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## Incidența minimă a suspiciunii / Minimum incidence of suspicion

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A<sup>1</sup>.

“...CNECSDTI a înregistrat cu nr. 1161/03.12.2012 sesizarea cu privire la: - transmiterea spre analiză, în baza prevederilor art. (4<sup>2</sup>), alin. 3 din Legea nr. 206/2004 privind buna conduită în cercetarea științifică, de către COMISIA DE ETICĂ a Universității de Medicină și Farmacie “ Grigore T. Popa” Iași, prin adresa nr. 25807/20.11.2012, a cazului de posibil plagiat legat de teza de doctorat “Tratatul chirurgical în leziunile degenerative ale coloanei cervicale – Hernia de disc cervicală” elaborată de Dl. Dr. Lucian EVA, teză susținută la UMF Iași în ianuarie 2010. ...

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<sup>1</sup> Consiliul Național de Etică a Cercetării Științifice, Dezvoltării Tehnologice și Inovării. Hotărârea nr.879/18 iulie 2012. Disponibil la: <http://cne.ancs.ro/wp-content/uploads/2013/11/Hotarare%20CNE%20inregistrata%20cu%20nr%201428%20si%20Raport%20final%20nr%201427.pdf>

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Marco Lucioni

# Practical Guide to Neck Dissection



 Springer

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# Practical Guide to Neck Dissection

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With 135 Figures, Mostly in Colour

 Springer

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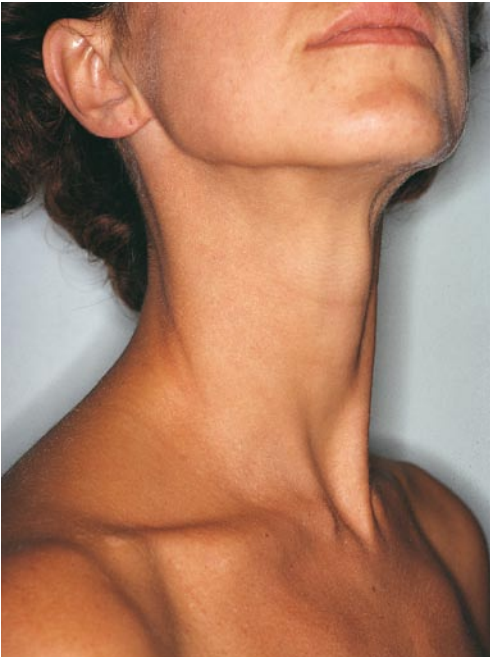
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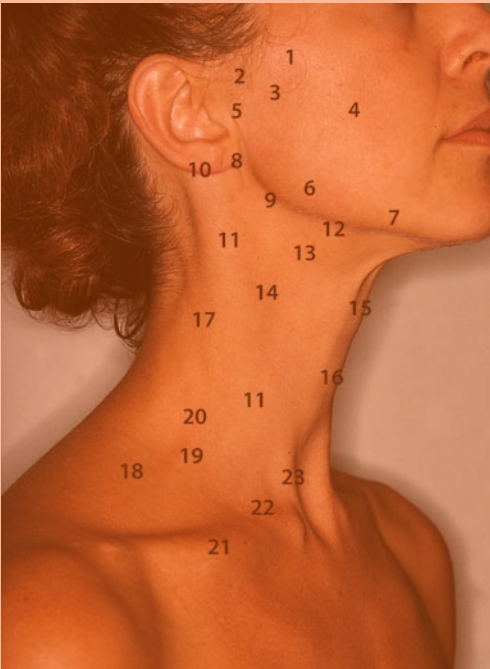
**Fig. 1.1** Carolina's neck

a sort of bridge between head and body, transporting blood, air, emotions, and information on movement and sensitivity, i.e., it is the point where the “breath of life” converges and is conveyed. We use the neck of a classic ballerina, like Carolina (Fig. 1.1), as a graceful introduction to our dissection class (Figs. 1.2, 1.3). Let us start by getting to know the superficial landmarks.

## 1.2 Releasing a Corpse for Research Purposes

Over the eras, in accordance with political and religious precepts, precise restrictions, in many cases prohibitions, have been placed on scientific research on corpses.

In the Western world in particular, Christian and Jewish culture condemned autopsy by virtue of the belief that “the human body is sacred since it was created in God’s image and likeness,” and because it was “contrary to Christian dogma on the resurrection of the flesh” [2]. Consequently, records on anatomic practice are only available



**Fig. 1.2** Superficial landmarks: lateral view

- 1 = zygomatic process of the temporal bone
- 2 = auriculotemporal nerve and superficial temporal pedicle
- 3 = caput mandibulae
- 4 = parotid duct
- 5 = external auditory canal
- 6 = angle of mandible
- 7 = facial pedicle
- 8 = transverse process of atlas
- 9 = inferior parotid pole
- 10 = apex of mastoid
- 11 = sternocleidomastoid muscle
- 12 = submandibular gland
- 13 = apex of greater cornu of hyoid bone
- 14 = carotid bifurcation
- 15 = laryngeal prominence
- 16 = cricoid cartilage
- 17 = emergence of spinal accessory nerve (peripheral branch)
- 18 = trapezius and entrance of spinal accessory nerve (peripheral branch)
- 19 = inferior belly of omohyoid muscle
- 20 = external jugular vein
- 21 = clavicle
- 22 = sternocleidomastoid muscle (clavicular head)
- 23 = sternocleidomastoid muscle (sternal head)

## Core Messages

- At the start of the dissection exercise, we must take a panoramic look for orientation. We then establish the limits of the area of operation and the main landmarks.

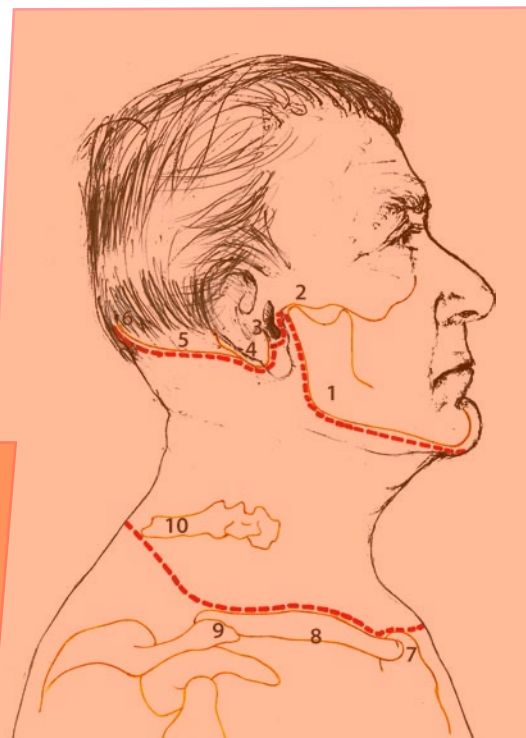
## 2.1 Anatomic Layout

The neck is the part of the trunk that joins the head and the chest and constitutes its most mobile part. It is essentially cylindrical in shape; length is constant while diameter varies. The expression “long neck/short neck” is incorrect, because the length of the neck, understood to be the cervical portion of the vertebral column, does not present significant variations. Conversely, neck width, determined by the development of muscular and adipose masses is extremely variable [2].

**Significant anatomical structures:** superficial, middle, and deep cervical fasciae; lymph nodes.

**Landmarks:** mandible, external auditory canal, mastoid, clavicle, jugulum.

- 2.1.1 Its upper limits run along the inferior and posterior borders of the mandible, the extreme posterior of the zygomatic arches, the anteroinferior borders of the external auditory canals, the profiles of the mastoid apophyses, the superior nuchal line, and the external occipital protuberance. Its lower boundaries lie along the superior border of the sternum and clavicles, the acromioclavicular joints, and an imaginary line joining the acromioclavicular joints to the spinous process of the seventh cervical vertebra (Fig. 2.1).



**Fig. 2.1** Neck boundaries

- 1 = mandible
- 2 = zygomatic process of the temporal bone
- 3 = external auditory canal
- 4 = mastoid
- 5 = superior nuchal line
- 6 = external occipital protuberance
- 7 = manubrium sterni
- 8 = clavicle
- 9 = acromioclavicular joint
- 10 = spinous process of seventh cervical vertebra

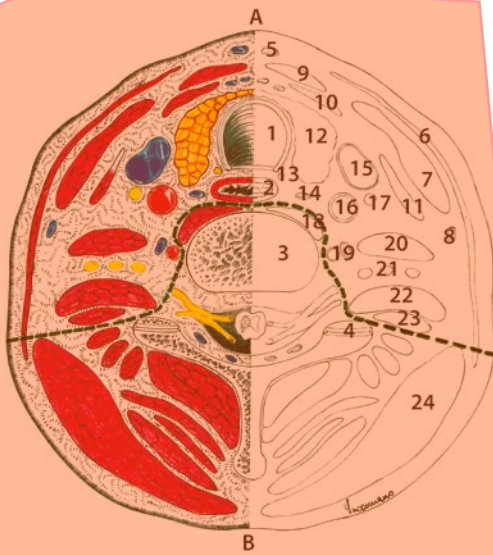
- 2.1.2 On transverse section, the neck appears to be roughly divided into two parts, a posterior or nuchal (osteo-muscular) part and an anterior or tracheal (muscular-fascial) part. The conventional dividing line extends from



the transverse vertebral processes to the anterior edges of the trapezius muscles (Fig. 2.2).

The function of the posterior region is essentially static and dynamic—powerful, articulated muscles support a bone framework with the head at the top. This structure functions

as an articulated joint since the two interapophyseal joints between one vertebra and the next permit head movement; it also functions as a shock absorber for intravertebral disk compressibility in addition to being a fastening point for the muscles of mastication, swallowing, and speech. The cervical portion of the vertebral column is curved with anterior convexity (cervical lordosis). In contrast, the anterior region, which is the object of this dissection, holds the internal organs. It contains the parotid and submandibular glands, the thyroid gland, several lymph nodes, and is crossed by important blood and lymphatic vessels, nerves, and by the respiratory and digestive tracts.



**Fig. 2.2** Transverse cervical section: tracheal region and nuchal region. A Tracheal region B Nuchal region

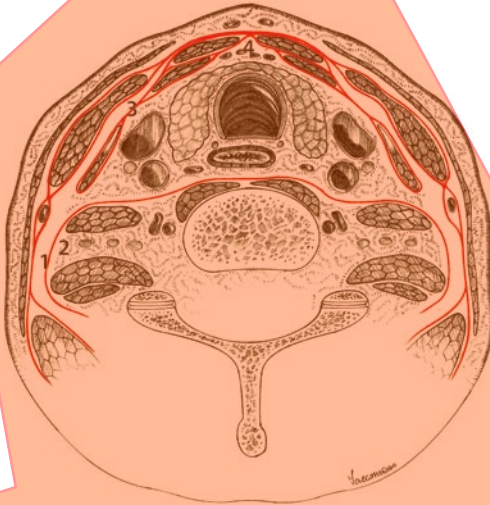
- 1 = trachea
- 2 = esophagus
- 3 = vertebral body of seventh cervical vertebra
- 4 = interapophyseal articulation
- 5 = anterior jugular vein
- 6 = platysma muscle
- 7 = sternocleidomastoid muscle
- 8 = external jugular vein
- 9 = sternohyoid muscle
- 10 = sternothyroid muscle
- 11 = omohyoid muscle
- 12 = thyroid gland
- 13 = recurrent nerve
- 14 = inferior thyroid vein
- 15 = internal jugular vein
- 16 = common carotid artery
- 17 = vagus nerve
- 18 = prevertebral muscles
- 19 = vertebral artery and vein
- 20 = anterior scalene muscle
- 21 = brachial plexus
- 22 = medial scalene muscle
- 23 = posterior scalene muscle
- 24 = trapezius muscle

2.1.3 In addition to being prevalently a structure of transit and union, the neck is an important point of autonomous physiological activity, linked to the presence of exocrine glands (parotid and submandibular), endocrine glands (thyroid, parathyroid, and thymus), muscle and tendon neuroreceptors, visceral receptors, vascular chemoreceptors, and lymph nodes.

2.1.4 Almost all cervical viscera originate from or lead to the thorax or upper extremities; the loose connective tissue surrounding them is in direct, continuous contact with the loose connective tissue of the mediastinum and axillary regions. In some points, the loose connective tissue thickens to form fibrous sheaths (around neurovascular bundles, the laryngotracheal canal, and the thyroid) and perimuscular aponeuroses. These latter define important dissection planes, particularly:

1. The superficial cervical fascia (*fascia colli*), extending from the anterior edge of the trapezius and splenius capitis muscles on both sides, which divides into two to enclose the sternocleidomastoid muscles, parotid gland and submandibular gland; it fuses with the middle cervical fascia on the midline.
2. The middle cervical fascia, lying between the omohyoid muscles on both sides; as a whole, it forms a triangle with the hyoid bone at its apex and the clavicles at the base; it divides in two to contain the infrahyoid muscles.





**Fig. 2.3** Transverse cervical section: cervical fasciae

- 1 = superficial cervical fascia
- 2 = deep cervical fascia
- 3 = middle cervical fascia
- 4 = white infrahyoid line



**Fig. 2.4** Lymph node stations

- 1 = jugular chain
- 2 = spinal chain
- 3 = supraclavicular chain
- 4 = occipital lymph nodes
- 5 = mastoid lymph nodes
- 6 = parotid lymph nodes
- 7 = submandibular lymph nodes
- 8 = submental lymph nodes
- 9 = retropharyngeal lymph nodes
- 10 = recurrent lymph nodes
- 11 = pretracheal lymph nodes
- 12 = prethyroidean lymph nodes

3. The deep (or prevertebral) cervical fascia, investing the prevertebral muscles and dividing laterally to contain the scalene and levator scapulae muscles (Fig. 2.3).

- 2.1.5 The cervical lymphatic system forms a three-dimensional network into whose nodal points the lymph nodes are intercalated. Although they vary in number and dimensions, they do keep a relatively constant position, and they can thus be considered topographically grouped into lymph gland stations (Fig. 2.4).

These are divided in the neck as follows:

1. A superficial, subfascial lymph node system with a circular arrangement between

chin and occiput (occipital, mastoid, parotid, submandibular, and submental lymph nodes) and along the course of the external jugular vein.

2. A deep, more consistent lymph node system in a bilateral triangular arrangement, bounded anteriorly by lymph nodes adjacent to the internal jugular vein, and posteriorly by the spinal lymph node chain, with a supraclavicular lymph node.

3. A perivisceral lymph node system close to the median viscera (prethyroidean, pretracheal, retropharyngeal, recurrent and finally prelaryngeal lymph nodes, the more defined of which, called “delficus”, is situated between the cricothyroideal muscles).

**Remarks:** The relationships between the lymph nodes/lymphatic vessels and the muscles/vessels/nerves and glands in the neck are of a contiguous nature, always in normal conditions, and nearly always in pathological ones. Thanks to the removal of the fasciae, they may be separated from the contiguous structures and moved away easily. There may be an interruption of the fascia and colonization of the contiguous structures only if the lymph node capsule gives way as a result of carcinomatous invasion [1].

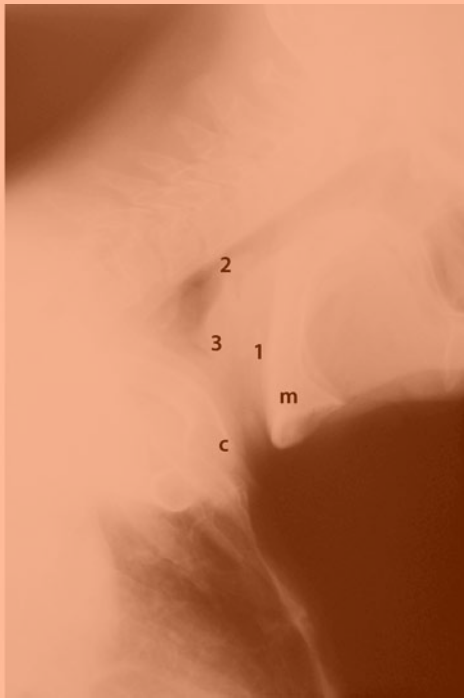
- 2.1.6 Anatomists divide the neck into two major regions:
  1. The anterior region, situated between the two sternocleidomastoid muscles, encom-

passing the suprahyoid, infrahyoid, and pre-vertebral regions.

2. The lateral regions, comprising the parotid, sternocleidomastoid or carotid, and supraclavicular regions.

For the sake of simplicity and for dissection purposes, we instead divide the neck into three lateral regions (parotid, submandibular, and laterocervical) and three median regions (inferior median, superior median, and pre-vertebral).

- 2.1.7 The anatomic arrangement of the neck organs varies considerably with neck movements, especially flexing–extending movements. For example, at maximum flexion, the hyoid bone, one of the more cranial structures,



**Fig. 2.5** Neck mobility. a Flexion, b extension

m = mandible  
 c = clavicle  
 1 = hyoid bone  
 2 = epiglottis  
 3 = laryngeal ventricle

4 = trachea  
 5 = cervical esophagus  
 6 = seventh cervical vertebra  
 7 = first thoracic vertebra

can almost reach the thorax (Fig. 2.5a, b). Surgeons should bear this in mind since they can take advantage of great cervical mobility to achieve the widest possible dissection areas.

**Remarks:** We stress that the symmetrical posture of the neck is commonly defined the normal position. The surgical maneuvers will be carried out on a neck, which we shall try to hyperextend as much as possible. To obtain this position, a thickness of at least 10 cm must be placed under the scapulae. That is as far as the anterior regions are concerned.

For the lateral regions, the head must be turned contralaterally with respect to the operator; this is defined the operating position. Instead, when the head is bent and slightly inclined toward the explored side, the structures relax and this allows deep exploration of the neck. This is defined as the clinical exploration position.

### Take Home Messages

- The correct position of the head (extended as far as possible) is of fundamental importance both in anatomic specimens and when operating in vivo.

### References

1. Bocca E (1972) Chirurgia dei linfonodi cervicali. In: Naumann HH (ed) *Chirurgia della testa e del collo*. Casa Editrice Ambrosiana, Milan, 153–187
2. Testut L, Jacob O (1977) *Trattato di Anatomia Topografica*, UTET, Turin

## Core Messages

- A large area of operation makes dissection easier. The cutaneous flap is raised between the platysma and the superficial cervical fascia, as in vivo. The superficial cervical fascia is interrupted as little as possible. It contains the vessels and lymph nodes that in neck dissection would be removed with the specimen.

## 3.1 Anatomic Layout

The neck is placed in a normal position, hyper-extended. The incision is very low and posterior, to allow reconstitution of the cadaver at the end of dissection without scars that disfigure the uncovered cutaneous areas. Our references are the mastoid and the inferior margin of the mandible superiorly, the clavicles, and the sternal manubrium inferiorly.

**Significant anatomical structures:** superficial cervical fascia, platysma, sternocleidomastoid muscle, digastric muscle.

**Landmarks:** jugulum, clavicle, anterior margin of the trapezius, mastoid, mental protuberance, laryngeal protuberance (Adam's apple), cricoid cartilage.

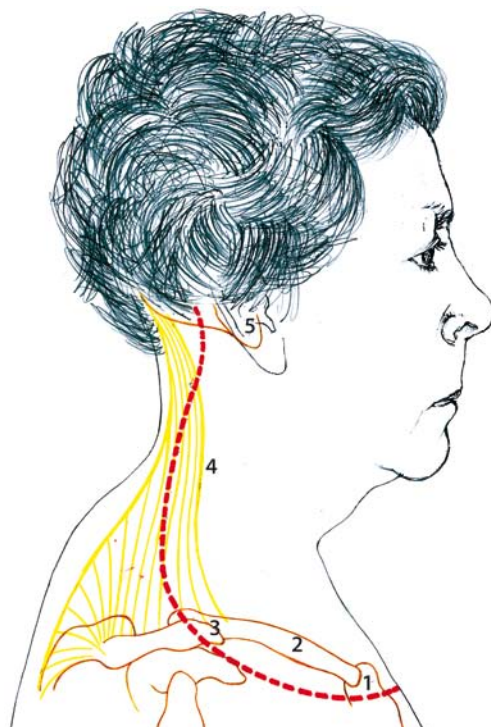
## 3.2 Dissection

- 3.2.1 A large cutaneous flap is raised, with an incision approximately 3 cm beneath the inferior margin of the clavicle, extending along the acromioclavicular joint, and ascending laterally by approximately 3 cm behind the trapezius margin and posterosuperiorly to the posterior profile of the mastoid apophysis, be-

yond the level of the external auditory canal (Fig. 3.1).

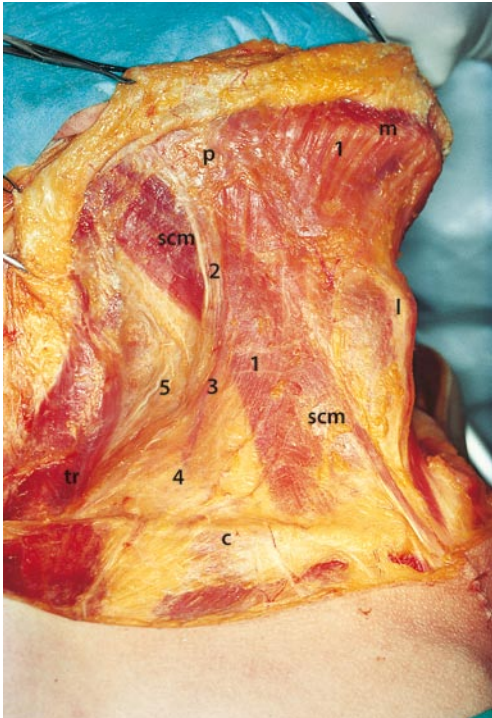
- 3.2.2 The flap may be raised above the platysma, which thus becomes fully exposed (Fig. 3.2).

The platysma muscle extends from the corpus mandibulae to the outer surface of the



**Fig. 3.1** Cutaneous line of incision

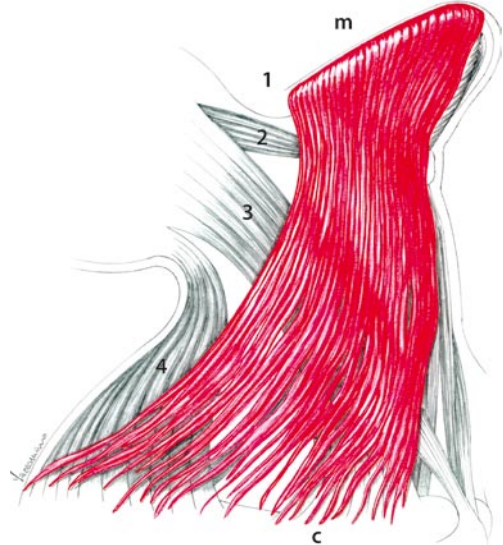
- 1 = manubrium sterni
- 2 = clavicle
- 3 = acromioclavicular joint
- 4 = anterior margin of trapezius muscle
- 5 = mastoid



**Fig. 3.2** Platysma muscle plane

- m = mandible
- p = parotid
- scm = sternocleidomastoid muscle
- tr = trapezius muscle
- c = clavicle
- l = larynx
- 1 = platysma muscle
- 2 = great auricular nerve
- 3 = external jugular vein
- 4 = superficial cervical fascia
- 5 = spinal accessory nerve (peripheral branch)

clavicle. Its lateral margin crosses the sternocleidomastoid muscle between its third median and third superior, and then descends toward the acromioclavicular joint; from the mental symphysis, its medial margin deviates from the midline in an inferior direction; its outer surface is more or less rectangular and invested with subcutaneous tissue and its inner surface is contiguous with the superficial cervical fascia. The platysma is innervated by a branch of the facial nerve (Fig. 3.3).

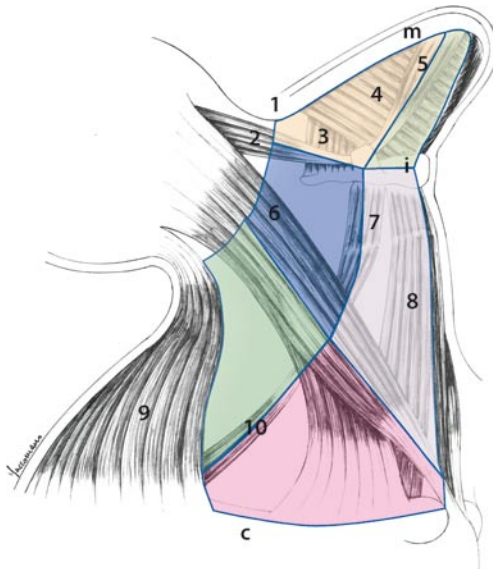


**Fig. 3.3** Platysma muscle

- m = mandible
- c = clavicle
- 1 = angle of mandible
- 2 = posterior belly of digastric muscle
- 3 = sternocleidomastoid muscle
- 4 = trapezius muscle

**Remarks:** This anatomic cut-down, which permits excellent platysma exposure, is not always easy to perform in preserved cadavers, owing to the muscle's slenderness and fragility. Accordingly, a flap incorporating the platysma is often required, and it is indeed more useful for teaching purposes. In routine surgical practice, preparation of a flap formed by skin, subcutaneous tissue, and the platysma is in fact envisaged in all cervical operations. It is raised from the superficial cervical fascia





**Fig. 3.4** Superficial surgical triangles

- m = mandible  
 c = clavicle  
 i = hyoid bone  
 1 = angle of mandible  
 2 = posterior belly of digastric muscle  
 3 = hyoglossus muscle  
 4 = mylohyoid muscle  
 5 = anterior belly of digastric muscle  
 6 = sternocleidomastoid muscle  
 7 = superior belly of omohyoid muscle  
 8 = sternohyoid muscle  
 9 = trapezius muscle  
 10 = inferior belly of omohyoid muscle

by upward traction and cut with a scalpel at a tangent to the flap; if this plane is carefully followed, the superficial vessels and nerves in the fascia are not interrupted because they remain below.

- 3.2.3 In the resulting dissection field, sternocleidomastoid muscle prominence is clearly evident as it crosses the region on both sides from top to bottom and from back to front, describing two large superficial, topographic triangles on each side, one anterior and one posterior (Fig. 3.4).

The *anterior triangle* is bounded by the sternocleidomastoid muscle, the inferior mar-

gin of the mandible, and the midline. It is further divided into:

1. The submental triangle, lying between the anterior belly of the digastric muscle, the corpus ossis hyoidei, and the midline.
2. The digastric triangle, lying between the two bellies of the digastric muscle, and the inferior margin of the mandible.
3. The muscular triangle, lying between the sternocleidomastoid muscle, the superior belly of the omohyoid muscle, and the midline.
4. The carotid triangle, lying between the sternocleidomastoid muscle, the posterior belly of the digastric muscle, and the superior belly of the omohyoid muscle.

The *posterior triangle* is bounded by the sternocleidomastoid muscle, trapezius, and clavicle. It is further divided into:

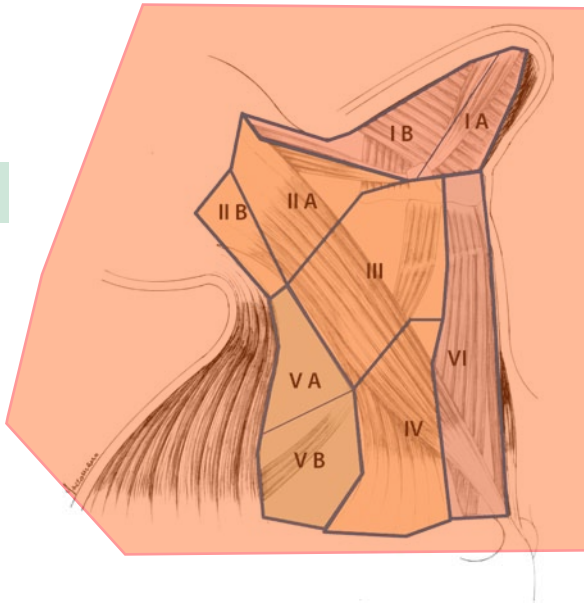
1. The spinal triangle, lying between the sternocleidomastoid muscle, the trapezius, and the inferior belly of the omohyoid muscle.
2. The supraclavicular triangle, lying between the sternocleidomastoid muscle, the inferior belly of the omohyoid muscle, and the clavicle.

The above topographic division of the neck is the one used by anatomists and is certainly a helpful method of orienting general anatomy.

- 3.2.4 In routine oncological practice, importance is laid on an additional, internationally accepted topographical subdivision, introduced by K. Thomas Robbins in 1991 [2]; it was updated by him in 2002 [4], and is now internationally accepted. Its aim is to achieve uniformity in the nomenclature of various types of cervical lymph node neck dissection, which it does by classifying the various topographical regions involved in the excision and any sacrificed anatomic structures. The neck is therefore divided into a total of 6 six levels (five on each side plus a sixth anterior median level) (Fig. 3.5).

**Remarks:** The concept of neck dissection as an indispensable complement to the treatment of tumors of the upper aerodigestive tract began with George Crile more than a century ago [1]. Neck dissection was always carried out with the demolitive technique. In the 1960s, Ettore Bocca introduced the so-called functional neck dissection in Europe [3]. It is based on Osvaldo





**Fig. 3.5** Cervical levels according to Robbins (2002)

Suarez's assertion that there are no lymph node formations outside the fascial investments of the neck. So, the surgeon can be just as radical as in the neck dissection proposed by Crile while preserving important structures such as the sternocleidomastoid muscle, the internal jugular vein, and the spinal accessory nerve. This applies as long as the lymph node capsule is intact. This new method has led to an appreciable reduction of morbidity.

In recent years the study of the pattern of metastatic diffusion of tumors of the head and neck has led surgeons performing prophylactic neck dissection (that is, in N0 necks), to neglect the lymphatic areas that are statistically less exposed to metastatic colonization. Selective neck dissections were therefore introduced in routine surgery. The reason behind this evolution is to reduce as far as possible the functional sequelae of cervical neck dissections.

- 3.2.5 At the end of this surgical phase, the vast dissection field extends inferiorly from the trapezius muscles to the clavicles and superiorly to encompass the mandible and external auditory canal (Fig. 3.6).

We now try to establish the limits of the Robbins levels conceptually and by palpation. At the top we identify the mastoid and the hyoid bone; farther down, the inferior margin of the cricoid and then the sternal manubrium and the clavicle; and posteriorly, the anterior margin of the trapezius.

### Take Home Messages

- Neck dissection is the most complete surgical procedure regarding the anatomical knowledge of the neck. Succeeding in performing it with methodological exactness, sureness, and confidence is one of the goals of the excellent surgeon.
- The Robbins levels (2002) are the fundamental map for oncological surgery of the neck. Cervical adenopathies should always be located in the Robbins levels, both in the objective examination prior to surgery and in the description of the neck dissection.

# Laterocervical Region (Supraclavicular Region – Robbins Level V)

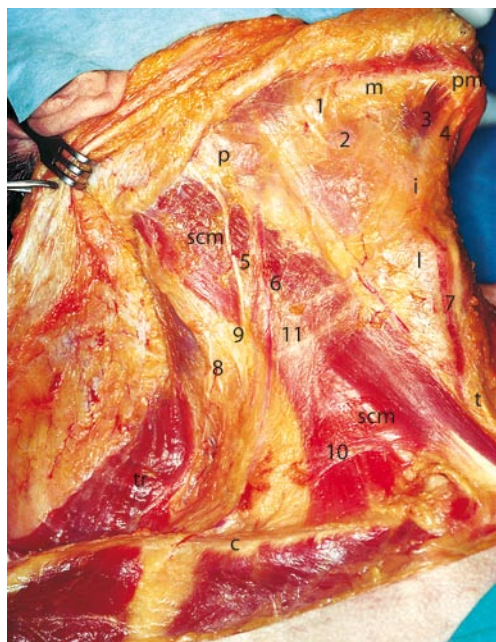
## Core Messages

- The surgery of this region has a specific oncological significance for the treatment of lymphodal metastases of tumors of the rhinopharynx, oropharynx, and of the posterior cutaneous tumors of the head and neck. It may also be considered for tumors of the larynx or of the hypopharynx if the presence of metastases at Robbins levels II or III has been ascertained. In the surgical exploration of this region, the peripheral branch of the spinal accessory nerve must be identified and preserved.

## 6.1 Anatomic Layout

The laterocervical region is bounded posteriorly by the anterior margin of the trapezius and by the splenius capitis muscle, anteriorly by the lesser cornu of the hyoid bone and lateral margins of the sternothyroid and thyrohyoid muscles, inferiorly by the superior margin of the clavicle, and superiorly by the inferior margin of the digastric muscle. The deep boundary of the region corresponds to the scalene, levator scapulae, and prevertebral muscle plane (Fig. 6.1).

Dissecting from bottom to top and from rear to front, we will adhere closely to the correct technique used for neck dissection in oncological patients, performing it here at least theoretically, to avoid the spread of any metastatic emboli.



**Fig. 6.1** Laterocervical region

- p = parotid
- m = mandible
- pm = mental protrusion
- scm = sternocleidomastoid muscle
- i = hyoid bone
- l = larynx
- tr = trapezius muscle
- t = thyroid gland
- c = clavicle
- 1 = facial pedicle
- 2 = submandibular gland
- 3 = anterior belly of digastric muscle
- 4 = interdigastric (submental) area
- 5 = great auricular nerve
- 6 = external jugular vein
- 7 = anterior jugular vein
- 8 = spinal accessory nerve (peripheral branch)
- 9 = Erb's point
- 10 = superficial cervical fascia
- 11 = cutaneous cervical nerve