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Anatomy of the Lymphatic System

Development of the Lymphatic System

The lymphatic system begins to develop at the end of the 5th week of pregnancy, approximately two weeks later than the cardiovascular system. One view states that the lymphatics develop as diverticulae (sac-like structures) of the endothelium of veins; another states that, like other blood vessels, they develop from clefts in the mesenchyme that connect with the venous system secondarily. Thus, the cells lining the mesenchymal clefts assume an endothelial shape and subsequent sprouting of these cells causes the clefts to fuse and form the lymphatic channels. After birth, the lymphatic system reaches almost every part of the body. Until recently, it was believed that the central nervous system didn’t have its own lymphatic drainage vessels. However, scientists at the University of Virginia discovered evidence of lymphatic drainage vessels in the intra-cranial space.

Components of the Lymphatic System

The lymphatic system is one of the organs that is present throughout the human body and consists of lymph vessels and a number of organs, all of which contain lymphatic tissue.
The lymphatic structures in the body are:

- **Lymph vessels (collectors)** - collect and transport protein-rich fluid (lymph) from the interstium to the central venous system.
- **Lymph nodes** - are filtering stations for the lymph fluid and serve as a storage place for white blood cells (lymphocytes).
- **Spleen** – is used to depose of aged red blood cells (erythrocytes) and serves as a storage place for blood (plasma).
- **Thymus** – serves very important immunological functions in the early years of life; also referred to as “thymus gland” because of its secretion of hormones, making it also part of the endocrine system.
- **Tonsils** – serve immunological functions.
- **Lymphocytes** – are white blood cells which the body uses to fight off infections, bacteria and foreign matter.
- **Peyer’s patches** – are aggregations of lymphoid tissue (aggregated lymphoid nodules) found in the lowest part of the intestine. Because the lumen of the gastrointestinal tract is exposed to the external environment, much of it is populated with potentially pathogenic microorganisms. Peyer’s patches are important for the immune surveillance of the intestinal lumen.

**Function of the Lymphatic System**

- Returns protein and water from the interstitium to the cardiovascular system.
- Absorbs protein, fat and fat-soluble vitamins (chyle) through the intestinal lymph vessels.
- Recognizes and responds to foreign cells, microbes, and cancer cells (serves important immunological functions).

Lymph vessels absorb interstitial fluid, mainly from the skin and subcutaneous tissues, and transport it into the venous circulation. From the intestines, the lymph vessels absorb nutritional fatty acids. This intestinal lymph is called chyle. In addition, the lymphatic organs have very important immunological functions. Lymphocytes (white blood cells) are stored in lymph nodes. These lymphocytes have the ability to recognize foreign cells, substances, microbes, and cancer cells and respond to them, i.e. destroy and eliminate them from the body.
Below is a drawing of the superficial lymph nodes of the axilla and inguinal region with the collecting lymphatics and lymph trunks leading to them.

**Lymph Vessels**¹

Lymph vessels are subdivided into:

- Capillaries (8)
- Pre-collectors (9)
- Collectors (11)
- Trunks (not shown)

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¹ Foeldi’s Textbook of Lymphology

(ibdenver.com)
Lymphatic Drainage System Poster by Jobst

Fig. 6 Lymph Drainage System.

Poster available for download at: jobstcompressioninstitute.com/Resources/Literature
**Lymph Capillaries**

Lymph capillaries are larger than blood capillaries and are structurally adapted to ensure the absorption of large molecules, i.e. proteins from the interstitium (Fig. 7). The lymph capillaries originate in tissue spaces and form an extensive plexus throughout the body. In the soft connective tissue of the skin and mucous membranes, lymph capillaries are located close to the blood capillaries. Their wall is made of flat endothelial cells that overlap each other. Because the overlapping ends of the endothelial cells open and close as needed for the absorption of fluid, they are sometimes referred to as “swinging flaps.” Anchoring filaments attach to the endothelial cells of the lymph capillary and the surrounding tissues. Any increase of interstitial fluid produces a pull on the anchoring filaments that opens the pores even more, allowing a passive influx of fluid into the small vessel.

To date, the absorption of fluids into the lymph capillaries is not completely explained. The aspiration of fluid during dilatation of larger transporting vessels, opening and closing of the interendothelial junctions by contractile elements of the anchoring filaments, as well as the variations of interstitial pressure caused by arterial pulsation, are being researched.

Lymph capillaries do not contain one-way (bicuspid) valves.

**The important characteristics of the lymph capillaries:**
- They are flat endothelium cells with anchoring filaments.
- They form an extensive network just below the epidermis.
- They have a larger diameter than blood capillaries.
- They are able to absorb interstitial fluid (protein and water) as necessary.
- There are no valves inside the lymph capillaries.

**The Lymph Capillary and Blood Capillary Loop**

![Fig. 7 Lymphatic Capillary](image)

1. Arterial side of the blood capillary
2. Venous side of the blood capillary
3. Lymph capillary
4. Open junction “swinging flap”
5. Fibrocyte
6. Anchoring filaments
7. Interstitial space

*Foeldi’s Textbook of Lymphology*
The Opening Mechanism of the Lymph Capillary

Lymph Formation (Fig. 8)

A. The initial lymph vessel is empty and collapsed. The subsequent precollector is filled with lymph. The anchoring filaments and the fiber network are relaxed as a result of low interstitial pressure.

B. Filling phase: The interstitium is filled with fluid and thus the interstitial pressure exceeds the pressure in the initial lymph vessel. The interstitial fiber network and the anchoring filaments are tense, causing the outer swinging flaps of the lymph vessel to be pulled outward. At the same time, the fluid flowing inside the lymph vessel pushes the inner flaps inward causing the inlet valves to open.

C. The initial lymph vessel is filled with lymph.* The pressure in the initial lymph vessel exceeds the interstitial pressure and thus the inlet valves are closed.

D. The pressure inside the initial lymph vessel opens the valve to the precollector and thus the lymph flows towards the precollector.

* Interstitial fluid travels through pre-lymphatic channels from the blood capillary to the lymph capillary. Once interstitial fluid has entered into the lymph capillary, it has become lymph. On its way to the central venous system, lymph fluid will be filtered by lymph nodes and becomes more concentrated with protein. Therefore, interstitial fluid differs from lymph fluid.
Pre-collectors

The pre-collectors channel the lymph fluid into the larger transporting vessels. Pre-collectors possess absorbing functions for fluid like the capillaries but in some areas resemble transporting vessels containing smooth-muscle cells and valves.

Lymph Collectors

In structure, the collectors resemble veins (Fig. 9) but have thinner walls and valves in shorter intervals. The valves are passive and determine the direction of flow. They prevent the return of fluid and guarantee transport from distal to proximal or to the regional lymph nodes.

Depending on the diameter of the vessel, valves are evident every 0.6 - 2 cm in the collectors and every 6 - 10 cm in the thoracic duct. The section of the collector between a distal and a proximal valve is called a lymph angion.

Tunica intima (inner layer)

Tunica media (middle layer)

Tunica externa (outer layer)

Fig. 9  Diagram of the wall structure of a vein.


Lymph collectors also consist of a three-layer wall plus bicuspid valves:

- **Tunica intima** (inner layer) - composed of endothelial cells and a basal membrane
- **Tunica media** (middle layer) - composed of smooth muscle cells
- **Tunica externa** (outer layer) - made of soft collagenous connective tissue
In contrast to circulation of the blood where the heart is acting as a pump, lymph is transported by the intrinsic contractions of the lymphangia, a process referred to as lymphangioactivity or lymphangiomotoricity. The frequency of contractions is determined by autonomous regulation through the sympathetic nervous system and the lymph volume. When lymph volume stretches the vessel wall, its smooth muscle responds with a contraction. The frequency of contractions amounts to 6-10 x/min at rest but may increase to 10 times that amount during exercise. An increase of lymph fluid due to physical activity, heat, or inflammation results in an increase in lymph time volume due to increased pulsation frequency and higher filling amplitude of the lymphangia. In addition, lymph transport is supported by the contraction of the skeletal muscle (muscle and joint pump), arterial pulsation, respiratory pressure changes, negative pressure in central veins, and external pressure such as with Manual Lymph Drainage (MLD).

Collectors are differentiated as either superficial or deep, based on location. The superficial collectors are located in the subcutaneous fat tissue and drain the skin and the subcutis. The individual collectors run relatively straight and are connected with each other through numerous anastomoses. The deep collectors are located sub-fascially at the extremities and the trunk. They are usually larger in diameter than the superficial collectors and they drain related muscle, joints, and ligaments. As a rule, they run within a sheath along with the deep arteries and veins. Like the veins, superficial and deep collectors are networked via so-called perforators (cross connections).
Lymphangion

The lymphangion is the smallest functional unit of the lymph collector. It is bordered by a distal and proximal valve. The lymphangion is characterized by:

- Muscle tissue and bicuspid valves
- Autonomic NS innervation
- Intrinsic contractions (6-10 x/min)

Extrinsic contractions are facilitated by:

- Breathing (diaphragm)
- Muscle movement
- Pulsation of the arteries (vasomotion)
- Negative pressure in the central veins
- External compression (MLD)

Like the heart, lymphangia respond to an increased load according to Starlings’s law of the heart, i.e. increased contraction rate and amplitude.

Fig. 11  Structure and function of lymphangion:
A - Arrangement of musculature
B - Normal function
C - Dilated lymph vessel with valvular insufficiency and reflux.
1 – Lymphangion
2 - Contracted segment (emptying phase)
3 - Relaxed segment (filling phase)
NOTE: Arrows indicate direction of flow.
Modified from Foeldi’s Textbook of Lymphology
Lymphatic Watersheds and Anastomosis

Lymphatic watersheds delineate (separate) lymphatic tributary regions (Fig. 12). Important watersheds on the trunk are the:

1. Median-sagittal (vertical) WS
2. Transverse (horizontal) WS
3. Clavicle WS
4. Spine of scapula WS
5. Chaps (gluteal) WS

Lymphatic regions may be referred to as the “tributary regions” or “root areas,” e.g. root areas for the axillary lymph nodes are the upper extremities, the upper trunk quadrants, and the mammary glands (breasts). Alternately, it can be said that the axillary lymph nodes are the “regional” lymph nodes for the upper extremities, upper trunk quadrants, and the breasts. See Tables 1-3 later in the Anatomy section for the tributary regions of lymph nodes.

Fig. 12  Lymphedema Watersheds
Modified from Foeldi’s Textbook of Lymphology
Lymphatic Anastomoses

Lymph collectors connect across lymphatic watersheds! These connections are referred to as anastomoses and are utilized in Manual Lymph Drainage for moving fluid from a congested to a healthy part of the body. The most prominent areas where lymphatic vessels connect are across the sternum (chest), the upper thoracic spine (back), super-pubic area (front), sacrum (back) and on the flank (between the anterior and posterior axillary lines).

Fig. 13  Lymphatic Anastomoses Pathways
1. Median-sagittal (vertical) WS
2. Posterior sagittal WS
3. Transversal (horizontal) WS
4. Drainage area of the lateral upper arm bundle
5. Anterior thoracic and abdominal walls
6. Lateral thoracic and abdominal walls
7. Posterior thoracic and abdominal walls
8. Axillo-axillary (interaxillary) anastomoses
9. Axillo-inguinal anastomoses
10. Intereginal anastomoses
11. Amputation plane of the shoulder

Foeldi’s Textbook of Lymphology
Lymph Trunks and Ducts

The largest lymph vessels are called trunks and ducts. The trunks collect fluid from the organs, the extremities and the related quadrants of the trunk. The ducts eventually transport approximately 4 liters of lymph into the venous circulation (Fig. 14).

The largest lymphatic vessel in the human body is the thoracic duct. It is approx. 2 – 5 mm in diameter and 40 cm long. Deep in the trunk, it parallels the spine from L2 to the venous angle (juncture between the left internal jugular and left subclavian veins). Because it penetrates the diaphragm and runs through the chest into the root of the neck, it can be subdivided into an abdominal, thoracic, and cervical part. The abdominal portion of the thoracic duct is a sack-like enlargement which is called the cisterna chyli.

Fig. 14 Right and left venous angles:
1, 1a - Internal jugular veins
2, 2a - Subclavian veins
3 - Superior vena cava
4 - Thoracic duct
5 - Right lymphatic duct

Modified from Foeldi's Textbook of Lymphology

Fig. 15 Major lymphatic trunks and ducts of the human body.
From the lower extremities and the adjacent trunk quadrants, lymph is transported into the inguinal lymph nodes and from there, via the right and left lumbar trunks, to the cisterna chyli, the beginning of the thoracic duct. The intestinal trunk also transports fluid to the cisterna chyli from the small intestines. After a meal, due to the absorption of fat into the intestinal trunk, the contents of the intestinal lymph vessels appear cloudy (milky white) in color. Because of its milky-white appearance, the intestinal lymph is referred to as chyle.

The lymphatic trunks of the lower body are:
- Right and left lumbar trunks - from the inguinal lymph nodes to the cisterna chyli
- Intestinal trunk - from the small intestines to the cisterna chyli

From the upper extremities and the adjacent trunk quadrants, the fluid is transported into the axillary lymph nodes, and from there, via the bilateral subclavian trunks, into the thoracic duct on the left side and the right lymphatic duct on the right. The cervical lymph nodes drain lymph via the bilateral jugular trunks into the thoracic and right lymphatic ducts. From the bronchi, lungs, and the mediastinum, the lymph fluid reaches the ducts via the broncho-mediastinal trunks.

The lymphatic trunks of the upper body are:
- Right and left jugular trunk - from the cervical lymph nodes to the thoracic duct (left side of body) and the right lymphatic duct (right)
- Right and left subclavian trunk - from the axillary lymph nodes to the thoracic duct (left) and the right lymphatic duct (right)
- Right and left broncho-mediastinal trunk - from the bronchi, lungs and mediastinum to the thoracic duct (left) and the right lymphatic duct (right)

Since the central (deep) lymphatic trunks and ducts are arranged asymmetrically, the lymph fluid of the lower body (everything below the diaphragm), as well as the left upper body, is carried via the thoracic duct to the left venous angle. The right upper body is eventually drained via the right lymphatic trunk into the right venous angle (Fig. 16).

The thoracic duct drains approx. ¾ of the body’s lymph into the left venous angle (subclavian vein). The right lymphatic duct drains approx. ¼ of the body’s lymph into the right venous angle (subclavian vein).

Fig. 16  Three-quarters of the body empties into the left venous angle. 
Foeldi’s Textbook of Lymphology
**Lymph Fluid and Lymph Nodes**

Lymph fluid consists of:

- Proteins
- Water
- Cells (RBCs, WBCs, lymphocytes)
- Waste products and other foreign substances
- Fat (intestinal lymph, chyle)

75-100 grams of protein are transported by the lymph vessels per day. This equals approximately ½ the amount of proteins circulating in the systemic circulation. In addition, the lymphatic system is able to carry foreign protein, lymphocytes, cancer cells, cell debris, and bacteria. From the interstitium, water is also absorbed and transported through the lymphatic system. In the small intestines, long-chain triglycerides, cholesterol, and the fat-soluble vitamins A, D, E and K are absorbed into the lymphatic system. The intestinal lymph is called chyle.

There are 600-700 lymph nodes in the human body. The majority of lymph nodes are found in the abdomen (intestines), but the head and neck region also contains a large quantity. Other lymph node stations are found in the axilla and inguinal areas. Lymph nodes vary in size and shape. They are 2-30 mm long and are oval, round, bean, or kidney-shaped. A strong connective-tissue capsule protects a dense filter-like network inside.

![Lymph node diagram](en.wikipedia.org)
The functions of the lymph nodes are:

- **Filtration of noxious matter** such as bacteria, toxins and dead cells. Due to the branched sinus system, the lymph flow is slowed, allowing macrophages to better catch and phagocytize harmful substances.

- **Storage of lymphocytes** (white blood cells). Lymphocytes are important in fighting infections and enhancing the body’s immune capabilities.

- **Regulation of the concentration of protein in the lymph**. As the lymph flows through the node, excess water is reabsorbed into blood capillaries.

Lymph nodes are generally located in adipose tissue and are therefore not palpable. Enlarged, easily-palpable nodes are always suspicious. Frequently, infections in the drainage areas of the nodes will cause enlargement and pressure-sensitivity. However, enlarged lymph nodes can also be indicative of malignant disease. In slender, athletic people, inguinal lymph nodes are easily palpable because the upper-thigh fascia forms a firm backing so that the lymph nodes cannot move away under palpation.

Lymph nodes have more afferent than efferent lymph vessels. Numerous afferent lymph vessels carry lymph into the node(s), whereas a small number of efferent lymph vessels leave the nodes at the “hilus.” The lymph-node hilus is also the place where arteries and veins enter/exit.

Each lymph node and lymph node group receives lymph from a specific region of the body. In regard to the superficial lymph system, these regions are delineated by “lymphatic watersheds.” On the trunk, the direction of flow changes at the lymphatic watersheds. Lymph vessels on either side of the watershed transport lymph fluid to the left/right side of the trunk and to the upper (axillary)/lower (inguinal) lymph nodes, respectively.
## Lymph Nodes and their Tributary Regions

### Table 1 Lymphatic tributary regions of the head and neck region

<table>
<thead>
<tr>
<th>Lymph Node Group</th>
<th>Location</th>
<th>Tributary Areas</th>
<th>Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submental LN</td>
<td>2-3 nodes below the chin</td>
<td>Lower lip, gums, tip of tongue, chin</td>
<td>Deep cervical lymph nodes</td>
</tr>
<tr>
<td>Submandibular LN</td>
<td>5-8 nodes in the area of the submandibular glands</td>
<td>Lips, external cheeks, medial eye lids, teeth, gums, tongue, floor of mouth, cheek mucosa</td>
<td>Deep cervical lymph nodes</td>
</tr>
<tr>
<td>Preauricular LN</td>
<td>2-4 nodes in front of the ear at the parotid gland</td>
<td>Front of the auricle, nasal root, lateral eye lids, parotis</td>
<td>Deep cervical lymph nodes</td>
</tr>
<tr>
<td>Retroauricular LN</td>
<td>1-2 nodes behind the ear</td>
<td>Auricle (chiefly posterior surface), neighboring scalp, middle ear</td>
<td>Deep cervical lymph nodes</td>
</tr>
<tr>
<td>Occipital LN</td>
<td>2-3 nodes above insertion of the trapezius muscle</td>
<td>Skin of posterior head, base of head</td>
<td>Deep cervical lymph nodes</td>
</tr>
<tr>
<td>Cervical LN</td>
<td>Along the sternocleidomastoid muscle and the internal jugular vein, in the supraclavicular fossa</td>
<td>Ear, parotid gland, jaw angle, neck, back of head, tonsils</td>
<td>Deep cervical lymph nodes and jugular trunk</td>
</tr>
<tr>
<td>Supraclavicular LN</td>
<td>Supraclavicular fossa</td>
<td>Lymph fluid from cervical LN, skin between clavicle and spine at scapula WS’s</td>
<td>Jugular trunk</td>
</tr>
</tbody>
</table>

### Table 2 Lymphatic tributary regions of the upper body

<table>
<thead>
<tr>
<th>Lymph Node Group</th>
<th>Location</th>
<th>Tributary Areas</th>
<th>Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axillary LN</td>
<td>25-30 nodes prefascial in the armpit, grouped around the large vessels</td>
<td>Upper extremities, upper trunk quadrants and breasts</td>
<td>Deep axillary lymph nodes, infra and supraclavicular nodes, subclavian trunk</td>
</tr>
<tr>
<td>Pectoral LN</td>
<td>Next to the major pectoral muscle, in the area of the third serratus digitation</td>
<td>Breasts, especially lateral quadrants</td>
<td>Deep axillary lymph nodes</td>
</tr>
<tr>
<td>Cubital LN</td>
<td>Cubital fossa</td>
<td>Ulnar skin of forearm, bones, muscle and connective tissue of forearm and hand</td>
<td>Deep axillary lymph nodes</td>
</tr>
</tbody>
</table>

### Table 3 Lymphatic tributary regions of the lower body

<table>
<thead>
<tr>
<th>Lymph Node Group</th>
<th>Location</th>
<th>Tributary Areas</th>
<th>Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumbar LN</td>
<td>Lumbar area</td>
<td>Testicles/ovaries, uterus, kidneys, adrenal glands</td>
<td>Lumbar trunks</td>
</tr>
<tr>
<td>Iliac LN</td>
<td>Pelvis</td>
<td>Inguinal lymph nodes, bladder, prostate, seminal vesicles, uterus, upper portion of vagina</td>
<td>Lumbar trunks</td>
</tr>
<tr>
<td>Superficial Inguinal LN</td>
<td>Approx. 10 nodes prefascial in the groin</td>
<td>Trunk wall below navel line, lumbar and gluteal region, perineum, external genitals, lower extremities</td>
<td>Deep inguinal lymph nodes</td>
</tr>
<tr>
<td>Popliteal LN</td>
<td>Popliteal fossa</td>
<td>Skin, deep parts of the lower leg</td>
<td>Deep inguinal lymph nodes</td>
</tr>
</tbody>
</table>
**Lymph Flow versus Blood Flow**¹,³,⁴,⁶,⁸,⁹

*Fig. 18* Diagram of the lymphatic system (A) and the blood circulatory system (B).

<table>
<thead>
<tr>
<th>LYMPH SYSTEM</th>
<th>BLOOD CIRCULATORY SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>One way</td>
<td>Circular</td>
</tr>
<tr>
<td>2–2.5 liters/day</td>
<td>Approx. 7200 liters/day</td>
</tr>
<tr>
<td>Fluid moved by intrinsic contractions of lymph collectors</td>
<td>Fluid moved by central pump (heart) and calf muscle pumps</td>
</tr>
<tr>
<td>No continuous column of fluid</td>
<td>Continuous column of fluid</td>
</tr>
<tr>
<td>Peripheral lymphatic pressure unaffected by dependency</td>
<td>Dependency significantly increases venous pressure</td>
</tr>
<tr>
<td>Obstruction leads to collection of high protein fluid (&gt;1.5 gm/dl)</td>
<td>Obstruction leads to collection of low protein fluid (&lt;1.0 gm/dl)</td>
</tr>
<tr>
<td>Long latency period between injury and clinical appearance</td>
<td>Long latency period between injury and clinical appearance</td>
</tr>
<tr>
<td>Lymph is filtered by lymph nodes</td>
<td>Blood is filtered by the kidneys and liver</td>
</tr>
</tbody>
</table>
Illustrations of Lymph Node Locations

Cervical (Head & Neck) Lymph Nodes

Fig. 19  Lymph nodes of the head and neck.
1. Occipital Lymph Nodes - Occipital region and upper part of the skin of the neck.
3. Retroauricular Lymph Nodes - Parietal area (posterior auricle)
4. Preauricular/Parotid Lymph Nodes - Forehead, upper eye lid, and lateral part of the lower eye lid (auricle)
11. Submandibular Lymph Nodes - Nose, upper and lower lip, medial part of the lower lid, cheek
12. Submental Lymph Nodes - Chin, medial part of lower lip

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Deep Cervical Lymph Nodes

Fig. 20  Deep cervical lymph nodes.
1. Internal jugular lymph nodes
6. Lymph nodes accompanying the accessory nerve
8. Supraclavicular lymph nodes

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Axillary & Parasternal Lymph Nodes

Fig. 21  Axillary lymph nodes.

1. +2. Jugular lymph nodes
2. Subclavian trunk
3. Right lymphatic duct
4. Parasternal trunk
5. lymph node (interpectoral LN)
6. Parasternal lymph nodes
7. Prepericardic l.n.
8. Falciform ligament
9. Epigastric pathway
10. Rectus abdominis muscle
11. Liver
12. Paramammary lymph node
13. Premammary lymph node
14. Pectoral lymph nodes
15. Subscapular lymph nodes
16. Medial upper arm bundle
17. Deltoid bundle
18. Lateral axillary lymph nodes
19. Central axillary lymph nodes
20. Subpectoral lymph nodes
21. Infracoraclic lymph nodes
22. Supraclavicular lymph nodes
23. Brachial nerve plexus

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Level 1-3 Axillary Lymph Nodes

Fig. 22  Three levels of axillary lymph nodes.
figshare.com

Intercostal Lymph Nodes and Collectors

Fig. 23  Intercostal lymph nodes and collectors
1. Intercostal (paravertebral) lymph node
2. Intercostal collector
3. Lymph vessel plexus of the pleura
7. Axillary lymph nodes
10. Medial upper arm bundle
21. Sagittal (median) watershed
22. Parasternal lymph nodes
24. Thoracic duct
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Lymph Vessels and Drainage Areas of the Upper Extremity

Fig. 24 and 25  Lymph vessels of the upper extremity.
   a. Medial forearm bundle
   b. Radial forearm bundle
   c. Ulnar forearm bundle
   d. Medial upper arm bundle
   e. Dorso-medial upper arm bundle
   f. Lateral upper arm bundle
   g. Upper trunk quadrant

*Foeldi’s Textbook of Lymphology*
Variations of the Lateral Upper Arm Bundle

Fig. 26 Variations of lateral upper arm bundle
A. Injection specimen
B. Long type connected with median upper-arm bundle
C. Short type connected with median upper-arm bundle
D. Extremity short deltoid bundle

Foeldi’s Textbook of Lymphology
Inguinal Lymph Nodes

Fig. 27 and 28  Inguinal lymph nodes.
1-2. Superficial inguinal nodes
3. Deep inguinal nodes
4. Rosenmueller’s node
5-10. Iliac nodes

*Foeldi’s Textbook of Lymphology*
Fig. 29 and 30  Lymph vessels and drainage areas of the lower extremity.

Foeldi’s Textbook of Lymphology
**Bonus Pictures**

**Fig. 31 and 32** Lymph collectors of the lower extremity in a cadaver.
*Anatomy Department of the University of Zurich, Switzerland*

**Fig. 33 and 34** Lymphanigiogram of the lower extremity. Healthy lymph collectors (left) and dilated lymph collectors in patient with primary lymphedema (right).
*N. Browse, Reducing Operations for Lymphoedema of Lower Limb*
Fig. 35  Superficial lymphatic vessels (chest).

BSN Video: The Two-Phase Treatment of Lymphedema

Fig. 36–38  Near-infrared lymphatic imaging of the upper and lower extremities using indocyanine green (ICG).
References


