

Education

# Thieme Dissector

Volume III  
Head, Neck, and Brain

Third Edition

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Thieme

# Contents

*Note from the Authors*

*About the Authors*

*List of Reviewers*

*Key Highlights*

1. Introduction and Osteology of the Head and Neck
2. Scalp and Superficial Temporal Region
3. Face
4. Eyelids and Lacrimal Apparatus
5. Posterior Triangle
6. Back of the Neck and Suboccipital Triangle
7. Anterior Triangle of the Neck
8. Parotid Region
9. Temporal and Infratemporal Regions
10. Temporomandibular Joint
11. Submandibular Region and Submandibular Gland
12. Removal of the Brain from the Cranial Cavity, Cranial Meninges, and Dural Venous Sinuses
13. Cranial Fossae
14. Orbit
15. Deep Dissection of the Neck—I: Thyroid Gland
16. Deep Dissection of the Neck—II: Structures under Cover of the Sternocleidomastoid and Posterior Belly of Digastric
17. Deep Dissection of the Neck—III: Root of the Neck
18. Deep Dissection of the Neck—IV: Upper Part of the Cervical Vessels and Nerves
19. Dissection of the Prevertebral Region and Cervical Plexus
20. Pharynx, Palatine Tonsil, and Soft Palate
21. Tongue
22. Nasal Cavity and Paranasal Air Sinuses
23. Larynx

- 24. Eyeball
- 25. Ear
- 26. Joints of the Neck Region
- 27. Brain: Introduction and Its Blood Vessels
- 28. Brainstem
- 29. Cerebellum
- 30. Fourth Ventricle
- 31. Cerebrum: External Features
- 32. Structures Seen on the Midsagittal Section of the Forebrain
- 33. White Matter of the Cerebrum
- 34. Dissection of the Lateral Ventricle
- 35. Dissection of the Basal Nuclei
- 36. Sections of the Brain

*Appendix*

*Index*

## Video Contents

- Video 2.1 Layers of scalp
- Video 2.2 Dissection of superficial temporal region
- Video 3.1 External nose
- Video 4.1 Layers of eyelid, orbicularis oculi muscle, and lacrimal gland
- Video 5.1 Posterior triangle of the neck
- Video 5.2 Lateral aspect of the neck, external jugular vein variant, cervical plexus, CN XI, and scalene triangle
- Video 7.1 Anterior triangle of the neck
- Video 7.2 Submental, submandibular, carotid, and muscular triangles
- Video 7.3 Carotid triangle
- Video 8.1 Parotid gland and parotid duct/Stensen duct
- Video 9.1 Infratemporal fossa and pterygomaxillary fissure
- Video 9.2 Infratemporal fossa: Part I
- Video 9.3 Infratemporal fossa: Part II
- Video 9.4 Anesthetic block of the inferior alveolar nerve
- Video 11.1 Submandibular region
- Video 12.1 Intracranial dural venous sinuses
- Video 13.1 Cranial venous sinus, superior sagittal sinus (SSS), cavernous sigmoid petrosal dural folds, clinicals
- Video 13.2 Cavernous petrosal sinus, origin, tributaries, cavernous sinus (CS) syndrome, carotid-cavernous fistula (CCF), clinicals
- Video 14.1 Salient features of bony orbit
- Video 14.2 Ocular muscles, lacrimal gland, and optic nerve
- Video 14.3 Orbit extraocular eye muscles and neurovascular structures
- Video 15.1 Thyroid gland and its relations
- Video 15.2 Larynx and trachea
- Video 16.1 Cranial nerves X, XI, XII, and ansa cervicalis in neck
- Video 17.1 Carotid, jugular, vagus, recurrent laryngeal nerve
- Video 17.2 Scalene triangle
- Video 17.3 Subclavian vessels, brachial plexus, and scalene triangle

- Video 18.1 Last four cranial nerves: Glosso-pharyngeal vagus, hypoglossal, and accessory nerves in the neck
- Video 18.2 Carotid arteries
- Video 19.1 Cervical plexus
- Video 20.1 Laryngopharynx and piriform fossa
- Video 21.1 Floor of the mouth
- Video 23.1 Larynx-part 1: external structure
- Video 23.2 Larynx-part 2: external structure
- Video 23.3 Interior of larynx, trachea, laryngopharynx, and piriform fossa
- Video 24.1 Exenterated eyeball showing ocular muscles, lacrimal gland, and optic nerve
- Video 27.1 Human brain: vertebrobasilar circulation of brain
- Video 27.2 Human brain: carotid middle cerebral, and anterior cerebral arteries
- Video 27.3 Tracking brain circulation via 2D time of flight angiography (TOF) serial MRI axial slices with narration
- Video 29.1 Cerebellar dissection: Part I
- Video 29.2 Cerebellar dissection: Part II
- Video 29.3 Deep nuclei of cerebellum
- Video 30.1 Ventricles of the brain
- Video 31.1 Hippocampus and fornix
- Video 31.2 Papez circuit
- Video 32.1 Circumventricular organs, location, cytoarchitecture description
- Video 33.1 Caudate nucleus, lentiform nucleus, thalamus, and internal capsule
- Video 34.1 Lateral ventricle
- Video 35.1 Basal ganglia: Part I
- Video 35.2 Basal ganglia: Part II

# Key Highlights

## Learning Objectives

At the end of the dissection of the face, you should be able to identify the following:

- Surface landmarks of the face.
- Subcutaneous muscles of the face and the masseter muscle.
- Motor and sensory nerves of the face, that is, branches of the facial (motor) nerve and cutaneous branches of the ophthalmic, maxillary, and mandibular nerves (sensory) on the face.

Learning objectives provide clear, structured, competency-based outcomes

## Dissection and Identification (Video 3.1)

### A. Skin incision and reflection.

1. For dissection of the face, the cadaver should be in the supine position. Raise the head by placing a wooden block under the head.
2. Give a circular incision in the skin close to the eyelids (A in Fig. 3.1) and another similar incision close to the red margins of the upper and lower lips (B in Fig. 3.1).
3. Give a midline incision from the root of the nose to the point of the chin (C in Fig. 3.1).
4. Give a horizontal incision from the lateral end of the circular incision around the margin of the eyelids and extend it to the front of the auricle (D in Fig. 3.1).
5. Give another horizontal incision from the angle of the mouth and extend it up to the posterior border of mandible (E in Fig. 3.1).
6. Start reflecting the upper flap from midline and go backward, together with the flap of the scalp, till you reach just anterior to the auricle. Similarly, reflect the lower flap downward till you reach the lower margin of the mandible below the auricle. Now carefully reflect the skin from the eyelids.



Video 3.1 External nose.

Highlighted Dissection boxes with videos and original cadaveric photographs for better correlation.

## Clinical Notes

**Partial ptosis (drooping) of the upper eyelid:** This occurs due to the paralysis of the Müller muscle (a smooth muscle part of the levator palpebrae superioris) supplied by the sympathetic fibers from the upper cervical sympathetic ganglion as in the case of *Horner syndrome*.

**Stye:** It is the inflammation followed by the collection of pus in the gland of Zeis (sebaceous gland associated with the eyelashes).

**Chalazion:** It is the infection and formation of a cyst in the meibomian gland (tarsal gland) due to obstruction in the duct of the gland.

Incorporates relevant clinical conditions under dedicated sections titled 'Clinical Notes'. These sections serve to connect theoretical knowledge with practical applications, therefore reinforcing the clinical relevance of anatomical concepts.

# Introduction to Dissection

Anatomy is one of the basic subjects in medical education. It deals with the structure of human body. A sound knowledge of this subject provides better understanding of the clinical subjects. The subject of anatomy is best studied by dissection. It will be appropriate to say that dissection forms an integral part of teaching or learning anatomy. It gives you an opportunity to explore, observe, and learn about structures/organs. The experience that you gain in the dissection room is unmatched. It cannot be compared to learning through books, illustrations, CDs, and DVDs that are available to learn the subject. Dissecting a cadaver improves your skill of handling the tissues

A Separate section on Introduction to Dissection provided in Volume 1 for preliminary alignment.

## The Oath

### Cadaveric Oath

I will always treat you with respect and dignity of the highest order, as you are my first anatomy teacher.

I will always respect your privacy and confidentiality.

I will use this knowledge for the service of society.

In all my deeds from now onward, I will do justice to your great sacrifice. My heart fills with gratitude as I realize your kind and courageous act of donating your body for the purpose of our learning.

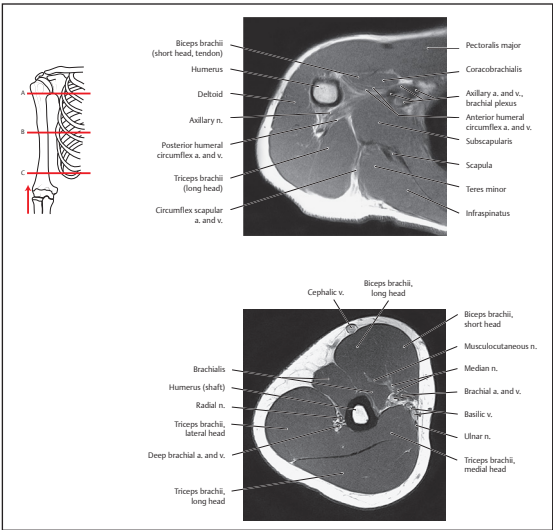
I will be grateful to you and your family for this act of "Living after Death."

A dedicated section for the competency "Cadaver as the First Teacher.

QR code-based digital learning experience with videos to support study anytime, anywhere.



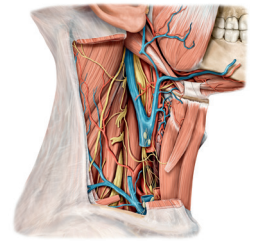
Video 16.1 Cranial nerves X, XI, and XII and arterial cervicalis in the neck.



CT and MRI images have been given at the end of each volume to show radiological appearance of various anatomical structures.



# Deep Dissection of the Neck—II: Structures under Cover of the Sternocleidomastoid and Posterior Belly of Digastric



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## Learning Objectives

At the end of the deep dissection of the neck (structures under cover of the sternocleidomastoid and posterior belly of the digastric muscle), you should be able to identify the following:

- Accessory nerve as it is crossed by the deep surface of the sternocleidomastoid muscle.
- Hypoglossal nerve as it lies deep to the posterior belly of the digastric muscle.
- Occipital and posterior auricular arteries.
- Superior and inferior roots of the ansa cervicalis.
- External and internal branches of the superior laryngeal nerves.
- Contents of the carotid sheath—common and internal carotid artery, internal jugular vein, and vagus nerve.
- Bifurcation of the common carotid artery into external and internal carotids/carotid body.

## Introduction

We have already seen the superficial contents of the digastric and carotid triangles. However, many structures were not seen clearly and completely as they were hidden under cover of the posterior belly of the digastric and sternocleidomastoid muscles. In this dissection, we shall reflect the sternocleidomastoid and posterior belly of the digastric muscle to see many deeper structures that are situated deep to the *upper and middle* parts of the sternocleidomastoid muscle.

In the upper part, the sternocleidomastoid muscle lies on the posterior belly of the digastric, levator scapulae, and splenius capitis muscles. In the upper part, it also covers the cervical plexus and is in relation to the deep cervical group of the lymph nodes.

The middle part of the muscle lies on the carotid sheath, ansa cervicalis, bifurcation of the common carotid artery and commencement of the external and internal carotid arteries, and brachial plexus. The sympathetic trunk lies posterior to the carotid sheath.

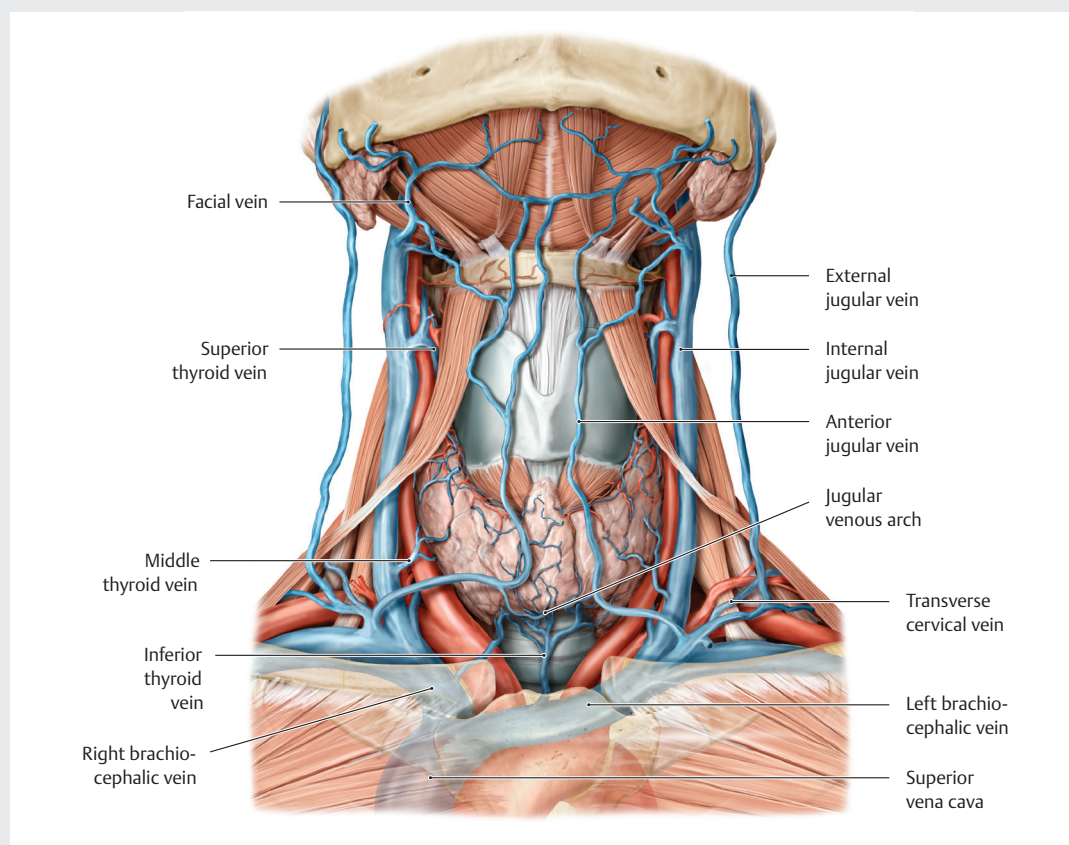
## Surface Landmarks

On a dry skull, see the site of attachment of the posterior belly of the digastric muscle at the mastoid groove. Also, review the attachments of the greater cornu of the hyoid bone. Review the two heads of the origin (from the clavicle and sternum) and insertion (on the mastoid process) of the sternocleidomastoid muscle in a living person.

## Dissection and Identification

### A. Exposure of the structures under cover of the sternocleidomastoid muscle.

1. Give a cut in the clavicular and sternal heads of origin of the sternocleidomastoid muscle, about an inch above their origin. Reflect the sternocleidomastoid muscle by carefully dissecting it from its covering of the investing layer of the deep fascia. Reflect it upward till the mastoid process.
2. Remove the three tributaries of the internal jugular vein (common facial vein, superior and middle thyroid veins) from the field as they may interfere with the dissection (**Fig. 16.1**).
3. Identify the accessory nerve as it lies deep to its undersurface below the mastoid process. Trace the accessory nerve superiorly as far as possible. We shall see its exit from the jugular foramen in a later dissection (**Fig. 16.2**).



**Fig. 16.1** Cervical veins (anterior view). (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)

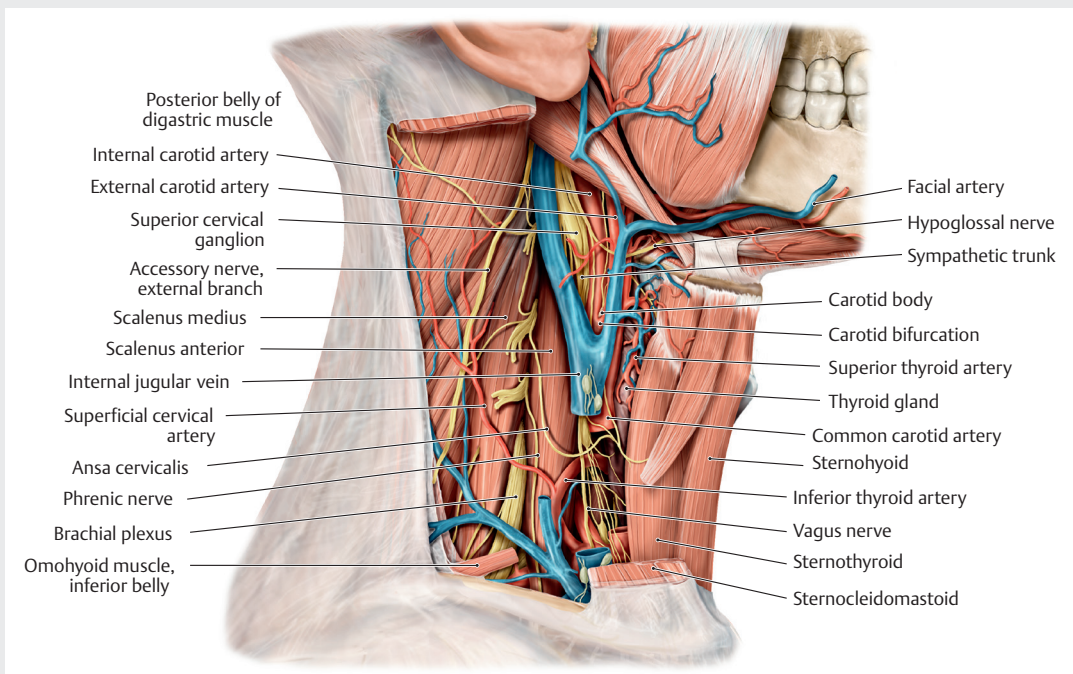
4. Identify the branches of the cervical plexus at the posterior border of the sternocleidomastoid muscle and trace these branches toward the cervical vertebral column.
5. Now identify the upper and lower border of the posterior belly of the digastric muscle. Look for the occipital branch of the external carotid artery on its inferior border and the posterior auricular artery on its superior border.
6. If you can save these two arteries, it is good; otherwise, detach the digastric muscle from its attachment on the mastoid groove and reflect it downward toward the intermediate tendon along with both the arteries.
7. Look for many large lymph nodes lying on the surface of the carotid sheath. The jugulodi-gastric and jugulo-omohyoid groups are in relation to the posterior belly of the digastric and inferior belly of the omohyoid, respectively (refer to **Fig. 11.9**).

## B. Dissection of the hypoglossal nerve, ansa cervicalis, and carotid sheath (Video 16.1).

1. Just above the tip of the greater cornu of the hyoid bone, find the hypoglossal nerve. Also, trace the nerve to the thyro-hyoid muscle as it is given when the hypo-glossal nerve lies on the hyoglossus mus-cle (**Fig. 16.4**).



**Video 16.1** Cranial nerves X, XI, and XII and ansa cervicalis in the neck.



**Fig. 16.2** Deep dissection of the neck showing structures under cover of the sternocleidomastoid. (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)

2. Follow the hypoglossal nerve backward to locate the superior root of the ansa cervicalis, which travels along with the hypoglossal nerve. More laterally on the carotid sheath, find the inferior root of the ansa cervicalis. See the loop formed by joining both the roots (**Figs. 16.2–16.4**).
3. We have already exposed the contents of the carotid sheath in the carotid triangle. Extend the incision on the sheath upward as far as possible and downward up to the root of the neck. Use blunt dissection to separate the internal jugular vein from the common carotid and internal carotid arteries. We have already seen three important tributaries (common facial vein, superior and inferior thyroid veins) of the internal jugular vein.
4. Once again, review the bifurcation of the common carotid artery at the level of the upper border of the thyroid cartilage (refer to **Fig. 18.6**). Identify the carotid body and carotid sinus at the bifurcation of the common carotid artery.
5. The branches of the external carotid artery have already been explained in the carotid triangle and the posterior auricular branch at the superior border of the digastric muscle before detaching it from its attachment on the mastoid. We have also seen its two terminal branches in relation to the parotid gland.
6. At the posterior border of the thyrohyoid muscle, search for the internal laryngeal nerve and superior laryngeal artery piercing the thyrohyoid membrane.

### C. Dissection of the cricothyroid muscle, external laryngeal nerve, and sympathetic trunk

1. Deep to the lateral lobe of the thyroid gland, search for the cricothyroid muscle and inferior constrictor of the pharynx. On their surface, find the external laryngeal nerve, which innervates the cricothyroid muscle (refer to **Fig. 15.9**). Now follow both the external and internal laryngeal nerves backward and upward; they will join together to form the superior laryngeal nerve. The superior laryngeal nerve is a branch of the vagus, which lies below the base of the skull, at a higher level. We shall dissect it later.
2. Pull the carotid arteries anteromedially and find the sympathetic trunk posterior to the carotid sheath (refer to **Fig. 17.3**).

## Muscles

*(Note: In this dissection, we have seen that there many muscles lie deep to the sternocleidomastoid muscle, that is, posterior belly of the digastric, stylohyoid, splenius capitis, and levator scapulae. We have studied these muscles in Chapters 6 and 7. Similarly, in this area of dissection we have also exposed constrictors of the pharynx and the cricothyroid muscle. We shall study these muscles later when we dissect the pharynx and larynx.)*

### Carotid Sheath

The major part of the carotid sheath is under cover of the sternocleidomastoid muscle. The carotid sheath is the facial sheath that encloses the internal jugular vein, carotid arteries (common carotid and internal carotid), and vagus nerve. The internal jugular vein lies lateral to the artery.

On the anterior surface of the carotid sheath, there are lymph nodes and roots of the ansa cervicalis, while posteromedially to the carotid sheath lies the sympathetic trunk (refer to **Figs. 11.9, 16.4, and 17.3**).

## Arteries

*(We have already studied the terminal branches of the external carotid [maxillary and superficial temporal] during the dissection of the parotid gland and all others [except the posterior auricular] during the dissection of the carotid triangle.)*

**Posterior auricular:** It arises from the external carotid artery above the level of the posterior belly of the digastric muscle and runs upward and posteriorly to ends near the base of the mastoid process.

**Carotid sinus:** It is a dilatation at the upper end of the common carotid artery and at the beginning of the internal carotid artery. The sinus is innervated by the branches of the glossopharyngeal nerve. It acts as a blood pressure receptor. An increase in blood pressure leads to the stimulation of the glossopharyngeal nerve, which reflexly stimulates the vagus nerve, leading to a fall in blood pressure and slowing of the heart rate.

**Carotid body:** It is a small mass of cells that acts as a chemoreceptor monitoring the concentration of oxygen within the arterial blood. The carotid body is present posterior to the bifurcation of the common carotid artery. A fall in the oxygen level of blood leads to the stimulation of the carotid body, which reflexly produces a rise in blood pressure, heart rate, and changes in the depth and rate of respiration.

## Veins

Four tributaries of the internal jugular vein are seen deep to the sternocleidomastoid muscle. These are the lingual vein, common facial vein (**Fig. 16.1**), and superior and middle thyroid veins (refer to **Fig. 15.6**).

*(We shall study the internal jugular vein after it is completely dissected at the root of the neck and the base of the skull.)*

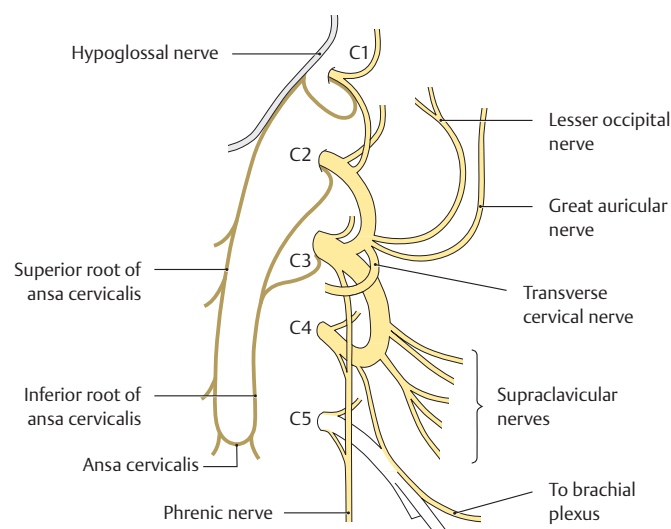
## Nerves

### Ansa Cervicalis

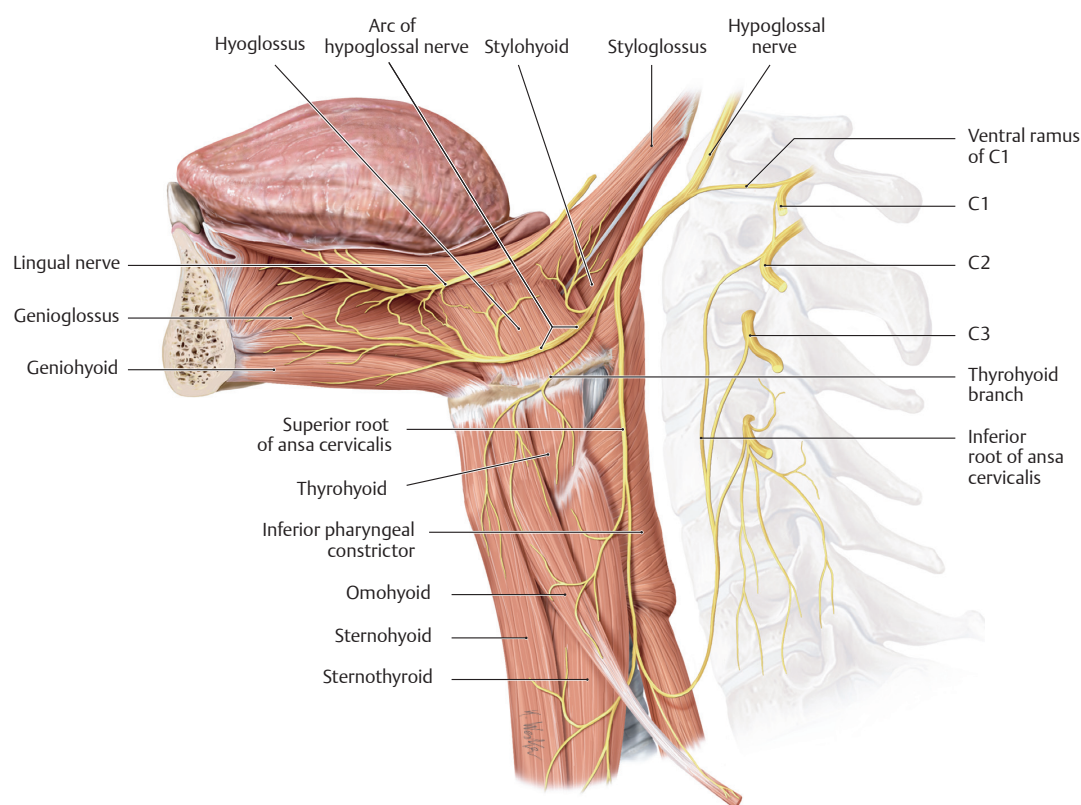
The ansa cervicalis is a nerve loop that lies in the carotid triangle in front of the carotid sheath (common carotid artery). It is formed by two roots (refer to **Figs. 16.2–16.4**):

1. **Superior root:** It arises from the hypoglossal nerve. However, in the true sense, it is not the branch of the hypoglossal nerve but is made up of fibers arising from the first cervical (C1) spinal nerve. These fibers of the spinal nerve run with the hypoglossal nerve for some distance and form the superior root and also supply motor fibers to the thyrohyoid and geniohyoid muscles.
2. **Inferior root:** It arises from the ventral rami of C2 and C3 spinal nerves. It descends superficially into the internal jugular vein and then joins the superior root at the level of the common carotid artery.

Branches arising from the ansa cervicalis supply motor fibers to the infrahyoid group of muscles, that is, the superior belly of the omohyoid, sternohyoid, and sternothyroid, and the inferior belly of the omohyoid.



**Fig. 16.3** Cervical plexus and ansa cervicalis. (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)



**Fig. 16.4** Hypoglossal nerve (CN XII) and ansa cervicalis (left lateral view). (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)

## Lymph Nodes

Deep cervical groups of lymph nodes are vertically arranged around the carotid sheath from the base of the skull to the root of the neck, deep to the sternocleidomastoid muscle (refer to **Figs. 7.6** and **11.9**). They drain to the superficial groups of the cervical lymph nodes and deeper tissues of the head and neck. They are divided into jugulodigastric (upper) and jugulo-omohyoid (lower) deep cervical groups.

*Jugulodigastric (upper or superior) nodes:* These lymph nodes are present on the carotid sheath where it is crossed by the posterior belly of the digastric muscle. They drain the cranial cavity, infratemporal fossa, parotid and submandibular nodes, tonsil, pharynx, and root of the tongue, etc. These nodes drain to the inferior deep cervical group of the nodes.

*Jugulo-omohyoid (lower or inferior) nodes:* These lymph nodes are present on the carotid sheath where it is crossed by the omohyoid muscle. They drain the superior deep cervical group, thyroid gland, lower larynx, cervical trachea, and esophagus. This group also drains the tip of the tongue.

### Clinical Notes

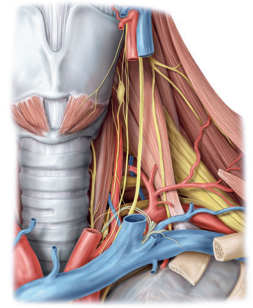
Cervical groups of the lymph nodes are of great clinical significance because they get enlarged during malignancy and tubercular infections. In malignancy, the nodes may adhere or infiltrate the internal jugular vein.



## CHAPTER

# 17

# Deep Dissection of the Neck—III: Root of the Neck



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### Learning Objectives

At the end of the deep dissection of the root of the neck, you should be able to identify the following:

- The subclavian vein joining the internal jugular vein to form the brachiocephalic vein on the right and left sides.
- Opening of the right lymphatic and thoracic ducts at the junction of the subclavian and internal jugular veins on the right and left sides, respectively.
- The vagus and phrenic nerves as they lie anterior to the subclavian artery.
- The subclavian artery and its branches.
- The scalene muscles.
- The cervical pleura.
- The root and trunks of the brachial plexus.
- The right and left recurrent laryngeal nerves in the groove between the esophagus and trachea.
- The cervical sympathetic trunk.

## Introduction

The root of the neck is an important anatomical region as it contains structures passing between the head and the thorax and also between the upper limb and the thorax. These structures pass through the *superior thoracic aperture*, which is sometimes also known as the *thoracic outlet*. The aperture is bounded anteriorly by the manubrium sterni, on the sides by the first rib and posteriorly by the first thoracic vertebra. The aperture is inclined anteriorly; therefore, the cervical pleural sac with the apex of the lung projects from the aperture into the root of the neck.

The subclavian and internal jugular veins join to form the brachiocephalic vein on either side of the root of the neck. The internal carotid artery and internal jugular vein run upward along with the vagus nerve in the carotid sheath. The subclavian artery and its branches are important constituents at the root of the neck. The phrenic nerve is anterior to the scalenus anterior muscle. This muscle divides the subclavian artery into three parts. The roots and trunks of the brachial plexus lie posterior to the scalenus anterior muscle. Deep to the internal jugular vein lie the cervical sympathetic trunk and the inferior cervical sympathetic ganglion. The trachea and esophagus lie in the midline with the left recurrent laryngeal nerve in the groove between the two. The right recurrent laryngeal nerve winds around the right subclavian artery to lie in the groove between the esophagus and the trachea on the right side.

## Surface Landmarks

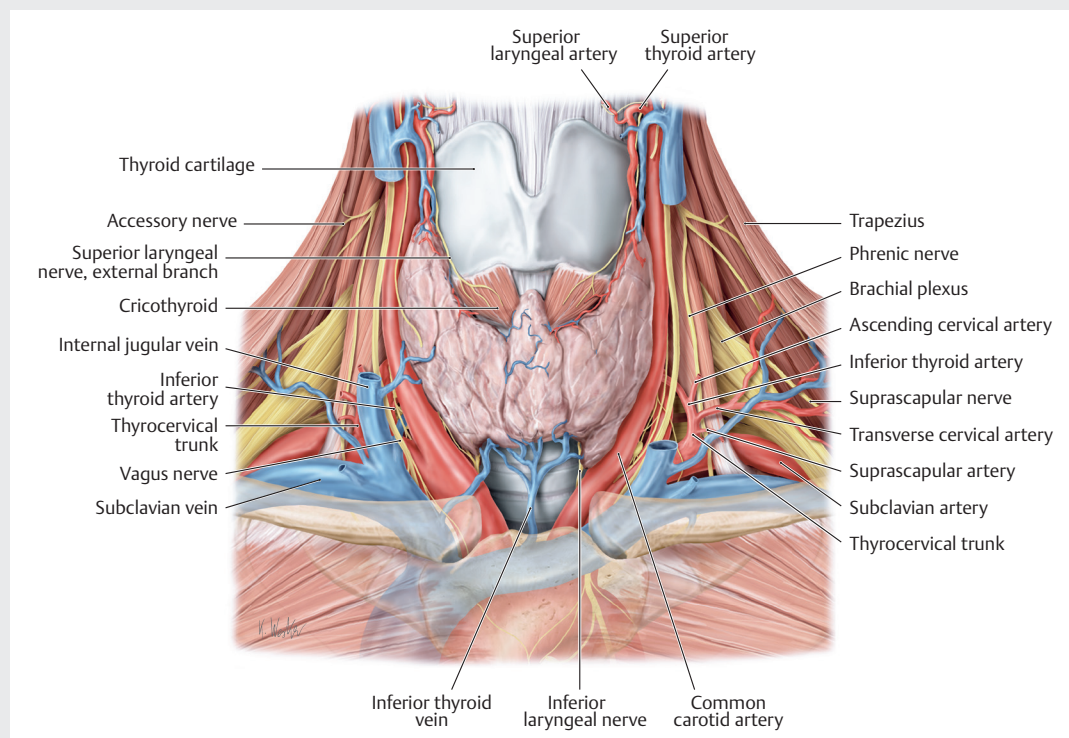
On an articulated skeleton, see the boundaries of the superior thoracic aperture. Note that the aperture is inclined anteriorly (refer to **Fig. 12.1a, b** of Volume I of *Thieme Dissector*). Also, note the superior border of the manubrium sterni and sternoclavicular joint.

Learn the bony features of the cervical vertebrae. Look for the anterior and posterior tubercles of the transverse processes (refer to **Fig. 1.13a**). See the scalene tubercle on the first rib and grooves for the subclavian vein and subclavian artery (refer to **Fig. 12.6** of Volume I of *Thieme Dissector*).

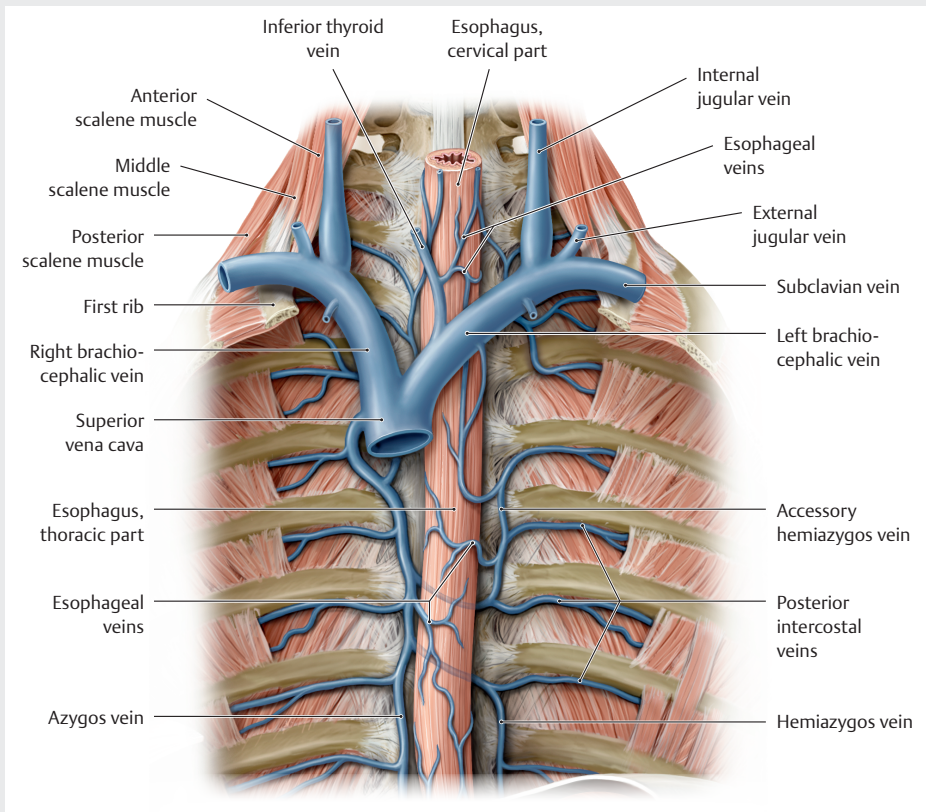
## Dissection and Identification

### A. Dissection to expose the junction of the internal jugular and subclavian vein (formation of the brachiocephalic vein), thoracic duct, and right lymphatic duct.

1. At the root of the neck, we have already reflected the sternocleidomastoid, sternohyoid, and sternothyroid muscles (**Fig. 17.1**).
2. Clean the inferior belly of the omohyoid muscle. Cut the fascial sling, which binds the intermediate tendon to the clavicle. Reflect the inferior belly of the omohyoid downward.
3. With the help of a saw, give a cut in the middle of the clavicle. Disarticulate the medial end of the clavicle at the sternoclavicular joint and remove the medial half of the clavicle. This will help dissect the structures at the root of the neck (thoracic outlet).
4. With a blunt dissection, clean the lower end of the internal jugular vein and subclavian vein. Follow the formation of the brachiocephalic vein and trace it downward till it disappears in the thorax (**Fig. 17.2**). See the external jugular vein joining the subclavian vein. If possible, lift the brachiocephalic vein and see the vertebral vein joining the posterior surface of the brachiocephalic vein.



**Fig. 17.1** Structures and their relationship at the root of the neck. (From: Schuenke M, Schulte E, Schumacher U. *THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy*. Illustrations by Voll M and Wesker K. © Thieme 2020.)

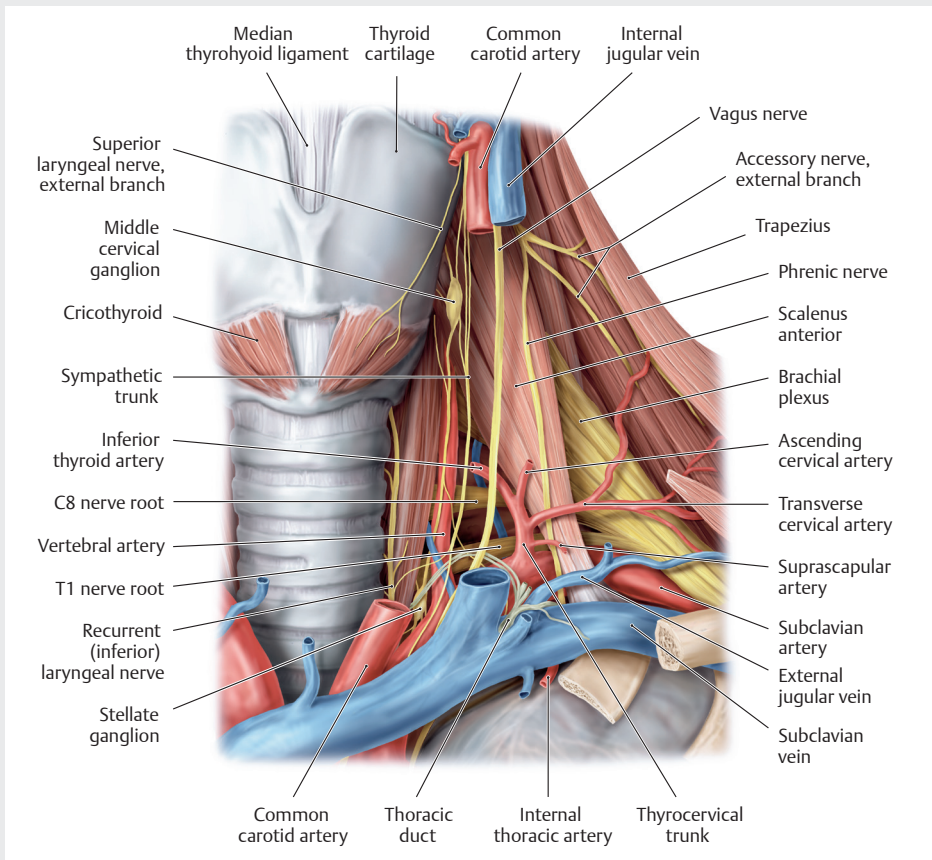


**Fig. 17.2** Formation of brachiocephalic veins. (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Internal Organs. Illustrations by Voll M and Wesker K. © Thieme 2020.)

5. On the left side, find the thoracic duct at the junction of the left subclavian and left internal jugular vein (**Fig. 17.3**). Follow the thoracic duct upward as it crosses the first part of the left subclavian artery to **go deep toward** the esophagus.
6. On the right side, find the right lymphatic duct in the same position, that is, at the junction of the right subclavian and right internal jugular veins.

## **B. Dissection to the subclavian artery, scalenus anterior muscle, vagus, recurrent laryngeal and phrenic nerves (Videos 17.1 and 17.2).**

1. Now give a cut in the subclavian vein at the level where it lies on the first rib. Reflect the vein toward the medial side to expose the subclavian artery.
2. Dissect a part of the right brachiocephalic trunk as it lies on the root of the neck.
3. See that the right subclavian artery is taking origin from the brachiocephalic trunk at the root of the neck (**Fig. 17.4**), while the left subclavian artery is coming out at the outlet of the thorax, as it arises from the arch of the aorta in the thoracic cavity.
4. With the help of blunt dissection, clean the anterior surface of the scalenus anterior muscle, transverse cervical and suprascapular arteries, vagus, and phrenic nerves, which are related to its anterior surface (refer to **Fig. 17.3**). Follow this muscle inferiorly at its attachment to the first rib. Anterior to this attachment lies the subclavian vein and posterior to it lies the subclavian artery.



**Fig. 17.3** Deep dissection of the root of the neck (right side). (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)

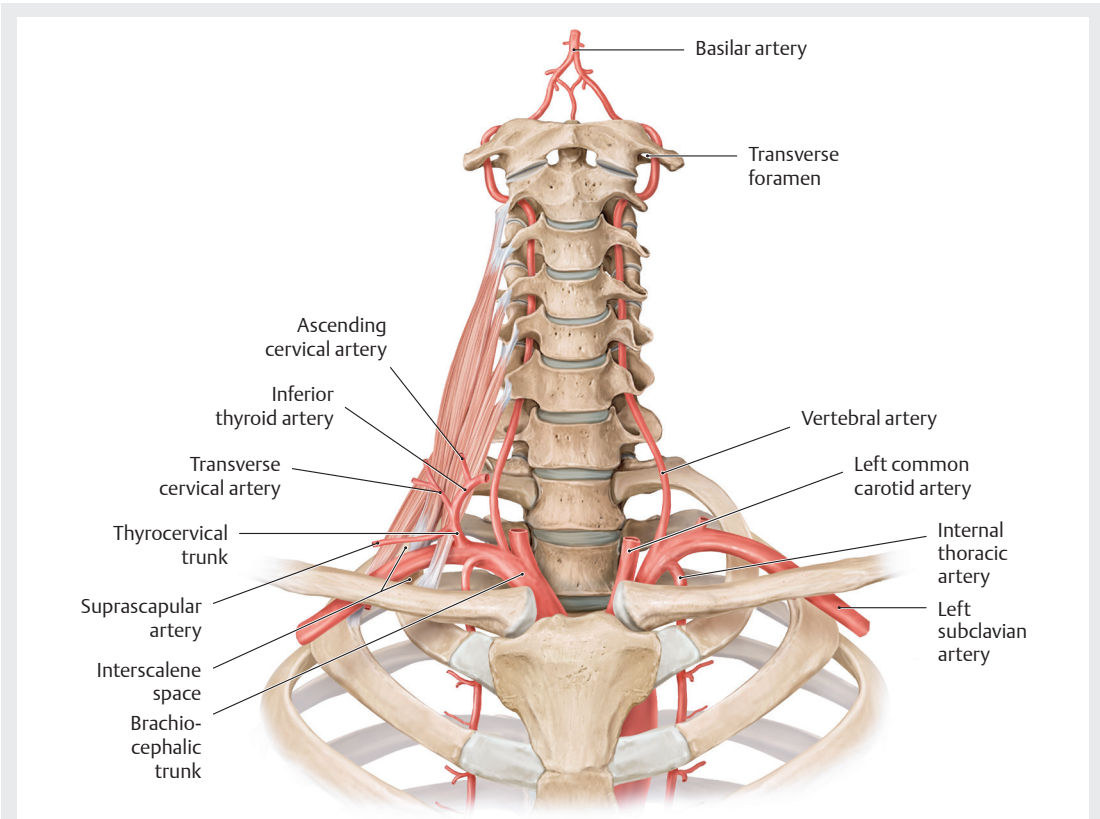


**Video 17.1** Carotid artery, jugular vein, vagus nerve, and recurrent laryngeal nerve.



**Video 17.2** Scalene triangle.

5. The subclavian artery is divided into three parts (first, second, and third) by its relationship with the scalenus anterior muscle (refer to **Fig. 17.4**).
6. Clean the vagus nerve as it crosses the first part of the subclavian artery. On the right side, it gives origin to the right recurrent laryngeal nerve. Follow the right recurrent laryngeal nerve winding around the subclavian artery to the groove between the trachea and the esophagus. On the left side, follow the left recurrent laryngeal nerve.
7. Clean the phrenic nerve as it crosses the first part of the subclavian artery. On the left, see the thoracic duct crossing the first part of the subclavian artery.



**Fig. 17.4** Arteries at the root of the neck. Note the branches of the subclavian artery. (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)

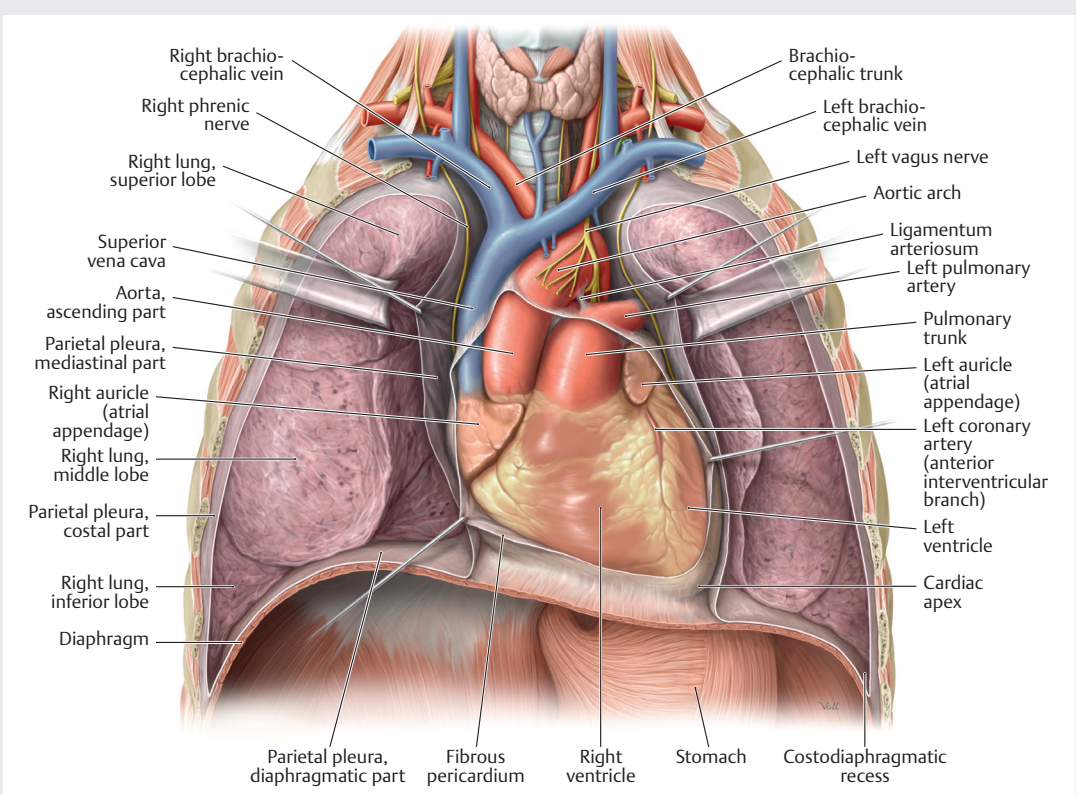
8. Clean the cervical pleura posterior to the first part of the subclavian artery (**Fig. 17.5**).
9. With the help of blunt dissection, clean the branches of the subclavian artery (i.e., vertebral, internal thoracic, thyrocervical trunk, costocervical trunk, and dorsal scapular artery) and follow each of them as far as possible (refer to **Fig. 17.4**).
10. Clean the vertebral artery and vein above the first part of the subclavian artery, as they lie between the longus colli and anterior scalene muscles (**Table 17.1** and **Fig. 17.3**). The vertebral artery passes anterior to the transverse process of the seventh cervical vertebra and disappears in the transverse process of the sixth cervical vertebra.



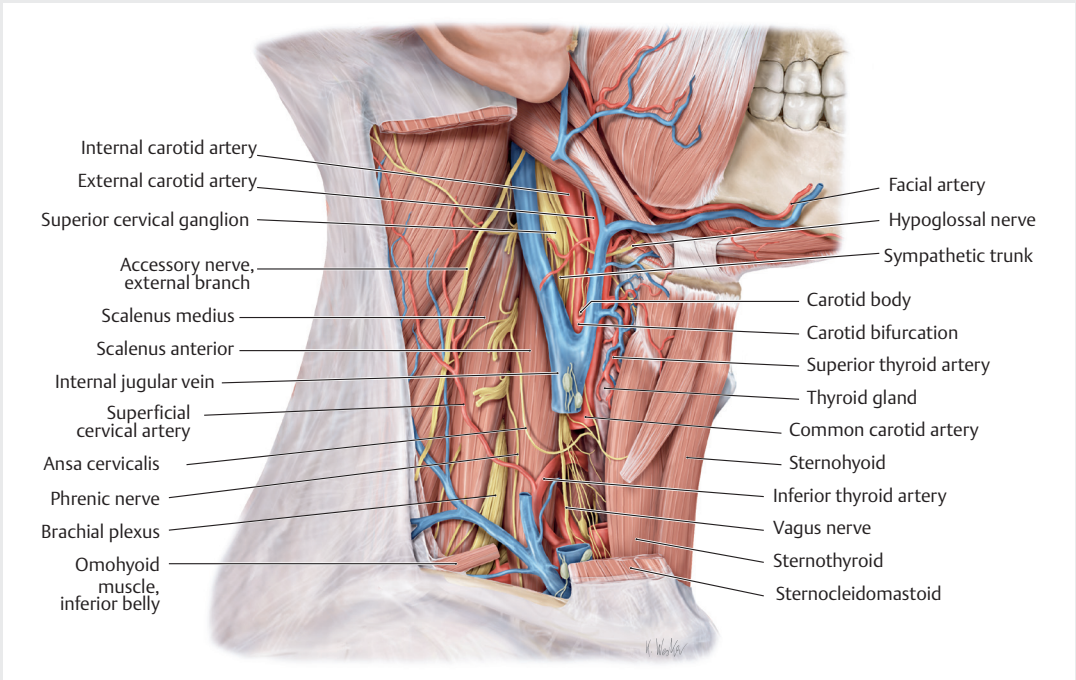
**Video 17.3** Subclavian vessels, brachial plexus, and scalene triangle.

### C. Dissection to expose the sympathetic trunk, inferior and middle cervical ganglia, and roots and trunks of the cervical plexus (**Video 17.3**).

1. Expose the ventral rami of the seventh and eighth cervical nerves, posterior to the vertebral artery (**Fig. 17.3**).



**Fig. 17.5** Dissection of the root of the neck extended into the thoracic cavity. (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Internal Organs. Illustrations by Voll M and Wesker K. © Thieme 2020.)



**Fig. 17.6** Muscles forming the floor of the posterior triangle exposed. (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)

2. Pull the common carotid artery laterally and look for the sympathetic trunk posterior to it. Trace the trunk inferiorly and find the cervicothoracic ganglion (inferior cervical ganglion) near the neck of the first rib (at the superior thoracic aperture) (refer to **Fig. 17.3**).
3. Trace the trunk superiorly and find the middle cervical ganglion close to the transverse process of the sixth cervical vertebra.
4. Clean the gap between the anterior and middle scalene muscles. Find the roots and trunks of the brachial plexus above the third part of the subclavian artery (refer to **Fig. 17.3** and **Table 17.2**).
5. Once again, review the muscles forming the floor of the posterior triangle of the neck, that is, the splenius capitis, levator scapulae, anterior, middle, and posterior scalene muscles (**Fig. 17.6**).

Muscles

Scalene Muscles

These muscles are present at the side of the neck (lateral vertebral muscles) and extend between the cervical transverse processes and the first two ribs (**Fig. 17.7**).

Table 17.1 Scalene muscles

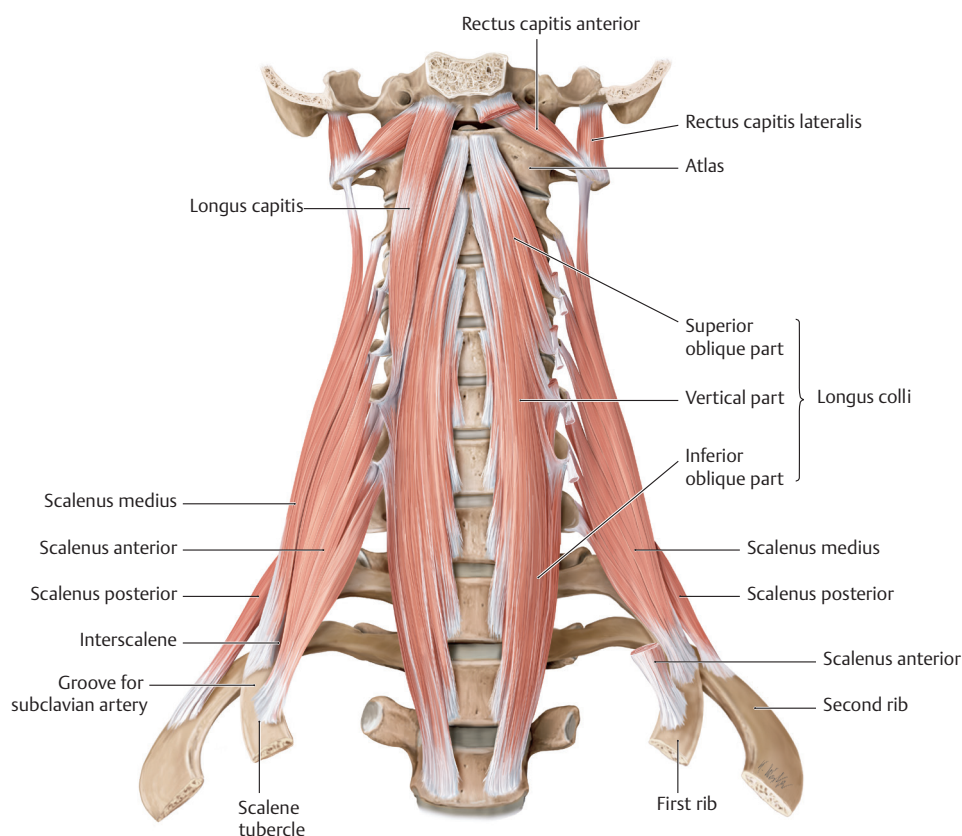
| Muscle             | Origin                                                                                        | Insertion                                                                                        | Nerve supply                                          | Action                                                                                                                                                                                                                  |
|--------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Scalenus anterior  | From the anterior tubercles of the typical cervical vertebrae (C3–C6)                         | On the scalene tubercle on the inner border of the first rib                                     | From the ventral rami of C4, C5, and C6 spinal nerves | Flexion of the cervical column when both muscles contract together from below<br>Elevation of the ribs when they act from above as in inspiration<br>Lateral flexion of the cervical vertebrae when acting unilaterally |
| Scalenus medius    | Transverse process of C2 and posterior tubercles of the transverse process of C3–C7 vertebrae | On the rough area of the first rib between its tubercle and the groove for the subclavian artery | From the ventral rami of C3–C8 spinal nerves          | Lateral flexion of the neck to the same side. It also elevates the first rib in inspiration                                                                                                                             |
| Scalenus posterior | From the posterior tubercles of the transverse processes of C4–C6 vertebrae                   | On the outer surface of the second rib                                                           | By the ventral rami of the lower five spinal nerves   | Lateral flexion of the neck and elevation of the second rib                                                                                                                                                             |

Relations of the Scalenus Anterior Muscle

The anterior scalenus muscle is the *key muscle at the root of the neck* (**Fig. 17.3**).

*Anteriorly:* It is crossed by the phrenic nerve, internal jugular vein (as it lies within the carotid sheath), subclavian vein, clavicle, and clavicular head of the sternocleidomastoid muscle. It is also crossed anteriorly by the inferior belly of the omohyoid, transverse cervical, and suprascapular arteries.

*Posteriorly:* It is crossed by the scalenus medius, roots of the brachial plexus, subclavian artery, costocervical trunk (from the second part of the subclavian artery), suprapleural membrane, and cervical pleura.



**Fig. 17.7** Pre- and paravertebral muscles of the neck. (From: Schuenke M, Schulte E, Schumacher U. THIEME Atlas of Anatomy. Head, Neck, and Neuroanatomy. Illustrations by Voll M and Wesker K. © Thieme 2020.)

*Medially:* It is crossed by the thyrocervical trunk, vertebral artery, thoracic duct on the left side, and lymphatic trunk on the right side.

*Laterally:* It is crossed by the trunks of the brachial plexus and the subclavian artery lies close to its lateral border.

## Arteries

### Common Carotid Artery

In the neck, both the common carotid arteries lie behind the sternoclavicular joint. Although the left common carotid arises from the arch of the aorta in the thorax, the right arises from the brachiocephalic trunk posterior to the right sternoclavicular joint.

The course of both the common carotid arteries from the sternoclavicular joint to the upper border of the thyroid cartilage is the same (**Fig. 17.1**). At the level of the upper border of the thyroid cartilage, it terminates by dividing into internal and external carotid arteries.

Throughout its course, the artery is enclosed in the carotid sheath. The internal jugular vein lies anterolateral to it and the vagus nerve lies posterolateral to it. No branch arises from the common carotid artery.

Subclavian Artery

The subclavian artery is the artery of the upper limb and also supplies blood to the neck and brain. On the right side, the subclavian artery arises from the brachiocephalic trunk behind the sternoclavicular joint. At the outer border of the first rib, it becomes the axillary artery (refer to Fig. 17.4).

Parts of the Artery

For the purpose of description, the artery is divided into three parts: the *first part* extends from behind the sternoclavicular joint to the medial border of the scalenus anterior muscle. The *second part* lies behind the muscle and the *third part* extends from the lateral border of the scalenus anterior muscle to the outer border of the first rib.

Branches of the Artery

For branches of the subclavian artery, refer to Fig. 17.4 and Table 17.2.

Table 17.2 Branches of the subclavian artery

| Parts       | Branches                            | Short description                                                                                                                                                                                                                |
|-------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| First part  | 1. Vertebral                        | It supplies the brain. It originates from the first part and ascends between the longus colli and the medial border of the scalenus anterior muscle. It passes through the foramen transversarium of the sixth cervical vertebra |
|             | 2. Internal thoracic                | It arises close to the medial border of the scalenus anterior muscle. It runs downward, forward, and medially on the cervical pleura posterior to the first costal cartilage                                                     |
|             | 3. Thyrocervical trunk              | It arises close to the medial margin of the scalenus muscle and immediately divides into three branches                                                                                                                          |
|             | • Inferior thyroid                  | It supplies the lobe of the thyroid gland                                                                                                                                                                                        |
|             | • Suprascapular                     | It runs transversely in front of the scalenus anterior muscle and crosses the phrenic nerve                                                                                                                                      |
| Second part | • Transverse cervical               | After origin, it runs transversely and crosses the scalenus anterior muscle and phrenic nerve                                                                                                                                    |
|             | Costocervical trunk                 | It passes backward to reach the deep muscles of the back of the neck                                                                                                                                                             |
|             | 1. Deep cervical                    |                                                                                                                                                                                                                                  |
|             | 2. Highest intercostal              | It divides into the first and second posterior intercostal arteries                                                                                                                                                              |
|             | Dorsal scapular (occasional branch) | When present, it may replace the transverse cervical artery.                                                                                                                                                                     |

## Veins

### Subclavian Vein

The subclavian vein lies on the first rib in front of the insertion of the scalenus anterior muscle and on the cervical pleura, behind the clavicle (**Fig. 17.1**).

### Brachiocephalic Vein

The right and left brachiocephalic veins are formed by the union of the internal jugular vein and the subclavian vein between the cervical pleura and the medial part of the clavicle. Soon after their formation, they go into the thorax where the right and left veins join to form the superior vena cava. The left vein receives the thoracic duct.

### Thoracic Duct

The thoracic duct is a thin-walled, slender vessel that drains the lymph into the venous system. It drains the lymph from both sides of the body below the diaphragm and from the left side of the body above the diaphragm. It ascends from the thorax along the left margin of the esophagus. At the level of the C7 vertebra, it arches laterally to end at the junction of the subclavian and internal jugular veins to drain the lymph in the brachiocephalic vein (refer to **Fig. 17.3**).

### Cervical Pleura

The cervical pleura forms the dome of the pleural sac which encloses the apex of the lung. On either side, it bulges upward in the root of the neck through the superior thoracic aperture (outlet of the thorax). Owing to the inclined plane of the thoracic aperture, the cervical pleura projects in the neck about 5 cm in front of the first costal cartilage, while posteriorly it projects till the level of the neck of the first cervical rib (**Fig. 17.5**).

## Nerves

### Phrenic Nerve

The phrenic nerve supplies the diaphragm; therefore, it is an important nerve of respiration. It arises from the ventral rami of the C3, C4, and C5 spinal nerves. The nerve runs obliquely toward the medial side on the anterior aspect of the scalenus anterior muscle (refer to **Fig. 17.3**). On the left side, it crosses the medial border of the muscle to lie in front of the first part of the subclavian artery. While on the right side, it does not cross the first part of the subclavian artery but remains in front of the scalenus muscle as it crosses the second part of the subclavian artery.

### Recurrent Laryngeal Nerves

The right recurrent laryngeal nerve arises at the root of the neck from the vagus nerve, where the vagus crosses the first part of the subclavian artery. It hooks below the subclavian artery and ascends in the groove between the esophagus and the trachea. The left recurrent laryngeal nerve arises in the thorax as the vagus crosses the arch of the aorta. It also ascends in the groove between the esophagus and the trachea on the left side, at the root of the neck (refer to **Figs. 18.2 and 18.5**).

**Branches:** Each recurrent laryngeal nerve gives the following branches: to all the intrinsic muscles of the larynx except the cricothyroid; to the mucous membrane of the larynx below the vocal fold; and to the trachea, inferior part of the pharynx and esophagus, and the cardiac branch to the heart.

## Brachial Plexus

The brachial plexus lies in the root of the neck between the scalenus anterior and medius muscles, behind the clavicle, and in the axilla (**Fig. 17.1**). It mainly supplies the upper limb and consists of four parts, that is, *roots*, *trunk*, *division*, and *cords*. Roots and trunks lie in the root of the neck, divisions are behind the clavicle, and cords and their branches are in the axilla.

*Branches of the brachial plexus arising in the neck:* The branches to the scalene muscle and longus cervicis contribute to the *phrenic nerve* from C5 (supplies diaphragm), *dorsal scapular nerve* (supplies the levator scapulae and rhomboids major and minor), *suprascapular nerve* (supplies the supraspinatus and infraspinatus muscles), *long thoracic nerve* (supplies the serratus anterior muscle), and nerve to the *subclavius* muscle (supplies the subclavius muscle).

## Lymph Nodes and Lymph Trunks

The jugulo-omohyoid or inferior deep cervical lymph nodes are present on the carotid sheath close to the intermediate tendon and inferior belly of the omohyoid muscle (**Fig. 11.9**).

### Clinical Notes

**Cervical rib:** The subclavian artery and brachial plexus, at the root of the neck, pass through a narrow space (triangle). This triangle is bounded anteriorly by the scalenus anterior muscle, posteriorly by the medius muscle, and inferiorly by the first rib. If a *cervical rib* is present, it raises the base of the triangle, thus displacing and compressing the brachial plexus and subclavian artery upward.

**Scalene syndrome:** Owing to the spasm of the scalene muscles, the first rib is elevated. This causes the displacement and compression of the brachial plexus and subclavian artery (refer to **Fig. 17.3**). This phenomenon is known as the scalene syndrome.

The cervical rib and scalene syndrome both result in similar neurological and vascular symptoms:

1. **Vascular symptoms:** In severe cases, ischemia occurs in the limb, leading to gangrene of the fingers.
2. **Neurological symptoms:** As C8 and T1 (lower trunk of the brachial plexus) are compressed, tingling pain occurs along the inner border of the forearm and hand. This also leads to weakness and wastage of the intrinsic muscles of the hand.



Education

# Thieme Dissector

Volume I  
Upper Limb and Thorax

Third Edition

Vishram Singh  
G. P. Pal  
S. D. Gangane  
Sanjoy Sanyal

Based on the work of  
Michael Schuenke  
Erik Schulte  
Udo Schumacher

Illustrations by  
Markus Voll  
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# Contents

*Video Contents*

*Note from the Authors*

*About the Authors*

*Contributor to Volume I*

*List of Reviewers*

*Key Highlights*

*Introduction to Dissection*

1. Osteology of the Upper Limb
2. Pectoral Region and Axilla
3. Dissection of the Back
4. Scapular Region and Shoulder
5. Anterior Compartment of the Arm and Cubital Fossa
6. Posterior Compartment of the Arm
7. Flexor Compartment of the Forearm and Palm
8. Extensor Compartment of the Forearm and Dorsum of the Hand
9. Nerves of the Upper Limb
10. Joints of the Upper Limb
11. Introduction to Thorax
12. Skeleton of the Thorax
13. Thoracic Wall
14. Thoracic Cavity
15. Joints of the Thorax

*Appendices*

*Index*

## Video Contents

- Video 2.1     Structure of breast
- Video 2.2     Pectoral region
- Video 2.3     Neurovascular structures from axilla to cubital fossa
- Video 2.4     Course of axillary and brachial arteries
- Video 4.1     Deltoid muscle and axillary nerve
- Video 5.1     Flexor/anterior compartment of arm
- Video 6.1     Ulnar and radial nerves
- Video 7.1     Flexor compartment of forearm and neurovascular structures
- Video 7.2     Neurovascular structures of the palm
- Video 8.1     Extensors of forearm and dorsum of hand
- Video 9.1     Musculocutaneous, axillary, and radial nerves
- Video 13.1    Structures of the anterior thoracic wall
- Video 14.1    Relations of mediastinal surface of lung
- Video 14.2    Mediastinum and great blood vessels
- Video 14.3    Azygos and hemiazygos veins and thoracic duct
- Video 14.4    Pericardial sinuses
- Video 14.5    External features of heart
- Video 14.6    Blood vessels of heart
- Video 14.7    Internal features of right atrium of heart
- Video 14.8    Internal features of right ventricle
- Video 14.9    Aortic arch and descending thoracic aorta

# Thieme Dissector

Volume II  
Abdomen and Lower Limb

Third Edition

Vishram Singh  
G. P. Pal  
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Sanjoy Sanyal

Based on the work of  
Michael Schuenke  
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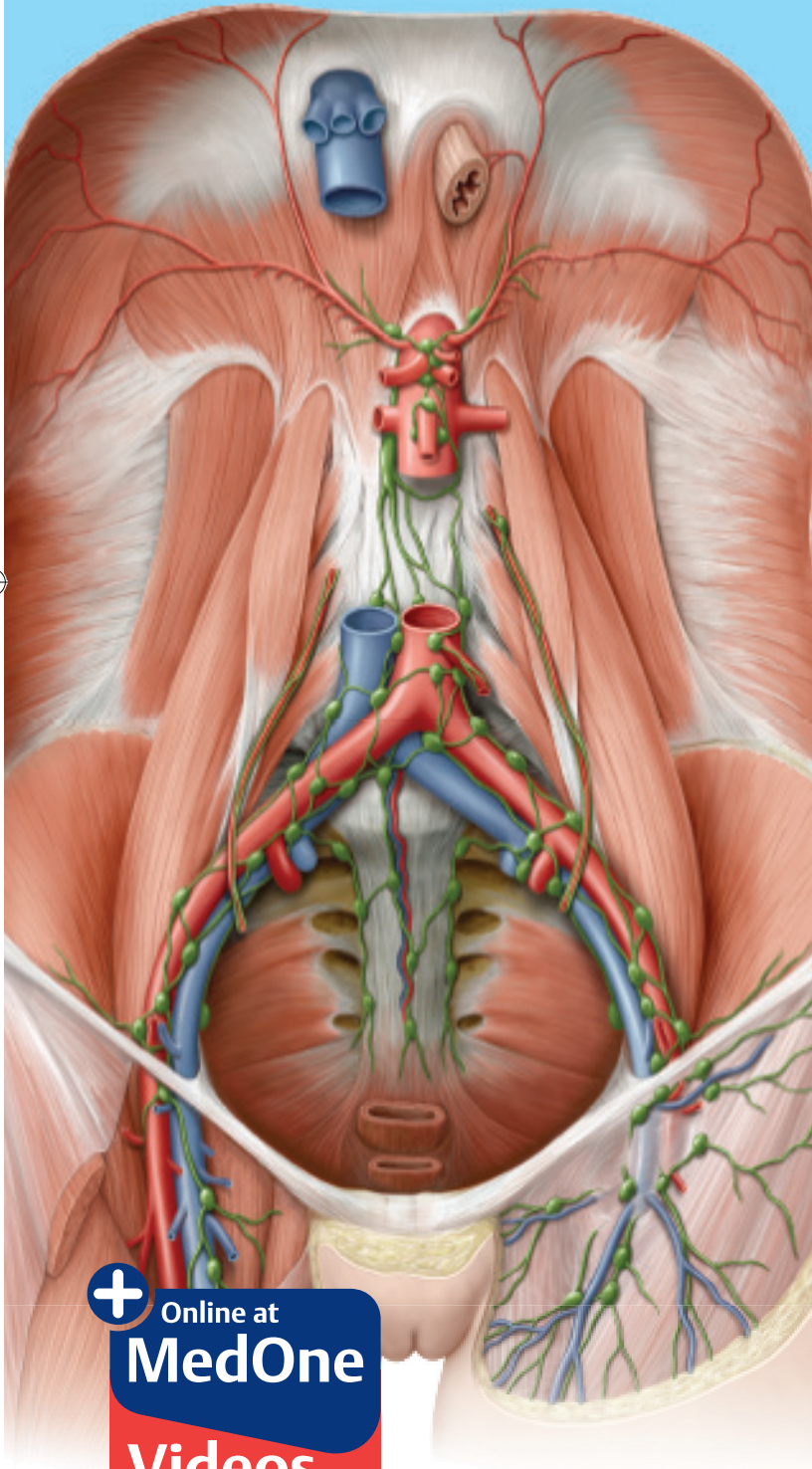
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# Contents

*Video Contents*

*Note from the Authors*

*About the Authors*

*Contributors to Volume II*

*List of Reviewers*

*Key Highlights*

1. Introduction and an Overview of the Bones of the Lower Limb
2. Anterior and Medial Compartments of the Thigh
3. Gluteal Region
4. Posterior Compartment of the Thigh and Popliteal Fossa
5. Anterior and Lateral Compartments of the Leg and Dorsum of the Foot
6. Posterior Compartment of the Leg
7. Sole of the Foot
8. Joints of the Lower Limb
9. Introduction and Overview of the Bones of the Abdomen
10. Anterior Abdominal Wall
11. Male External Genitalia
12. Loin
13. Abdominal Cavity and Peritoneum
14. Abdominal Part of Esophagus, Stomach, Celiac Trunk, and Spleen
15. Duodenum, Pancreas, and Portal Vein
16. Small and Large Intestines
17. Liver and Biliary System
18. Kidney, Ureter, and Suprarenal Gland
19. Diaphragm and Posterior Abdominal Wall
20. Introduction to Pelvis and Perineum
21. Pelvic Viscera
22. Rectum and Anal Canal
23. Uterus, Vagina, and Ovary
24. Pelvic Wall Muscles, Vessels, Nerves, and Lymphatics
25. Perineum
26. Joints of the Pelvis

*Appendices*

*Index*

## Video Contents

- Video 2.1 Muscles of anterior compartment of thigh
- Video 2.2 Femoral nerve
- Video 2.3 Fascia lata
- Video 2.4 Adductor brevis
- Video 2.5 Femoral triangle and adductor canal
- Video 3.1 Gluteal region—Part 1
- Video 3.2 Gluteal region—Part 2
- Video 3.3 Gluteal muscles
- Video 4.1 Hamstring muscles
- Video 4.2 Hamstring muscles and sciatic nerve
- Video 4.3 Popliteal fossa—Part 1
- Video 4.4 Popliteal fossa—Part 2
- Video 5.1 Tendons on dorsum of foot
- Video 5.2 Anterior compartment of leg
- Video 5.3 Anterior lateral aspect of leg and dorsum of foot
- Video 6.1 Posterior aspect of leg—Part 1
- Video 6.2 Posterior aspect of leg—Part 2
- Video 6.3 Posterior aspect of leg—Part 3
- Video 7.1 Sole of foot aponeurosis muscle layers and plantar nerves
- Video 8.1 Knee—Part 1
- Video 8.2 Knee—Part 2
- Video 8.3 Ankle joint/Talocrural joint (movements and axis)
- Video 8.4 Joints of foot
- Video 10.1 Abdominal wall—flat muscles, rectus sheath, and linea alba
- Video 10.2 Abdominal wall—rectus muscles, posterior rectus sheath, and vessels
- Video 11.1 Spermatic cord and testis
- Video 11.2 Testis, epididymis, spermatic cord, ductus deferens, and clinical aspects
- Video 11.3 Male genital organs—structural configuration
- Video 13.1 Peritoneal cavity—greater sac, lesser sac, and greater omentum
- Video 13.2 Peritoneal cavity—Foramen of Winslow

- Video 14.1 Overview of abdominal organs
- Video 14.2 Abdominal viscera—an overview
- Video 15.1 Duodenum: parts, relations, and vasculature
- Video 15.2 Pancreas
- Video 15.3 Portal vein
- Video 16.1 Small intestine and its mesentery
- Video 16.2 Superior mesenteric artery and its distribution
- Video 16.3 Distribution of Inferior mesenteric artery in hindgut—  
high-definition clinical demonstration
- Video 16.4 Large intestine
- Video 17.1 Liver in situ
- Video 17.2 Gallbladder and extrahepatic biliary apparatus
- Video 18.1 Kidney
- Video 18.2 Renal pelvis and ureter
- Video 18.3 Locations of Suprarenal glands
- Video 19.1 Posterior abdominal wall
- Video 19.2 Lumbar plexus
- Video 21.1 Urinary bladder: Parts, ligaments, and vessels
- Video 21.2 Urinary bladder, UV junction, and trigone
- Video 21.3 Bladder neck, trigone, and prostatic urethra
- Video 21.4 Pelvic part of ureter, bladder of urinary relations, and  
trigone of urinary bladder
- Video 22.1 Ampulla of ductus deferens, seminal vesicle, rectum,  
and pelvic vessels
- Video 22.2 Ischioanal fossa, Alcock's canal, and sciatic foramen
- Video 23.1 Layers of uterine wall
- Video 23.2 Female pelvic organs with endopelvic fascia and pelvic vessels
- Video 23.3 Bony pelvis male vs. female: obstetric fractures
- Video 24.1 Bony pelvis inlet–outlet and diameters
- Video 25.1 Neurovascular structure of male perineum

### A Comprehensive Dissection Manual

Thoroughly revised for the modern learner, *Thieme Dissector, Third Edition*, is a richly illustrated and detailed three-volume manual for guiding students and teachers in the dissection lab. It is enriched with intricate illustrations of human anatomy created from the clinician's perspective. Carefully drawn high-quality illustrations, QR code-based videos, and carefully researched and structured text guide the students during dissection in a step-by-step manner.

The volumes have been created by renowned experts in the field, Dr. Vishram Singh, Dr. G. P. Pal, Dr. S. D. Gangane, and Dr. Sanjoy Sanyal. The text of the volumes flows lucidly through well-defined sections in each chapter. These sections have also been made visually distinct to aid access. The authors have aimed to make the reading educative, interesting, and visually engaging.

### Salient Features of the Third Edition

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- Dissection screenshots: Presents most relevant and duly labelled clippings from the cadaveric dissection videos for better insight into the steps of dissection.
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### New to This Edition

- The content has been thoroughly revised and updated in accordance with the revised CBME competencies (NMC curriculum 2024).
- Cadaver as the first teacher has been dedicatedly discussed separately in Volume I.
- Video list has been revised to make the book more relevant and student-friendly.
- New illustrations have been added to support improved anatomical understanding and accuracy.
- Computed tomography (CT) and magnetic resonance (MR) images of various regions have been provided as an appendix to support clinical and radiological integration with anatomy.

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