchy skin, fatigue, chest pain fever, coughing and trouble swallowing are the symptoms of Hodgkin's Lymphoma [38].

#### 5.10 Non-Hodgkin's Lymphoma

Non-Hodgkin's Lymphoma is a usually malignant cancer. The cause of this disease is the body producing more amounts of abnormal white blood cells. It is not the same as Hodgkin's disease. Symptoms usually include painless, weakness, fever, weight loss, enlarged lymph node or nodes in the neck and anaemia [39, 40].
5.11 Splenomegaly

Splenomegaly is a disorder of lymphatic system in which spleen becomes enlarged. It may have due to a viral infection [41, 42].

5.12 Tonsillitis

Tonsillitis is an infection of the pharyngeal tonsils. In this infection, tonsils are infected and become inflamed and swollen, leading to sore throat, fever, and difficult in swallowing [43, 44].

CONCLUSION

The lymphatic system consists of lymphatic vessels. Lymphatic vessels are crucial to maintain body fluid balance, immune defence and uptake of dietary fats. In present review, an attempt has been to describe the components and parts of lymphatic system. The various disorders of lymphatic system, its diagnosis, causes and treatment are discussed.

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