

JoVE: Science Education
Lymph Node Examination
--Manuscript Draft--

Manuscript Number:	10061
Full Title:	Lymph Node Examination
Article Type:	Manuscript
Section/Category:	Manuscript Submission
Corresponding Author:	Richard Glickman-Simon UNITED STATES
Corresponding Author Secondary Information:	
Corresponding Author's Institution:	
Corresponding Author's Secondary Institution:	
First Author:	Richard Glickman-Simon
First Author Secondary Information:	
Order of Authors:	Richard Glickman-Simon
Order of Authors Secondary Information:	

Author Name: Richard Glickman-Simon

Clinical Skills Education Title: Lymph Node Examination

Overview

The lymphatic system has two main functions: to return extracellular fluid back to the venous circulation and to expose antigenic substances to the immune system. As the collected fluid passes through lymphatic channels on its way back to the systemic circulation, it encounters multiple nodes consisting of highly concentrated clusters of lymphocytes. Most lymph channels and nodes reside deep within the body and, therefore, are not accessible to physical exam (Figure 1). Only nodes near the surface can be inspected or palpated. Lymph nodes are normally invisible, and smaller nodes are also non-palpable. However, larger nodes (> 1 cm) in the neck, axillae, and inguinal areas, are often detectable as soft, smooth, movable, non-tender, bean-shaped masses imbedded in subcutaneous tissue.

Lymphadenopathy usually indicates an infection or, less commonly, a cancer in the area of lymph drainage. Nodes may become enlarged, fixed, firm, and/or tender depending on the pathology present. For example, a soft, tender lymph node palpable near the angle of the mandible may indicate an infected tonsil; whereas, a firm, enlarged, non-tender lymph node palpable in the axilla of a female patient may be a sign of breast cancer.

Regional lymph nodes draining the area of a localized infection typically remain invisible, but may become enlarged and tender on palpation. An infected wound or cellulitis may also result in lymphangitis or lymphadenitis, a condition in which the infection spreads along the chain of lymph channels and nodes. This may be accompanied by the appearance of red streaks and systemic symptoms such as fever, chills, and malaise. In rare cases, the intensity of the inflammatory reaction may cause the nodes to adhere to the surrounding soft tissue, fixing them in place.

Many metastatic cancers spread to regional lymph nodes first. Unlike infections, lymph nodes invaded by malignant cells may feel irregular and firm (even rock hard) but remain non-tender. If the cancer invades the outer capsules, nodes may become fixed to the surrounding soft tissue or matted together. Lymphoma, a primary cancer intrinsic to the lymphatic system, may be present anywhere in the body as single or multiple enlarged lymph nodes, which may become big enough to see on inspection, and are generally hard and non-tender on palpation. In addition to lymphoma, diffuse lymphadenopathy may be an indication of generalized infectious or inflammatory disorders such as HIV, mononucleosis, or sarcoidosis.

Procedure

Comment [D1]: From Anna: The overview is slightly longer than usual. I can abbreviate it, but I think it is really great. I highlighted the parts that I'd definitely like to keep. AS

As lymph nodes are distributed throughout the body, their evaluation usually takes place as part of the regional examinations of the head and neck, breast and axillae, upper extremities, external genitalia and/or lower extremities. It is best to use the pads of the index and middle fingers to note the size, shape, number, pliability, texture, mobility, and tenderness of nodes bilaterally.

1. Lymph Nodes of the Head and Neck (Figure 2)

- 1.1 Have the patient flex their neck slightly forward, and inspect for noticeably visible node enlargement.
- 1.2 For each of the following: plan to palpate the head and neck nodes with both hands, one on each side. In many cases, the nodes are not palpable.
- 1.3 Palpate the preauricular, posterior auricular, and mastoid nodes in front of the ear, behind the ear, and superficial to the mastoid process, respectively.
- 1.4 Palpate the occipital nodes posteriorly at the base of the skull.
- 1.5 Palpate the tonsillar nodes located at the angle of mandible, the submandibular nodes midway between the angle and tip, and the submental nodes a few centimeters from the tip. Note that submandibular nodes need to be distinguished from the underlying submandibular gland, which is larger and lobulated.
- 1.6 Palpate the anterior and superficial cervical nodes in front of and overlying the sternomastoid muscle, respectively. Deep cervical nodes, beneath the sternomastoid muscle, are rarely palpable.
- 1.7 Palpate the posterior cervical nodes between the anterior edge of the trapezius and posterior edge of the sternomastoid.
- 1.8 Palpate the supraclavicular nodes deep within the angle formed by the sternomastoid muscle and clavicle. Some lung and abdominal cancers metastasize to these nodes, so they may be discovered during the examination.
- 1.9 Palpate the infraclavicular nodes on the underside of the clavicle.

2. Axillae and Upper Extremity

Three groups of axillary nodes – brachial, subscapular, and pectoral – drain their lymph into the central axillary nodes that lay deep within axilla against the chest wall about midway between the anterior and posterior axillary folds (Figure 3). These nodes, in turn, drain into the infraclavicular (apical) and supraclavicular nodes. Of the four axillary groups, only the central nodes are usually palpable. Since most breast cancers drain here, the axillary lymphatics need

to be examined carefully, particularly in women. Most parts of the upper extremities drain more or less directly into the axillary lymph nodes. One exception is drainage from the ulnar aspects of the hand and forearm, which first encounters the epitrochlear nodes above the elbow.

- 2.1 To examine the left axillary nodes, stand in front and to the left of the seated patient, supporting their relaxed left arm at the wrist or elbow.
- 2.2 Inform the patient that the exam may feel slightly uncomfortable.
- 2.3 Reach your right hand up high in the left axilla, just behind the pectoralis muscle, with fingers pointing toward the mid-clavicle. Press your fingers against the chest wall, and slide them downward to feel the central nodes.
- 2.4 If not done yet, palpate the infraclavicular (apical) and supraclavicular nodes.
- 2.5 While still supporting the patient's left arm, palpate the epitrochlear nodes, which are located medially about three centimeters above the elbow.
- 2.6 Repeat steps 2.1 – 2.5 for the patient's right axilla and upper extremity using your left hand.

3. Lower Extremities

Superficial inguinal lymph nodes located high in the anterior thigh drain various regions of the legs, abdomen, and perineum. These nodes are often large enough to palpate, even when normal.

- 3.1 Have the patient lay supine with hips fully extended or slightly flexed.
- 3.2 Palpate a horizontal group of nodes along and just inferior to the inguinal ligament. These nodes drain the superficial buttock and lower abdomen, external genitalia (excluding the testes), lower vagina, anal canal, and perianal area.
- 3.3 Palpate a vertical group of nodes medial to the horizontal group just inferior to the femoral artery pulse. These nodes lie along the upper saphenous vein and drain the same regions of the lower extremities.

Summary

Most lymph nodes lie too deep to be accessible via physical examination. The superficial nodes are most efficiently assessed during regional examinations of the head and neck, breasts and axillae, upper extremities, lower extremities and/or external genitalia. Because lymph nodes are constantly interacting with extracellular fluid draining from nearby tissues, their examination can provide information about the presence and status of infections or

malignancies in the area. Nodes draining the site of a soft tissue infection are apt to become enlarged and tender, but generally remain soft, smooth, and mobile. Hard, non-tender, matted, or fixed nodes are more typical of a spreading malignancy. Diffuse lymphadenopathy may indicate systemic diseases such as lymphomas, HIV, mononucleosis, or sarcoidosis. Finding a single abnormal node should prompt an examination of all nodes.

Figures and legends:

Figure 1: The Lymphatic System.

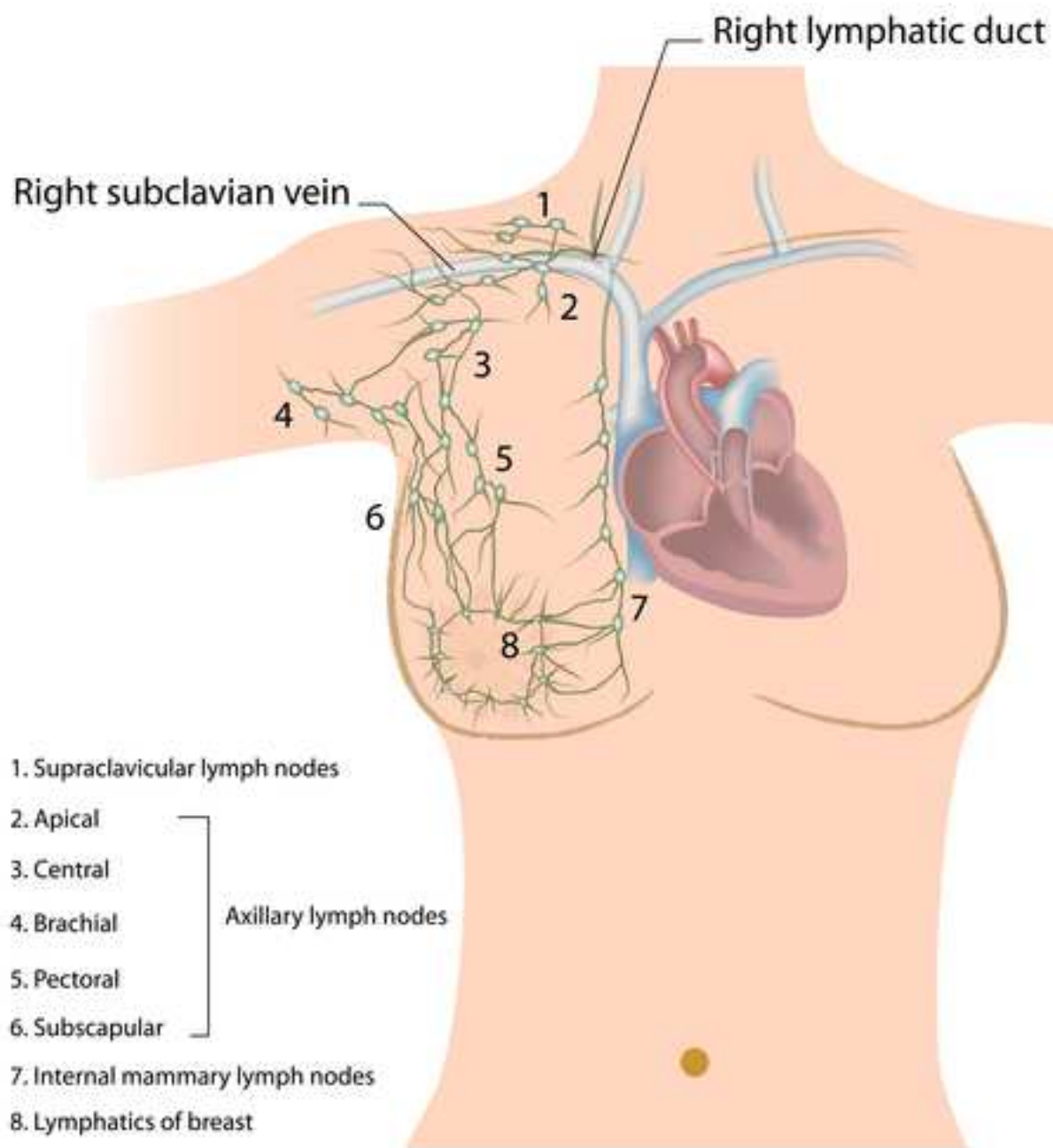
A drawing of the human lymphatic system.

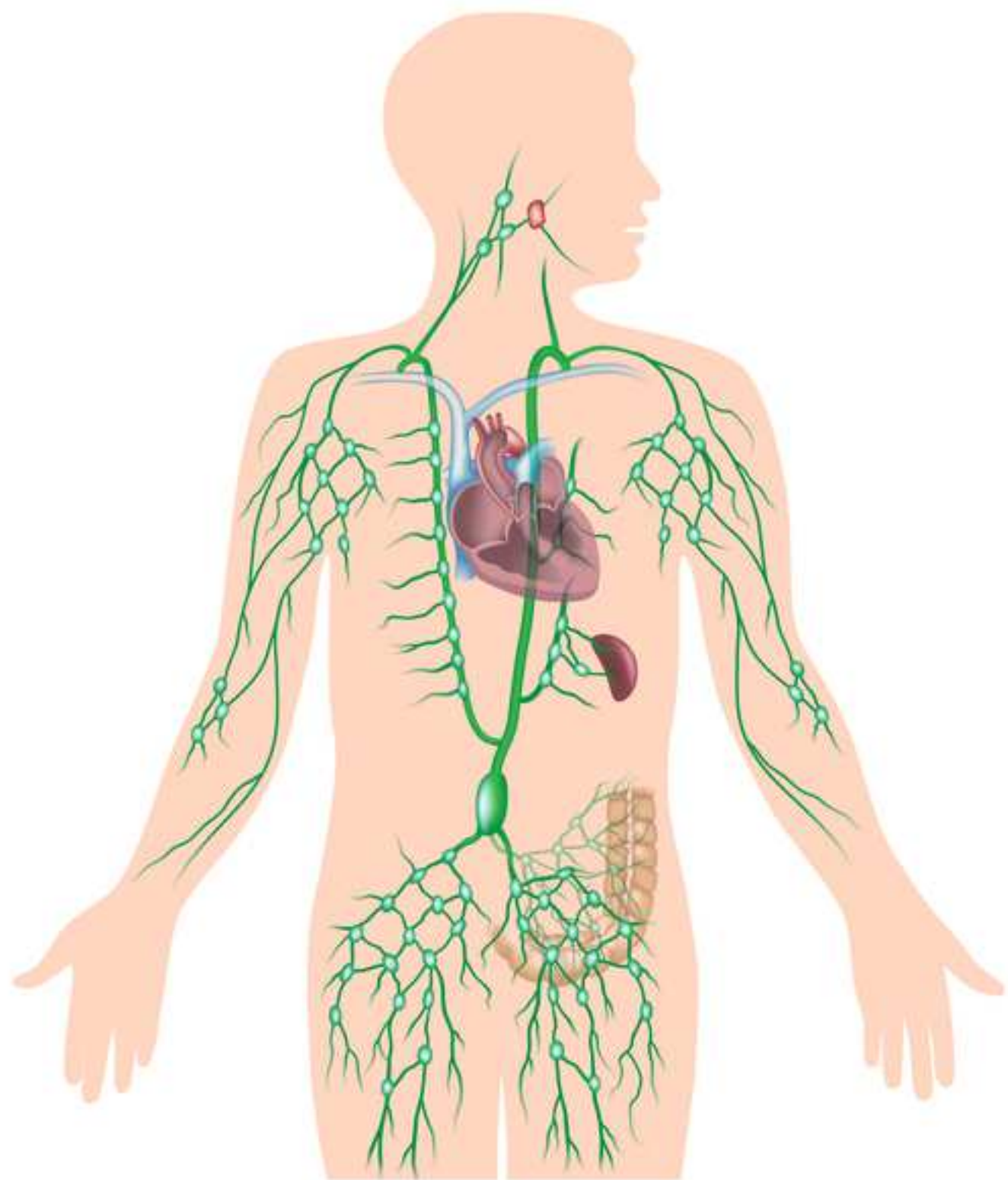
Figure 2: Lymph Nodes of the Head and Neck.

The locations of the lymph nodes of the head and neck.

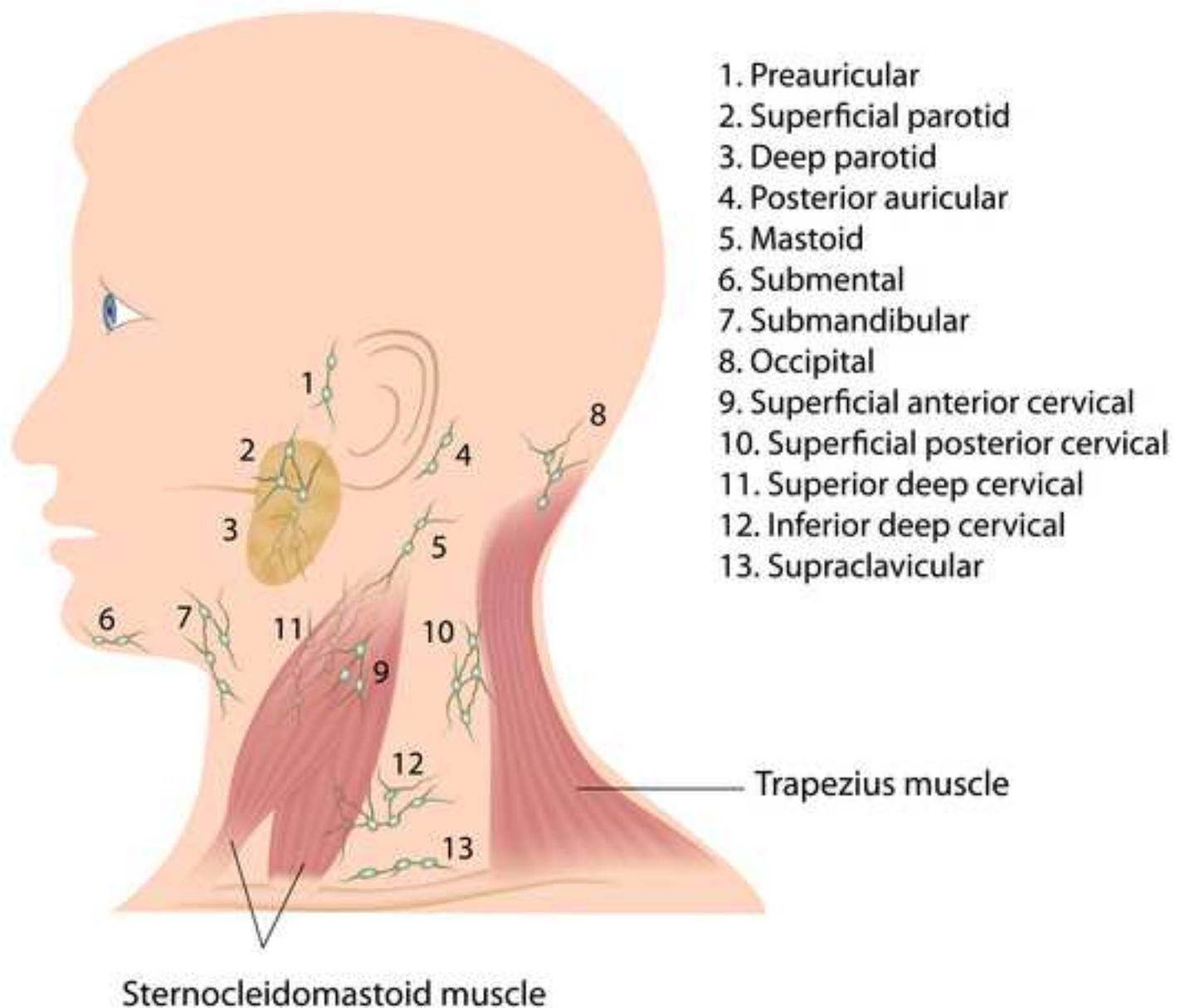
Figure 3: Axillary Lymph Nodes.

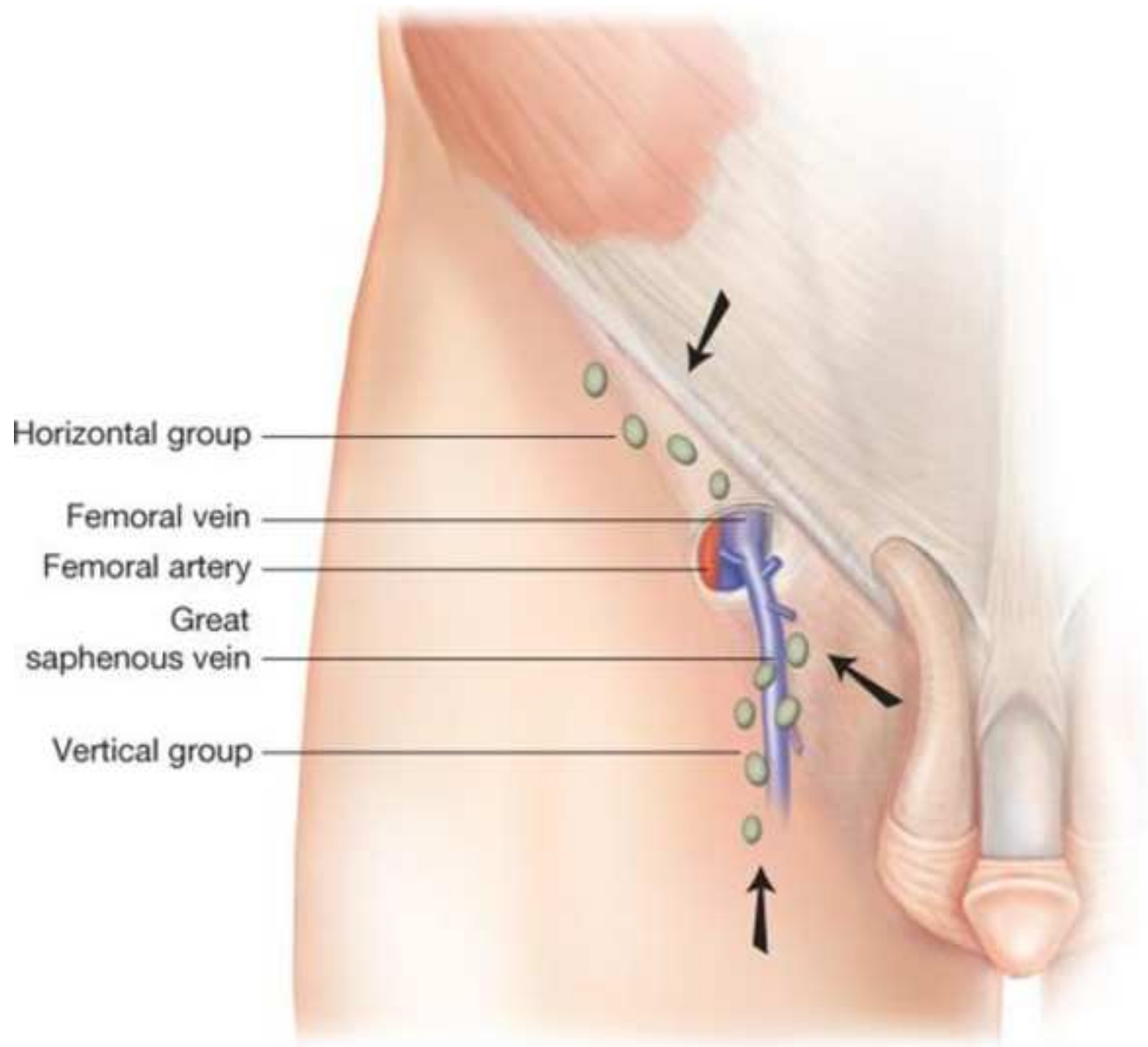
The location of the axillary lymph nodes.





Lymph Nodes of the Head and Neck





Author Name: Richard Glickman-Simon

Clinical Skills Education Title: Lymph Node Examination

Overview

The lymphatic system has two main functions: to return extracellular fluid back to the venous circulation and to expose antigenic substances to the immune system. As the collected fluid passes through lymphatic channels on its way back to the systemic circulation, it encounters multiple nodes consisting of highly concentrated clusters of lymphocytes. Most lymph channels and nodes reside deep within the body and, therefore, are not accessible to physical exam (Figure 1). Only nodes near the surface can be inspected or palpated. Lymph nodes are normally invisible, and smaller nodes are also non-palpable. However, larger nodes (> 1 cm) in the neck, axillae, and inguinal areas, are often detectable as soft, smooth, movable, non-tender, bean-shaped masses imbedded in subcutaneous tissue.

Lymphadenopathy usually indicates an infection or, less commonly, a cancer in the area of lymph drainage. Nodes may become enlarged, fixed, firm, and/or tender depending on the pathology present. For example, a soft, tender lymph node palpable near the angle of the mandible may indicate an infected tonsil; whereas, a firm, enlarged, non-tender lymph node palpable in the axilla of a female patient may be a sign of breast cancer.

Regional lymph nodes draining the area of a localized infection typically remain invisible, but may become enlarged and tender on palpation. An infected wound or cellulitis may also result in lymphangitis or lymphadenitis, a condition in which the infection spreads along the chain of lymph channels and nodes. This may be accompanied by the appearance of red streaks and systemic symptoms such as fever, chills, and malaise. In rare cases, the intensity of the inflammatory reaction may cause the nodes to adhere to the surrounding soft tissue, fixing them in place.

Many metastatic cancers spread to regional lymph nodes first. Unlike infections, lymph nodes invaded by malignant cells may feel irregular and firm (even rock hard) but remain non-tender. If the cancer invades the outer capsules, nodes may become fixed to the surrounding soft tissue or matted together. Lymphoma, a primary cancer intrinsic to the lymphatic system, may be present anywhere in the body as single or multiple enlarged lymph nodes, which may become big enough to see on inspection, and are generally hard and non-tender on palpation. In addition to lymphoma, diffuse lymphadenopathy may be an indication of generalized infectious or inflammatory disorders such as HIV, mononucleosis, or sarcoidosis.

Procedure

Comment [JR1]: 10061 – Clinical Skills – Glickman-Simon – Lymph Node Examination
In general, the manuscript is well written, detailed, and precise.

- Figure Usage/Clarity: Can you provide a figure for lymph nodes of Lower Extremities (similar to Fig. 2) that corresponds to the physical exam protocol?

- Procedure – Formatting of Protocol Text: Theory paragraphs are contained within protocol steps.

- Procedure – Details: While you indicate in 1.2 that “in many cases nodes are not palpable”, only one instance is referenced in 1.6. Are there more instances within the protocol that should be noted?

Comment [D2]: The overview is slightly longer than usual, I can abbreviate it, but I think it is really great.
I highlighted the parts of the Overview that I’d like to keep. AS

Because lymph nodes are distributed throughout the body, their evaluation usually takes place as part of the regional examinations of the head and neck, breast and axillae, upper extremities, external genitalia and/or lower extremities. It is best to use the pads of the index and middle fingers to note the size, shape, number, pliability, texture, mobility, and tenderness of nodes bilaterally.

1. Lymph Nodes of the Head and Neck (Figure 2)

- 1.1 Have the patient flex their neck slightly forward, and inspect for noticeably visible node enlargement.
- 1.2 For each of the following: plan to palpate the head and neck nodes with both hands, one on each side. In many cases, the nodes are not palpable.
- 1.3 Palpate the preauricular, posterior auricular, and mastoid nodes in front of the ear, behind the ear, and superficial to the mastoid process, respectively.
- 1.4 Palpate the occipital nodes posteriorly at the base of the skull.
- 1.5 Palpate the tonsillar nodes located at the angle of mandible, the submandibular nodes midway between the angle and tip, and the submental nodes a few centimeters from the tip. Note that submandibular nodes need to be distinguished from the underlying submandibular gland, which is larger and lobulated.
- 1.6 Palpate the anterior and superficial cervical nodes in front of and overlying the sternomastoid muscle, respectively. Deep cervical nodes, beneath the sternomastoid muscle, are rarely palpable.
- 1.7 Palpate the posterior cervical nodes between the anterior edge of the trapezius and posterior edge of the sternomastoid.
- 1.8 Palpate the supraclavicular nodes deep within the angle formed by the sternomastoid muscle and clavicle. Some lung and abdominal cancers metastasize to these nodes, so they may be discovered during the examination.
- 1.9 Palpate the infraclavicular nodes on the underside of the clavicle.

Comment [D3]: I am not certain about this figure placement because it is relevant for this whole segment. AS

Comment [AS4]: In general, deep lymph nodes are almost never palpable, and superficial lymph nodes can be palpable depending on their size. Here the author emphasizes this point only because there are superficial and deep cervical lymph nodes, but only superficial lymph nodes are examined, because deep lymph nodes are not accessible. More discussion on the lymph node size and palpability is in the introduction. In general, only enlarged lymph nodes are of concern.

Comment [AS5]: For this video collection we include short background information/rationale behind the maneuver/clinical relevance in the protocol steps to facilitate the learning process in the viewer when it's warranted by content and within the limits for format. We have been doing this for every manuscript for this project.

2. Axillae and Upper Extremity

Three groups of axillary nodes – brachial, subscapular, and pectoral – drain their lymph into the central axillary nodes that lay deep within axilla against the chest wall about midway between the anterior and posterior axillary folds (Figure 3). These nodes, in turn, drain into the infraclavicular (apical) and supraclavicular nodes. Of the four axillary groups, only the central nodes are usually palpable. Since most breast cancers drain here, the axillary lymphatics need

to be examined carefully, particularly in women. Most parts of the upper extremities drain more or less directly into the axillary lymph nodes. One exception is drainage from the ulnar aspects of the hand and forearm, which first encounters the epitrochlear nodes above the elbow.

- 2.1 To examine the left axillary nodes, stand in front and to the left of the seated patient, supporting their relaxed left arm at the wrist or elbow.
- 2.2 Inform the patient that the exam may feel slightly uncomfortable.
- 2.3 Reach your right hand up high in the left axilla, just behind the pectoralis muscle, with fingers pointing toward the mid-clavicle. Press your fingers against the chest wall, and slide them downward to feel the central nodes.
- 2.4 If not done yet, palpate the infraclavicular (apical) and supraclavicular nodes.
- 2.5 While still supporting the patient's left arm, palpate the epitrochlear nodes, which are located medially about three centimeters above the elbow.
- 2.6 Repeat steps 2.1 – 2.5 for the patient's right axilla and upper extremity using your left hand.

3. Lower Extremities

Superficial inguinal lymph nodes (**Figure 4**) are located high in the anterior thigh drain various regions of the legs, abdomen, and perineum. These nodes are often large enough to palpate, even when normal.

- 3.1 Have the patient lay supine with hips fully extended or slightly flexed.
- 3.2 Palpate a horizontal group of nodes along and just inferior to the inguinal ligament. These nodes drain the superficial buttock and lower abdomen, external genitalia (excluding the testes), lower vagina, anal canal, and perianal area.
- 3.3 Palpate a vertical group of nodes medial to the horizontal group just inferior to the femoral artery pulse. These nodes lie along the upper saphenous vein and drain the same regions of the lower extremities.

Comment [AS6]: This is a new figure added in response to the reviewer. The image needs to be reproduced because it is copyright protected.

Summary

Most lymph nodes lie too deep to be accessible via physical examination. The superficial nodes are most efficiently assessed during regional examinations of the head and neck, breasts and axillae, upper extremities, lower extremities and/or external genitalia. Because lymph nodes are constantly interacting with extracellular fluid draining from nearby tissues, their examination can provide information about the presence and status of infections or

malignancies in the area. Nodes draining the site of a soft tissue infection are apt to become enlarged and tender, but generally remain soft, smooth, and mobile. Hard, non-tender, matted, or fixed nodes are more typical of a spreading malignancy. Diffuse lymphadenopathy may indicate systemic diseases such as lymphomas, HIV, mononucleosis, or sarcoidosis. Finding a single abnormal node should prompt an examination of all nodes.

Figures and legends:

Figure 1: The Lymphatic System.

A drawing of the human lymphatic system.

Figure 2: Lymph Nodes of the Head and Neck.

The locations of the lymph nodes of the head and neck.

Figure 3: Axillary Lymph Nodes.

The location of the axillary lymph nodes.

Figure 4: Superficial Inguinal Lymph Nodes.

The drawing shows the location of the superficial inguinal lymph nodes and major blood vessels of the upper lower extremity. Arrows indicate directions of the lymph flow in the area.