

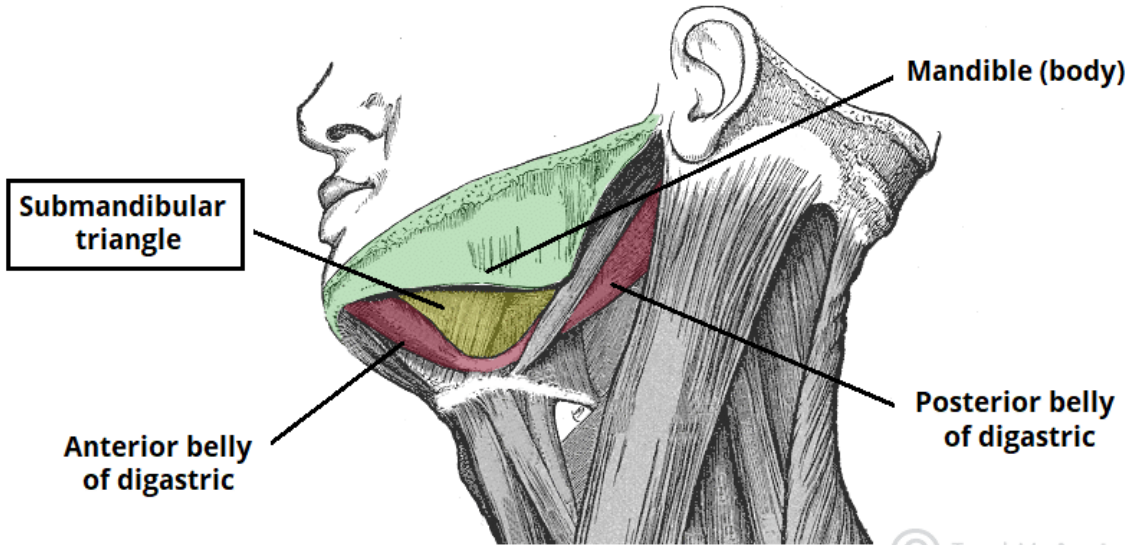


Pirogov Russian National  
Research Medical  
University

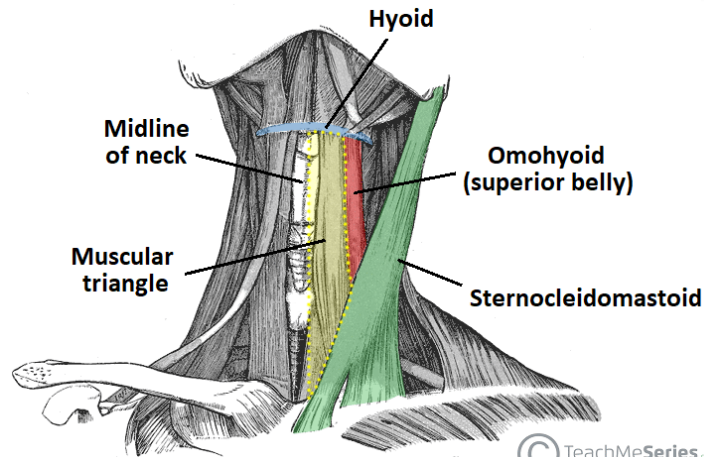
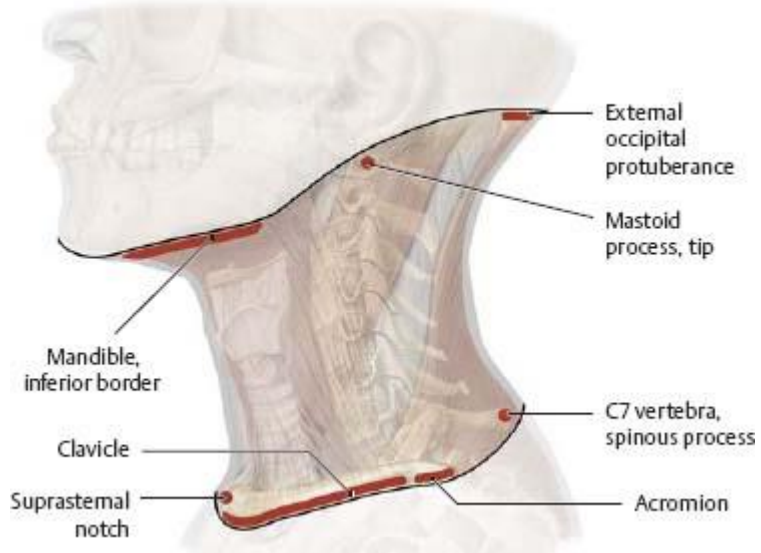
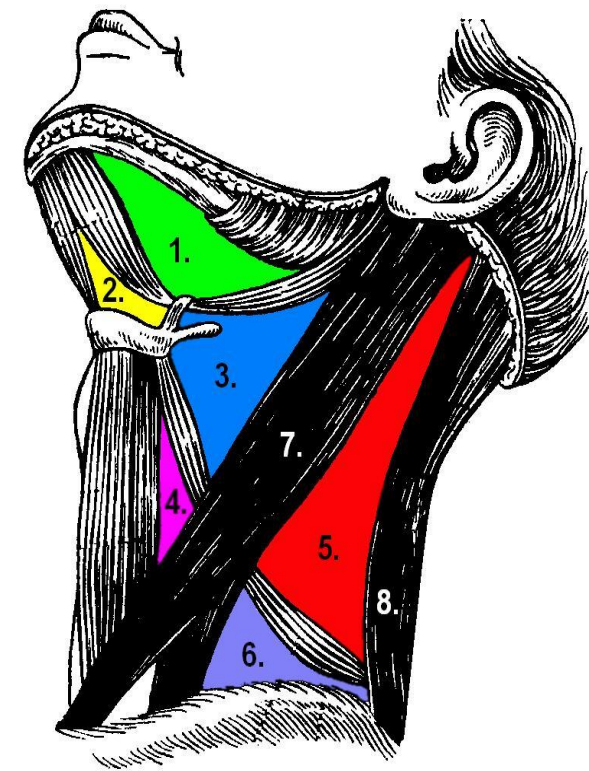
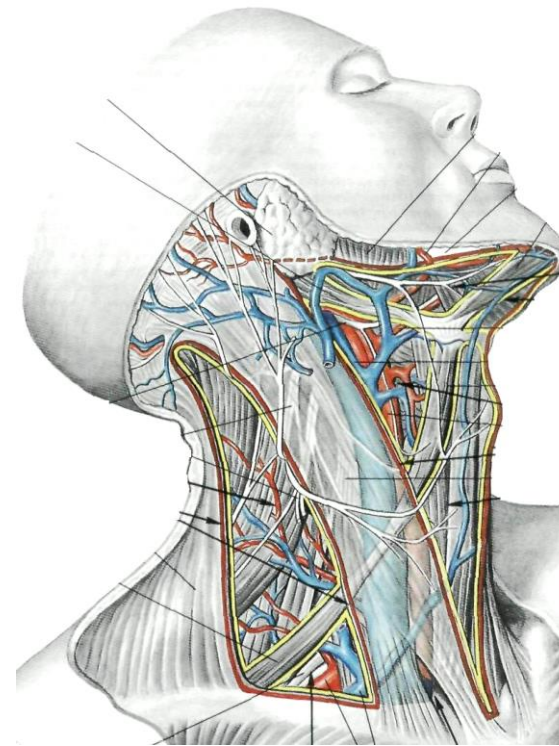
# **The basics of neck surgery**



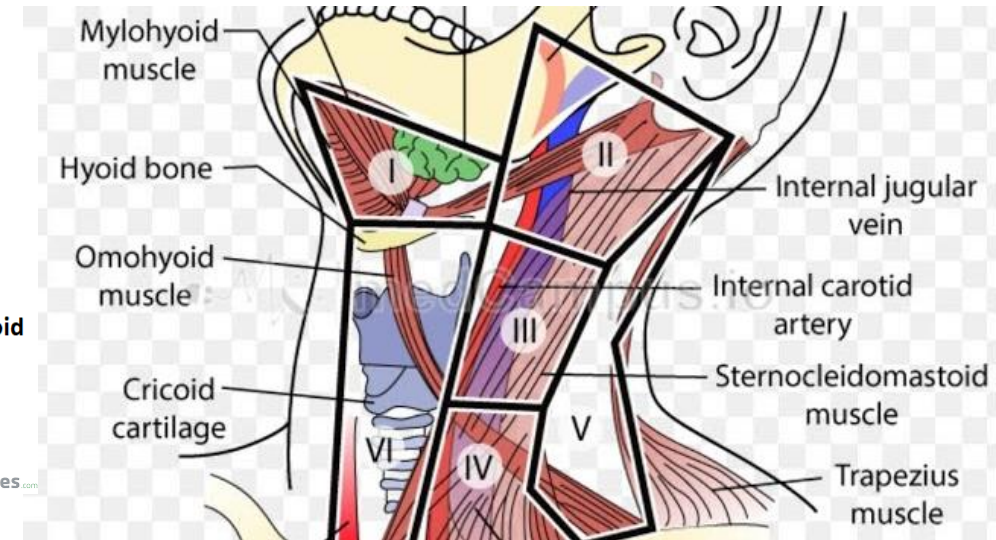
# Neck Borders



© TeachMeAnator



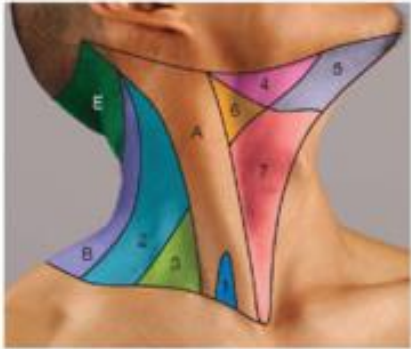
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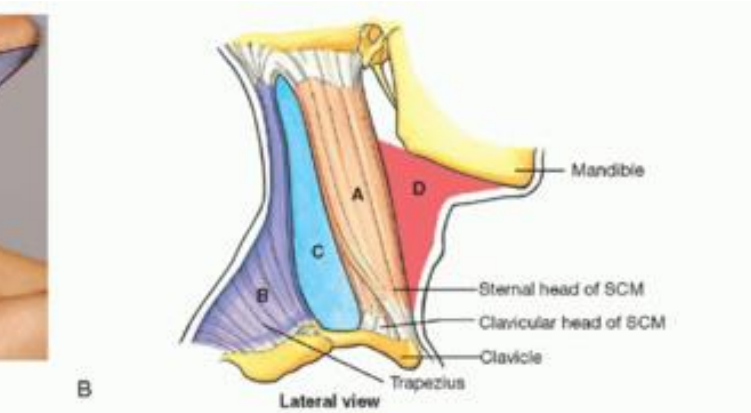
# Neck areas and triangles

- Submandibular Triangle
- Suprahyoid Triangle
- Carotid Triangle
- Muscular Triangle
- Occipital Triangle
- Subclavian Triangle

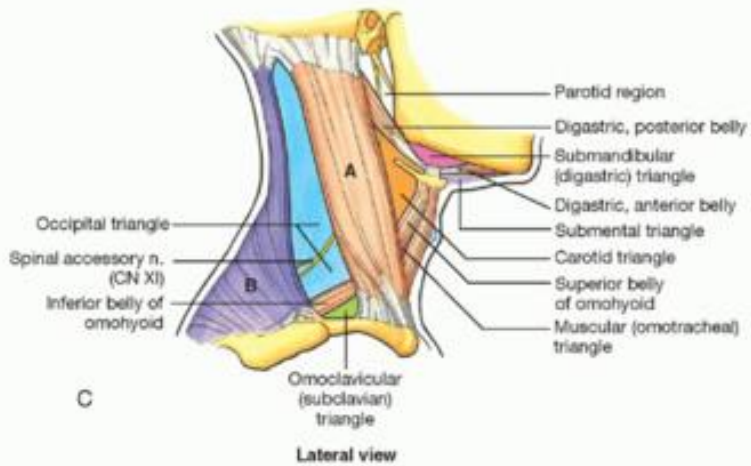


A Anterolateral view

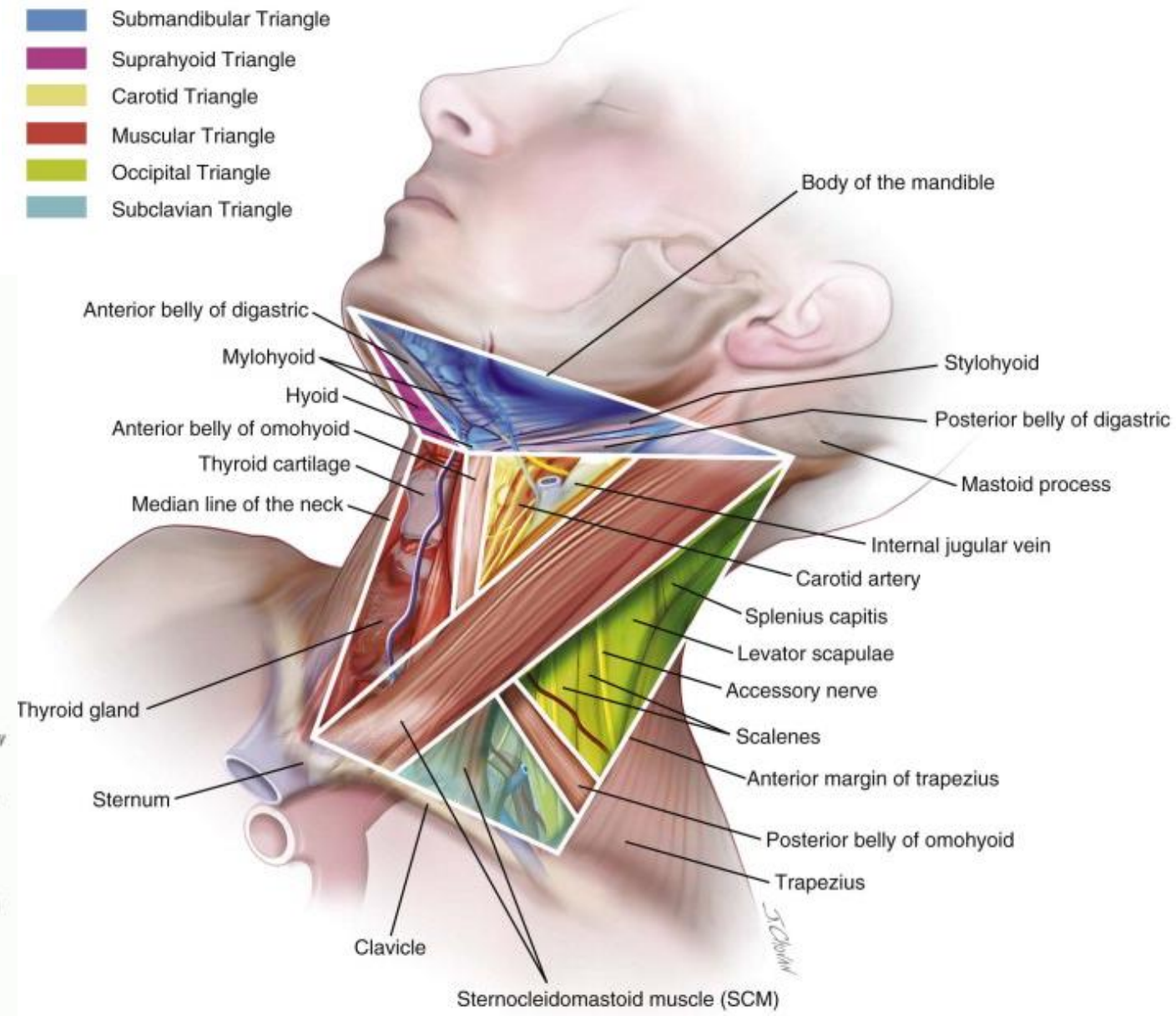
- | Region  |  |
|---|--|
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #f1c40f; border: 1px solid black;"></span> | Sternocleidomastoid region (A)           |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #34495e; border: 1px solid black;"></span> | Lesser suprascapular fossa (1)           |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #8e44ad; border: 1px solid black;"></span> | Posterior cervical region (B)            |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #27ae60; border: 1px solid black;"></span> | Suboccipital region (E)                  |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #3498db; border: 1px solid black;"></span> | Lateral cervical region (C)              |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #2980b9; border: 1px solid black;"></span> | Occipital triangle (2)                   |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #7ed321; border: 1px solid black;"></span> | Omo clavicular (subclavian) triangle (3) |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #e74c3c; border: 1px solid black;"></span> | Anterior cervical region (D)             |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #e91e63; border: 1px solid black;"></span> | Submandibular triangle (4)               |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #9b59b6; border: 1px solid black;"></span> | Submental triangle (5)                   |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #f1c40f; border: 1px solid black;"></span> | Carotid triangle (6)                     |
| <span style="display: inline-block; width: 15px; height: 15px; background-color: #c0392b; border: 1px solid black;"></span> | Muscular (omotracheal) triangle (7)      |



B Lateral view

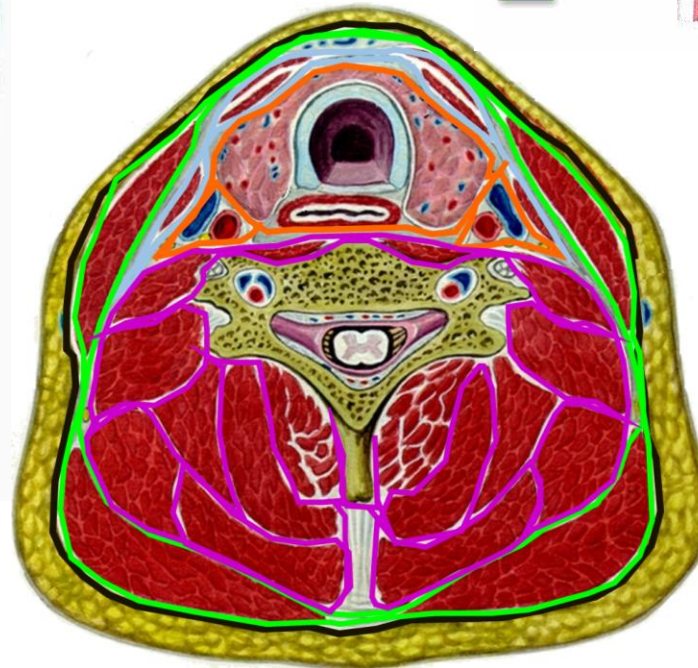
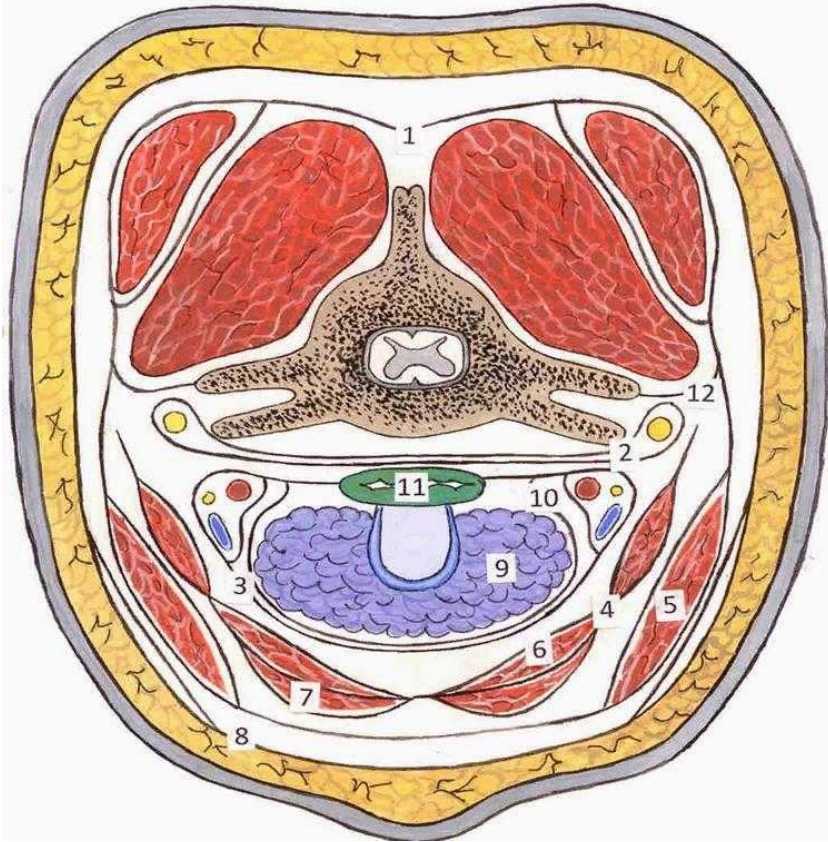


C Lateral view





# Fascia of the neck (according to V.N.Shevkunenko)



Сагиттальный  
распил

Pharynx

Fascia  
buccopharyngea

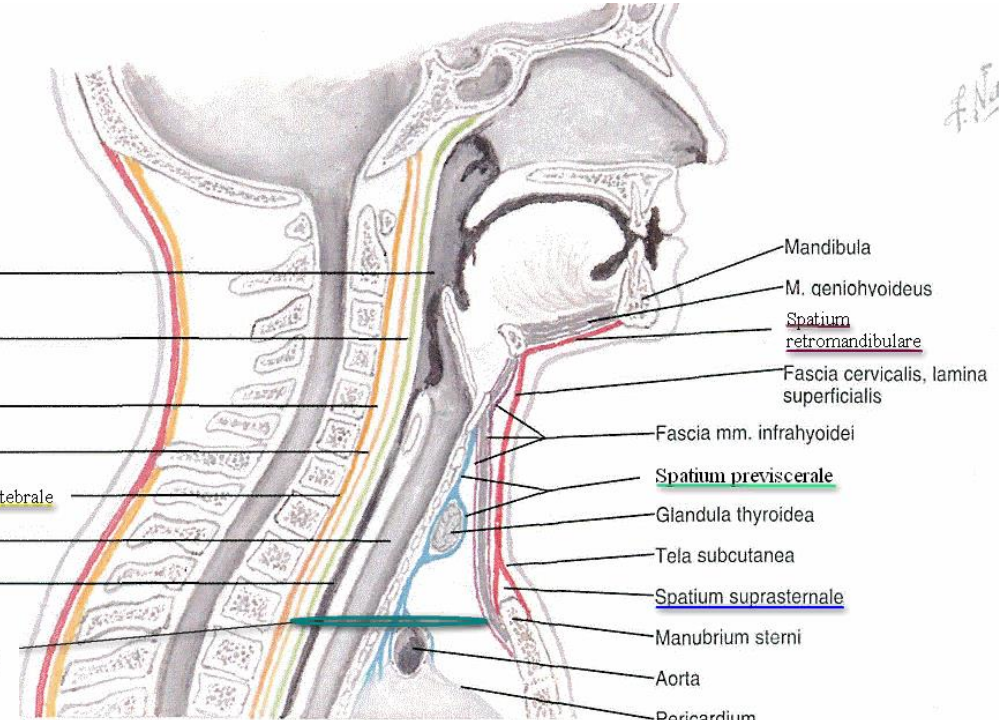
Spatium  
retroviscerale

Spatium prevertebrale

Trachea

Oesophagus

Spatium  
interaponeuroticum  
laterale



1 – fascia superficialis

2 – lamina superficialis  
fascii propria

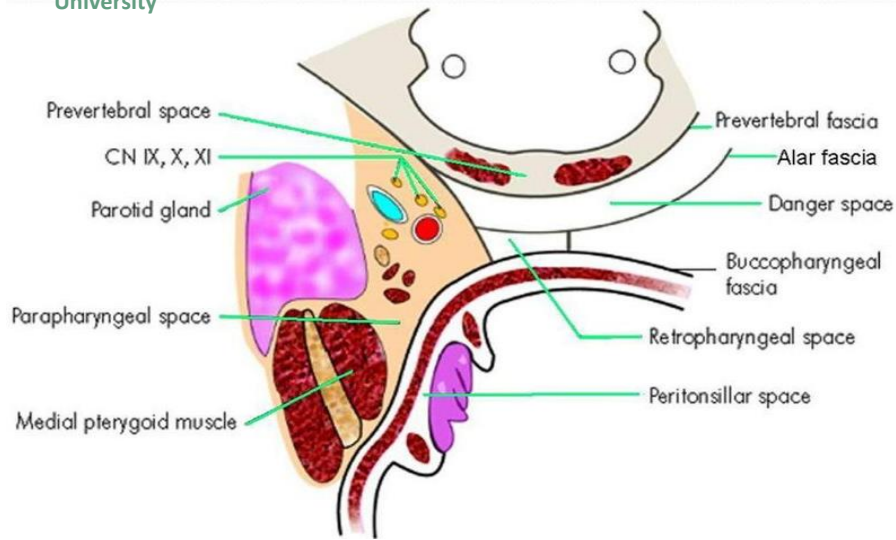
3 – lamina pretrachealis  
fascii propria

4 – fascia endocervicalis

5 - lamina prevertebralis  
fascii endocervicalis



# Cellular spaces

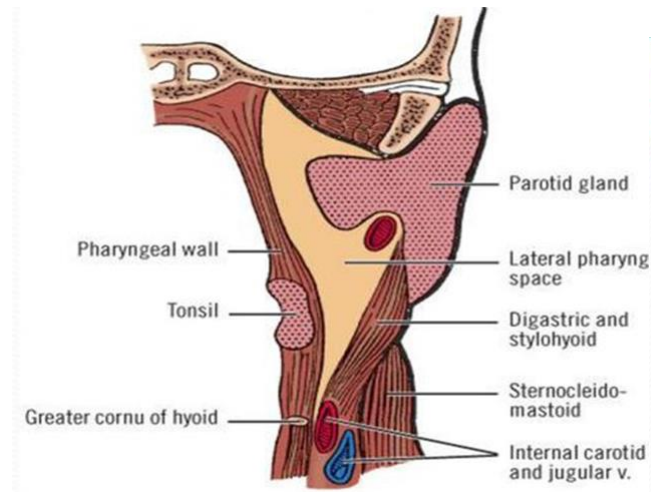
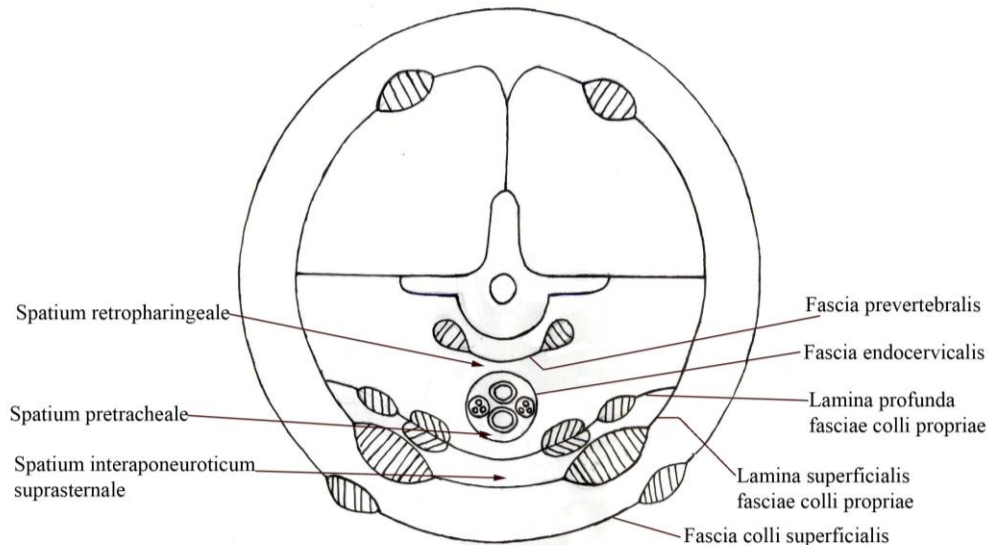


SUPRAHYOID NECK	INFRAHYOID NECK	SUPRA- AND INFRAHYOID NECK
PARAPHARYNGEAL SPACE	ANTERIOR CERVICAL SPACE	CAROTID SPACE
PAROTID SPACE	POSTERIOR CERVICAL SPACE	RETROPHARYNGEAL SPACE
PHARYNGEAL MUCOSAL SPACE	VISCERAL SPACE	PERIVERTEBRAL SPACE
MASTICATOR SPACE		DANGER SPACE
BUCCAL SPACE		

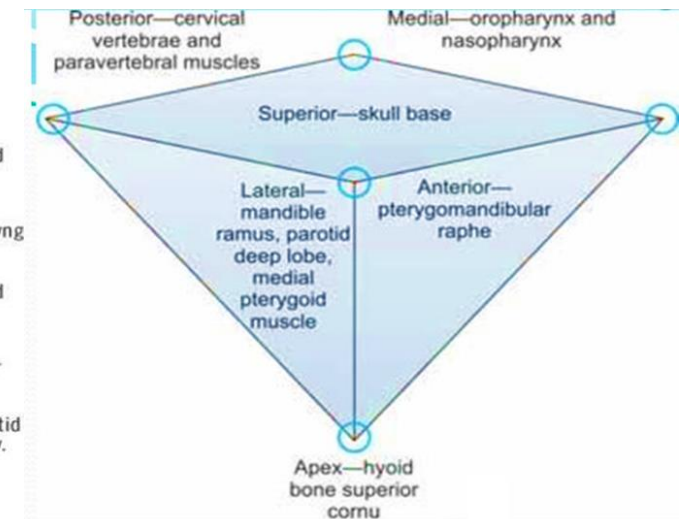
❖ The para-pharyngeal space is shaped like a pyramid, inverted with its base at the **skull base**, with its apex inferiorly pointing to the greater cornu of the **hyoid bone**.

## ❖ CONTENTS

- Fat (Main Component)
- **Internal Maxillary Artery**
- **Ascending Pharyngeal Artery**
- **Pterygoid Venous Plexus**
- Lymph Nodes



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## Cellular spaces

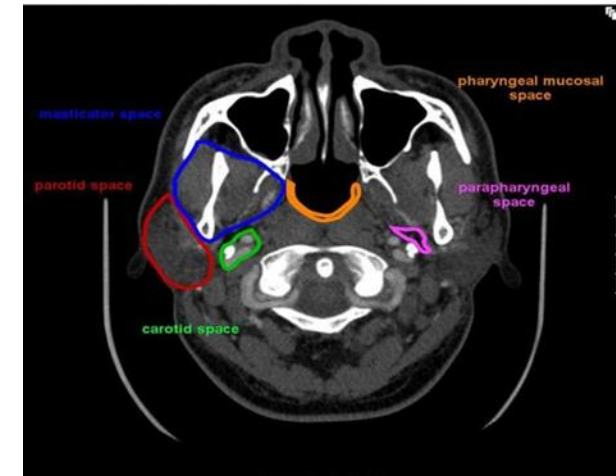
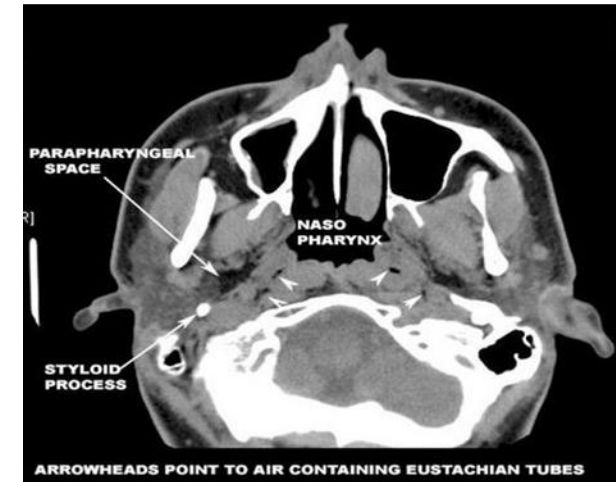
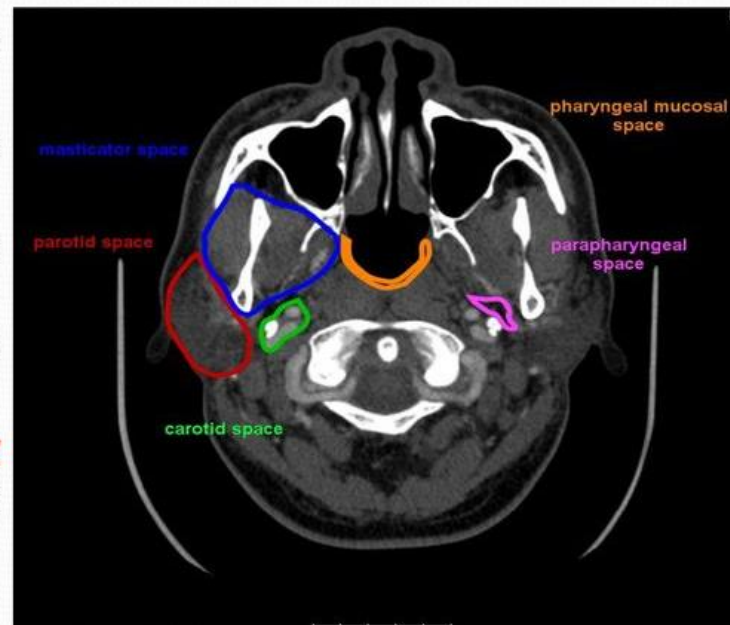
### Relations

- ❖ Medial to the masticator space.
- ❖ Lateral to the pharyngeal mucosal space.
- ❖ Anterior to the prevertebral space.
- ❖ Posterior to the medial pterygoid.

### Divisions

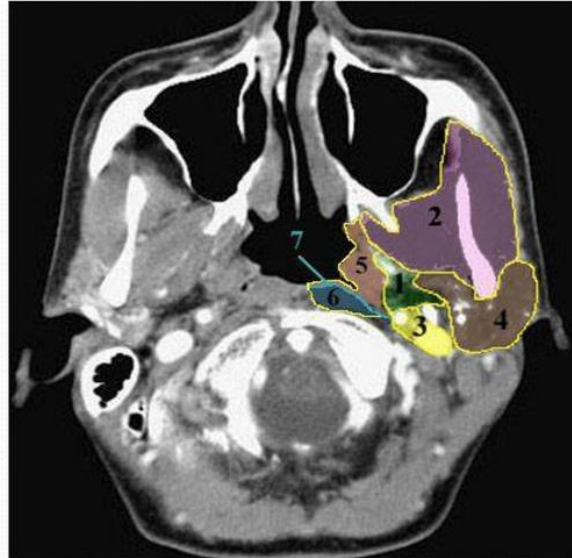
- ❖ Prestyloid compartment
- ❖ Poststyloid compartment

- ❖ Parotid space displaces the parapharyngeal fat anteromedially
- ❖ Masticator space displaces the parapharyngeal fat posteromedially
- ❖ Carotid space displaces the parapharyngeal fat anteriorly
- ❖ Pharyngeal mucosal space displaces the parapharyngeal fat posterolaterally
- ❖ Retropharyngeal space and danger space displace the parapharyngeal fat anterolaterally



❖ The pharyngeal mucosal space is the most internal compartment (closest to the airway) of the deep compartments of the head and neck, delineated by the middle (pretracheal) layer of **deep cervical fascia**.

❖ It extends from the base of the skull to the **cricoid cartilage**



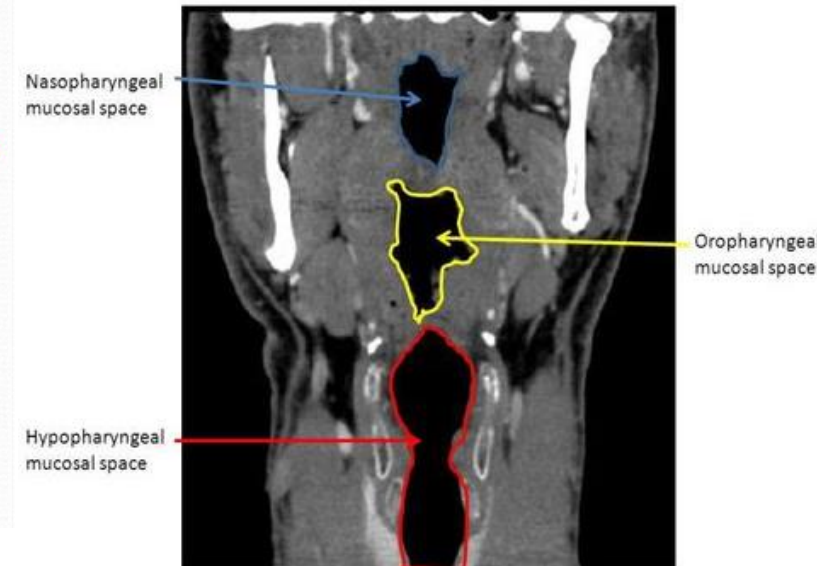
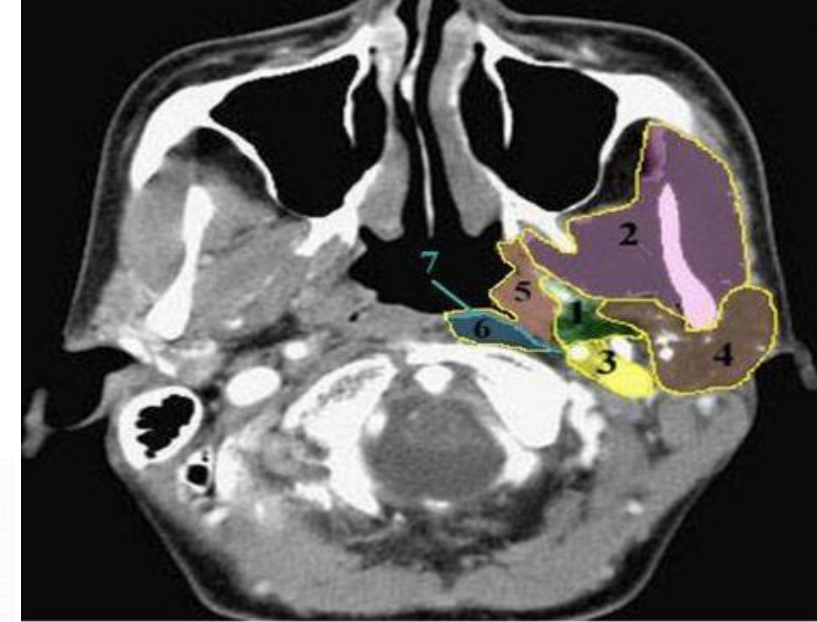
Contrast enhanced CT 1 Parapharyngeal space. 2 Masticator space. 3 Carotid space. 4 Parotid space. 5 Mucosal space. 6 Perivertebral space (anterior portion). 7 Retropharyngeal space

## Contents

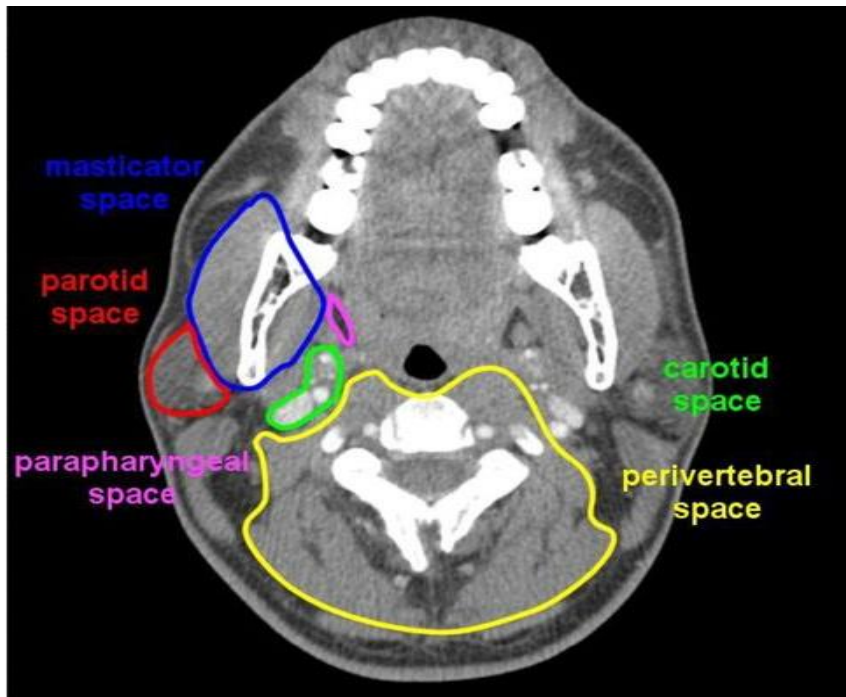
- ❖ Squamous mucosa
- ❖ Lymphoid tissue belonging to the pharyngeal lymphoid ring (**waldeyer's ring**)
- ❖ **Minor salivary glands.**
- ❖ Cartilaginous portion of the **eustachian tube.**
- ❖ **Superior pharyngeal constrictor.**
- ❖ **Middle pharyngeal constrictor.**
- ❖ **Levator palatini.**

## Relations

- ❖ Medial to the **parapharyngeal space**
- ❖ Anterior to the **retropharyngeal space**



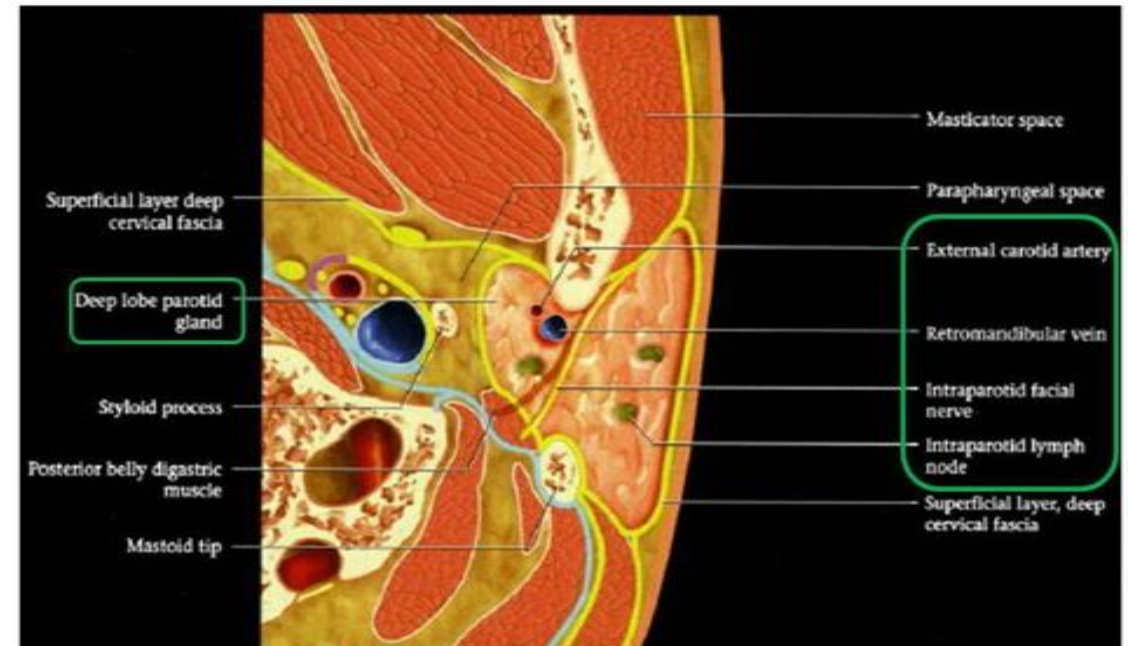
- The parotid space is a roughly pyramidal space, the broad elongated base facing laterally, formed by the superficial layer of the deep cervical fascia overlying the superficial lobe of the parotid gland, and its apex pointing medially.
- It is traversed by the external carotid artery (ECA), retromandibular vein and facial nerve.



## Contents

- Parotid glands
- Intraparotid lymph nodes
- Intraparotid facial nerve (CN VII)
- External carotid artery (ECA)
- Retromandibular vein

## Parotid Space







## Contents

- Muscles of mastication.
- Ramus and body of mandible.
- Mandibular division of the trigeminal nerve.
- Inferior alveolar nerve.
- Inferior alveolar artery and vein.

## Boundaries and relations

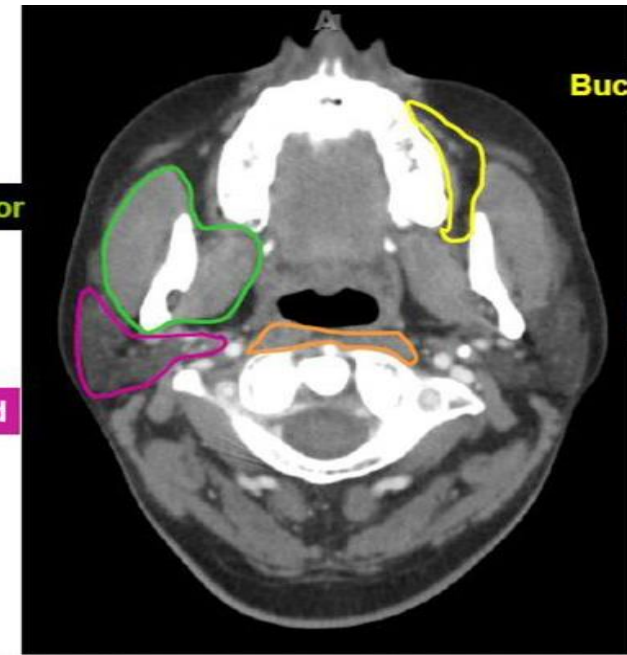
- Anteriorly: Buccal space.
- Posterolaterally: Parotid space.
- Medially: Parapharyngeal space.

Masticator

Parotid

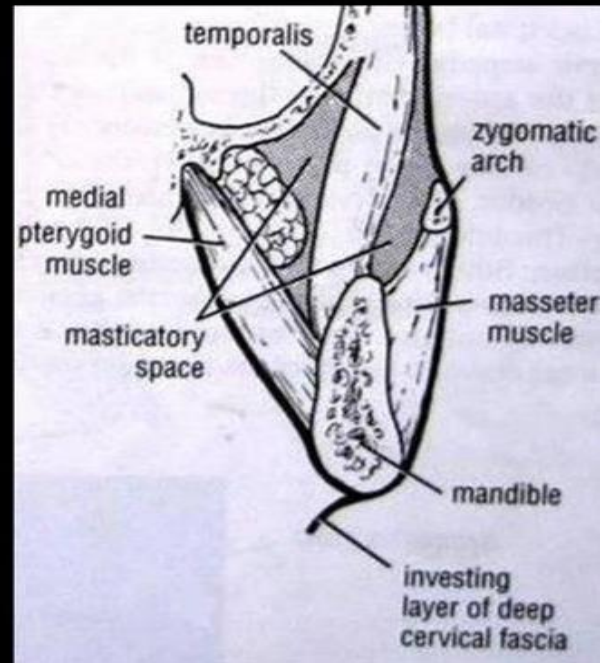
Buccal

Prevertebral



## Masticator spaces

Formed around muscles of mastication (masseter, pterygoids, insertion of temporalis) & covered by investing layer of deep cervical fascia



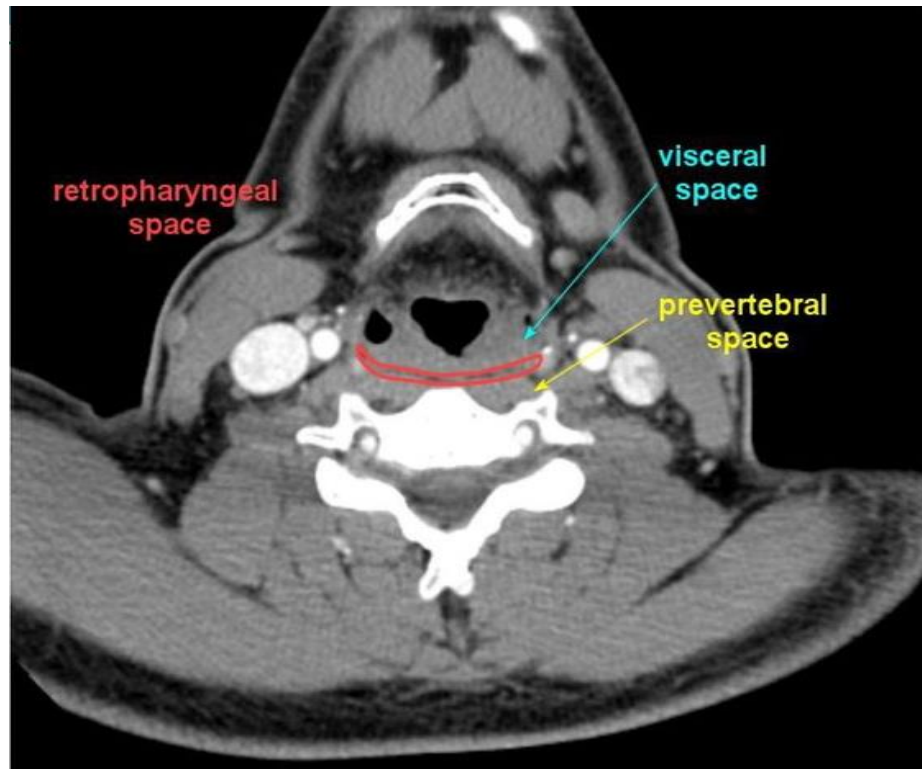


❖ The **retropharyngeal space** (also known as the **true retropharyngeal space** to distinguish it from the **danger space**, which is sometimes referred to as part of the retropharyngeal space) is one of the seven **deep compartments of the head and neck**.

❖ It is a midline space that consists largely of fatty areolar tissue and contains lymph nodes that drain the **pharynx, nose and middle ear**.

❖ The retropharyngeal space is posterior to the **pharynx** and **oesophagus**, and extends from the base of the skull to a variable level between the T1 and T6 vertebral bodies. The main component of the retropharyngeal space is areolar fat.

❖ Lymph nodes are found in the portion of the retropharyngeal space above the hyoid bone, and these lymph nodes drain the pharynx, nasal cavity, paranasal sinuses and middle ears. These lymph nodes are prominent in children, and atrophy with age



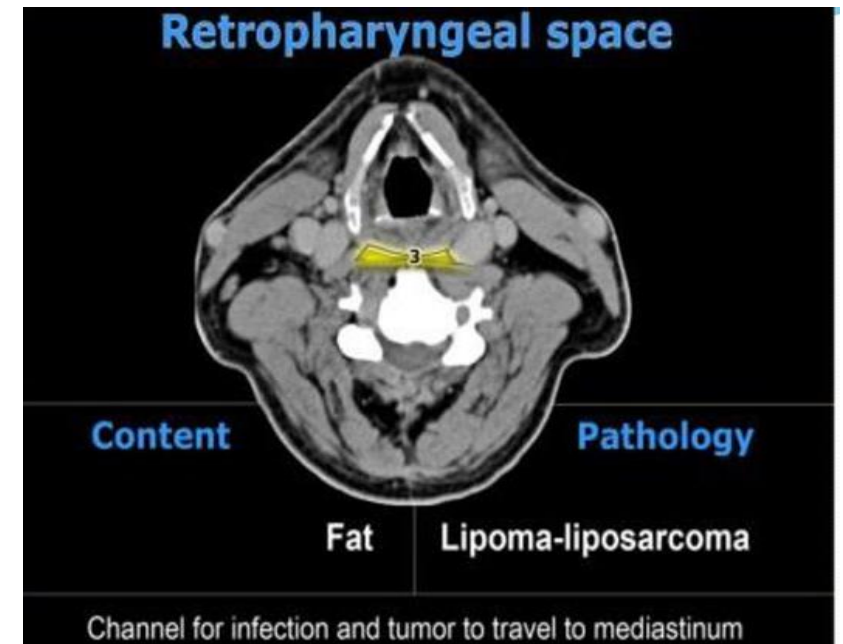
## Contents

- ❖ Areolar fat
- ❖ Lymph nodes (lateral and medial retropharyngeal) only above hyoid
- ❖ Small vessels

## Relations

The retropharyngeal space is:

- ❖ Anterior to the **danger space**
- ❖ Posterior to the **pharyngeal mucosal space**
- ❖ Anteromedial to the **carotid space**
- ❖ Posteromedial to the **parapharyngeal space**



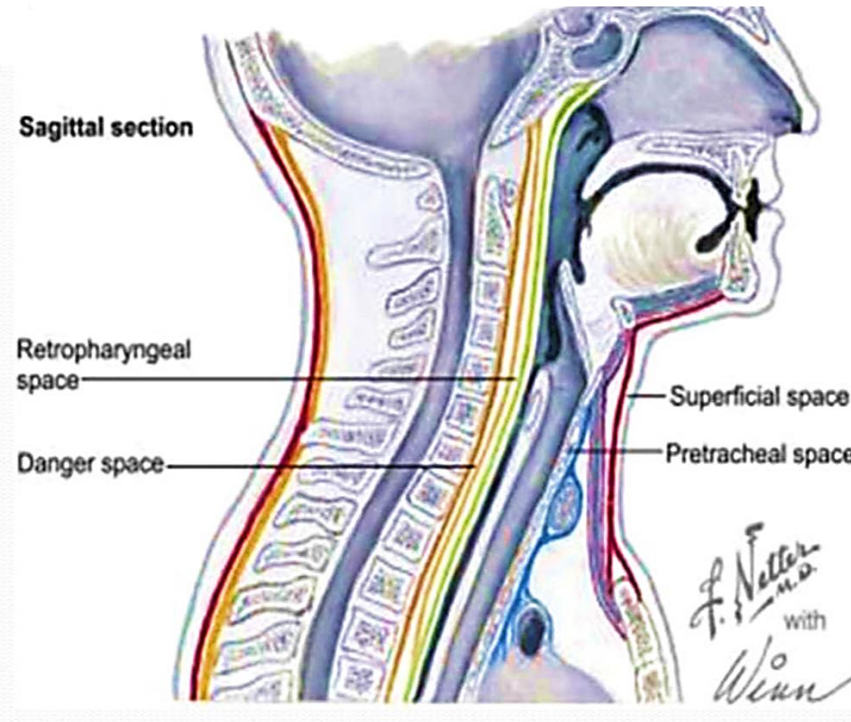


• The **danger space** is a potential space located behind the true retropharyngeal space, which connects the deep cervical spaces to the mediastinum.

- In healthy patients, it is indistinguishable from the retropharyngeal space. It is only visible when distended by fluid or pus, below the level of T<sub>1</sub>-T<sub>6</sub>, since the retropharyngeal space variably ends at this level.

## Boundaries

- Anteriorly: Alar fascia
- Posteriorly: Prevertebral layer of the deep cervical fascia
- Superiorly: Clivus
- Inferiorly: posterior mediastinum at the level of the diaphragm





- The carotid space is roughly cylindrical space that extends from the skull base through to the aortic arch.
- It is circumscribed by all three layers of the deep cervical fascia, forming the **carotid sheath**.
- The bifurcation of the common carotid usually occurs at the boundary of the suprahyoid and infrahyoid spaces

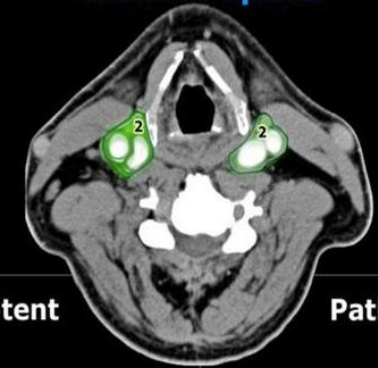
### Contents

- Common carotid artery inferiorly and internal carotid artery superiorly
- Internal jugular vein
- Glossopharyngeal nerve (CN IX): anterior to vessels
- Vagus nerve (CN X): posterior to vessels in posterior notch; extends below hyoid to mediastinum within the carotid sheath
- Accessory nerve (CN XI)
- Hypoglossal nerve (CN XII)
- Sympathetic nerves: medial to vessels lateral to retropharyngeal space
- Deep cervical lymph node chain

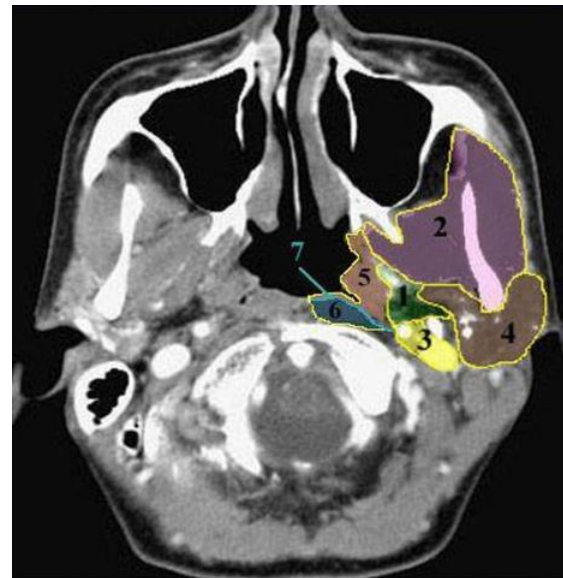
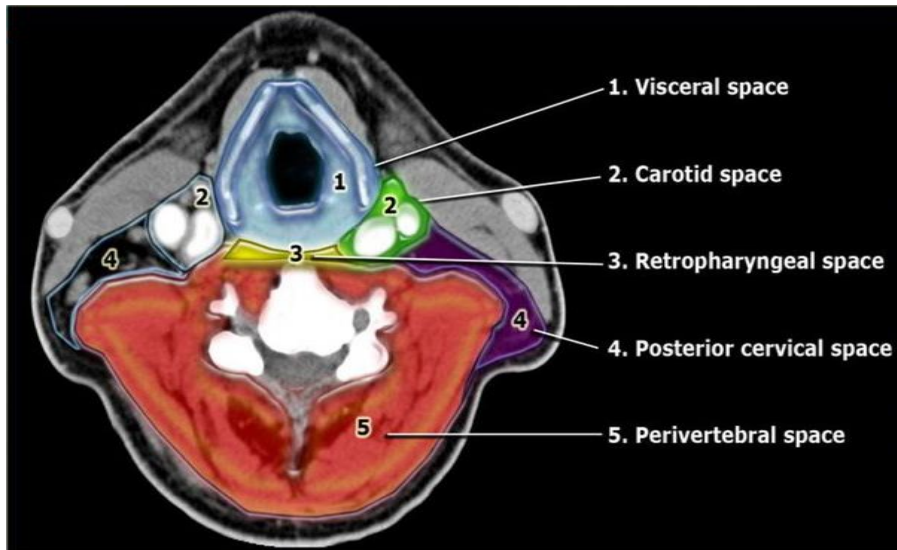
### Relations

- Suprahyoid carotid space:
- Anteriorly: Masticator space; parapharyngeal space
- Laterally: Parotid space
- Posteriorly: Perivertebral space
- The suprahyoid portion of the carotid space is often synonymous with the post-styloid compartment of the Parapharyngeal space

### Carotid space



Content	Pathology
Carotid artery	Aneurysm -Thrombosis Dissection
Internal jugular vein	Thrombosis - Thrombophlebitis
Vagus nerve (X)	Schwannoma - Neurofibroma
Sympathetic plexus	Paraganglioma
Lymph nodes (Level 2-4)	Lymphoma Metastases of squamous cell ca or thyroid ca
Congenital remnants of second branchial cleft	Second branchial cleft cyst



### Contrast enhanced CT

- 1 Parapharyngeal space. 2 Masticator space. 3 Carotid space. 4 Parotid space. 5 Mucosal space. 6 Perivertebral space (anterior portion). 7 Retropharyngeal space



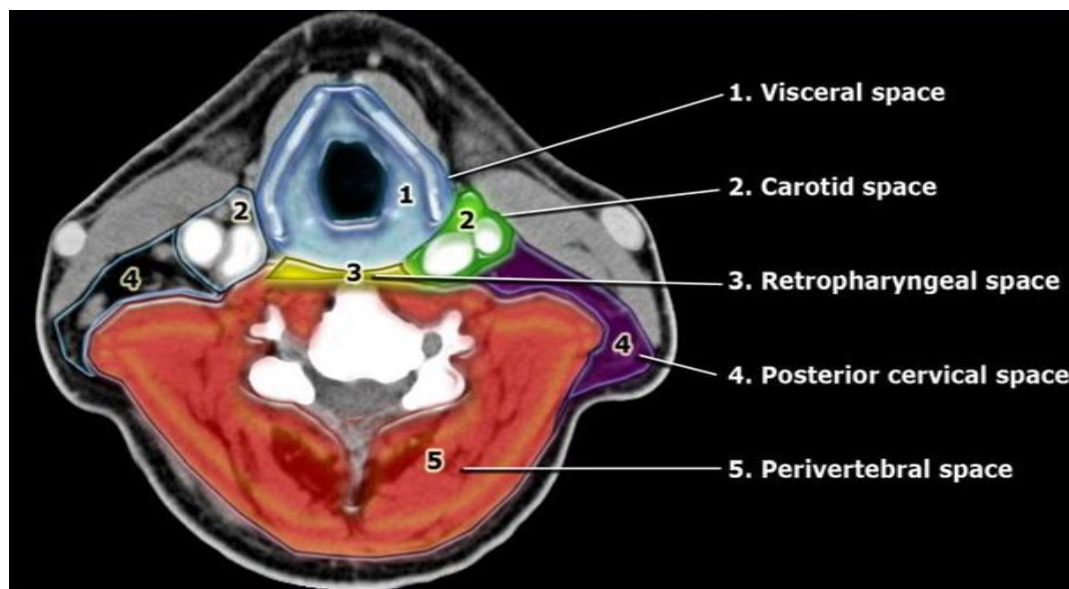
## Contents

- Spinal accessory nerve (cranial nerve XI)
- Preaxillary brachial plexus
  - Dorsal scapular nerve
- Spinal accessory lymph nodes
- Fat

## Relations

- Superficial: Sternocleidomastoid and trapezius muscles
- Deep: Prevertebral space
- Anterior: Carotid space

- Posterolateral part of the neck extending from the mastoid tip and base of skull to the clavicles.



## Posterior cervical space

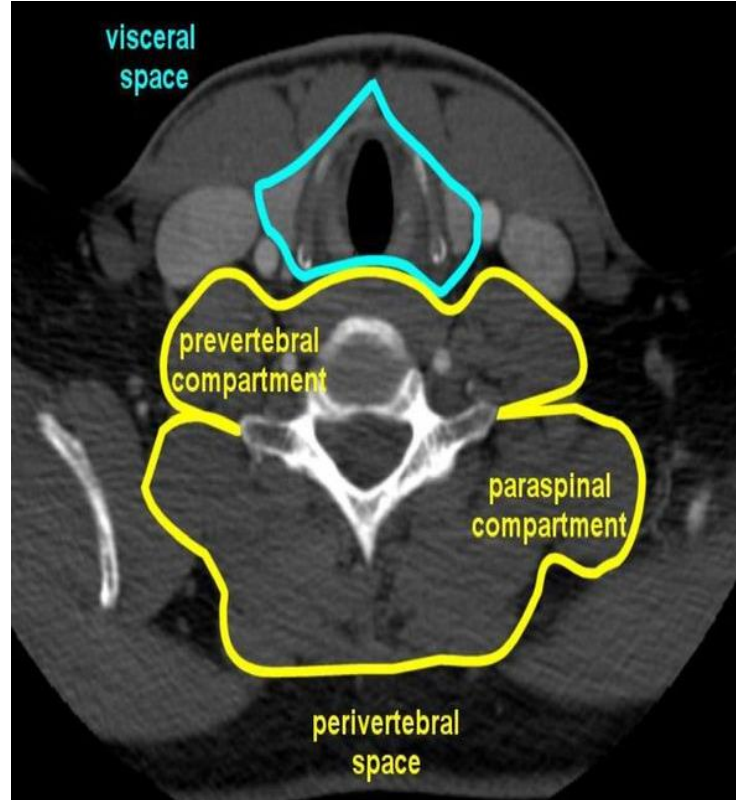


### Content

### Pathology

Fat	Lipoma - liposarcoma
Accessory nerve XI	Schwannoma - Neurofibroma - MPNST
Brachial plexus	Schwannoma - Neurofibroma Direct invasion of apical lungca - breastca - lymphoma
Lymph nodes	Lymphoma - metastases - TB
Primitive embryonic lymph sacs	Cystic hygroma - Lymphangioma
Remnants 3rd branchial	3rd branchial cleft cyst

- The perivertebral space is a cylinder of soft tissue lying posterior to the retropharyngeal space and danger space surrounded by the prevertebral layer of the deep cervical fascia and extends from the skull base to the upper mediastinum.
- The deep cervical fascia sends a deep slip to the transverse process which subdivides the space into:
  - **Prevertebral portion:**  
Anteriorly located
  - **Paraspinal portion:**  
Posteriorly located



### Contents

- **Prevertebral portion.**
  - Cervical vertebral body and disc
  - Prevertebral muscles: longus colli and capiti
  - Scalene muscles
  - Vertebral artery and vein
  - Phrenic nerve
  - Brachial plexus
- **Paraspinal portion**
  - Posterior elements of cervical vertebrae
  - Paraspinal muscles

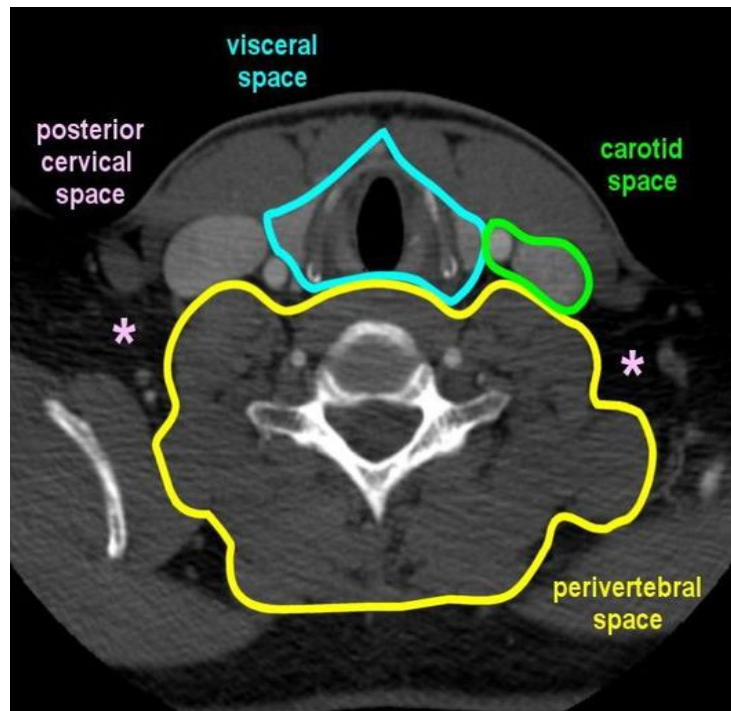
Perivertebral space	
Content	Pathology
Vertebra	Osteomyelitis Prim bone tumor - metastasis
Muscles	Myositis - Abscess - Sarcoma Fibromatosis
Brachial plexus	Schwannoma - neurofibroma MPNST
Vertebral artery and vein	Aneurysm Dissection - Thrombosis



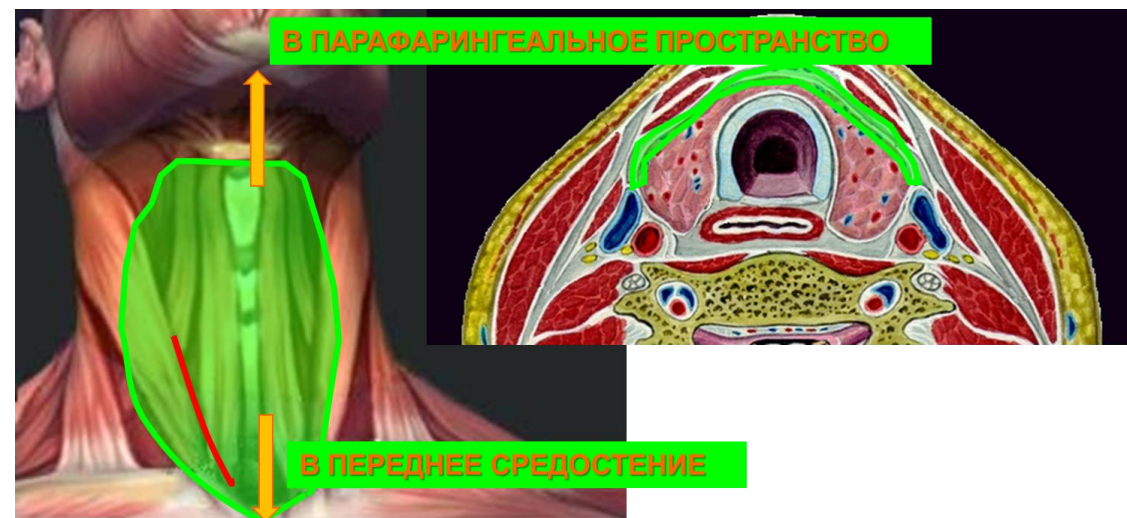
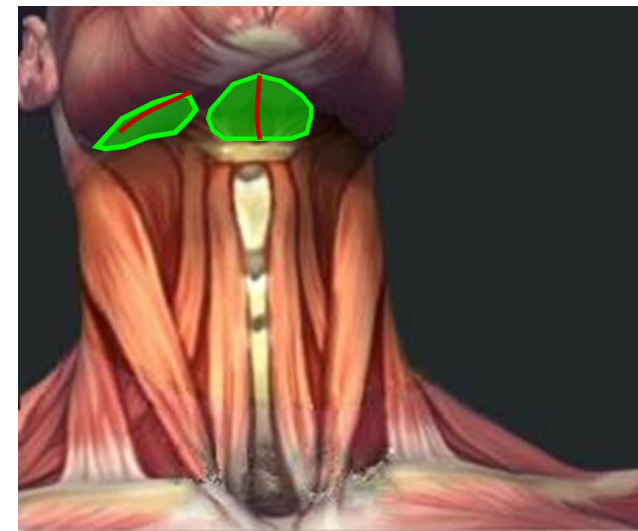
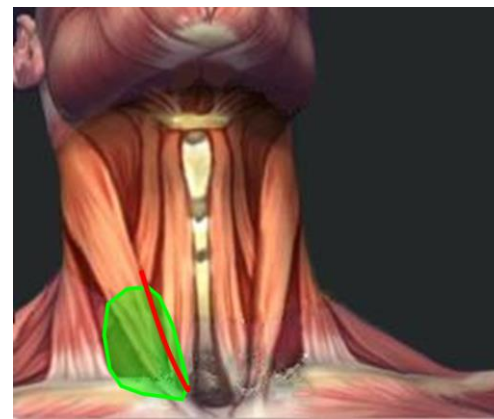
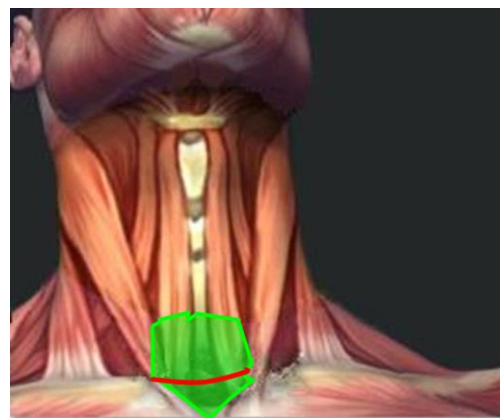
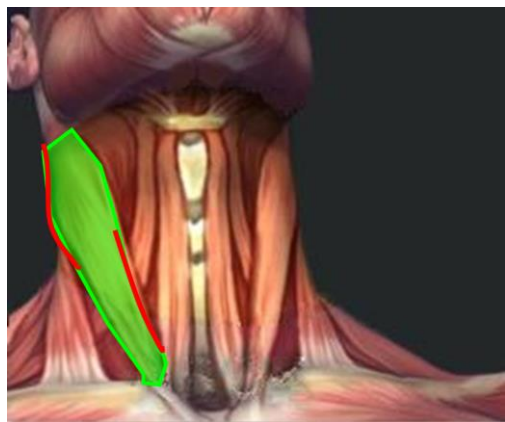
The visceral space extends from the hyoid bone to the superior mediastinum (level of aortic arch / T4), and is surrounded by the middle layers of the deep cervical fascia.

## Contents

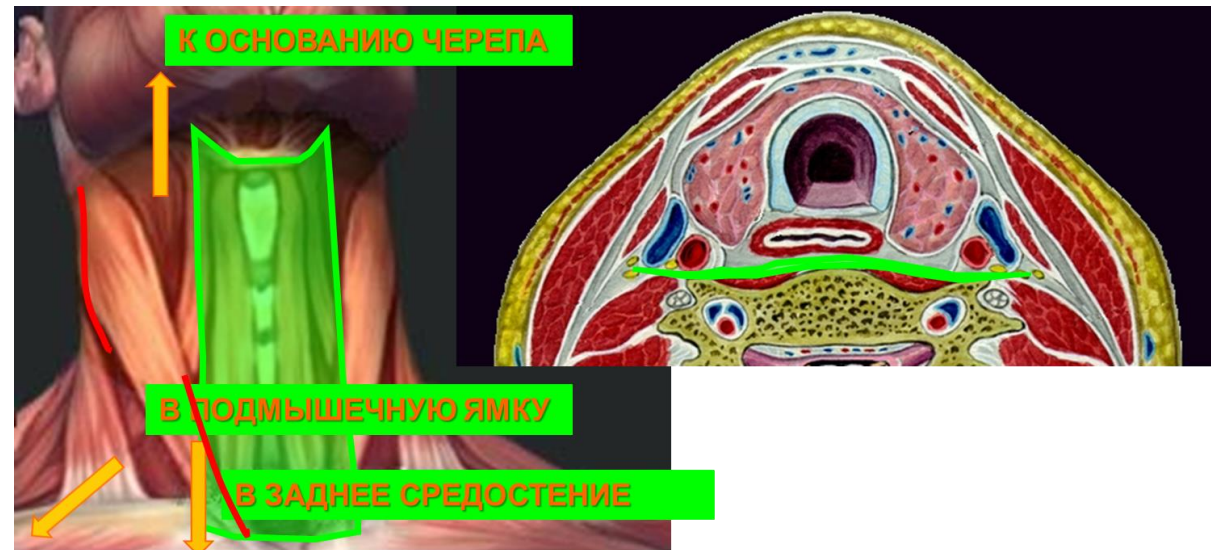
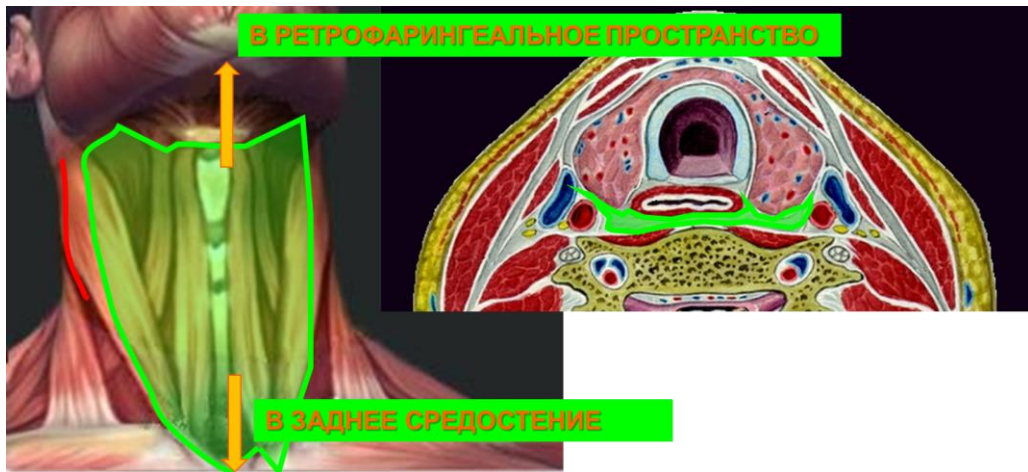
- Thyroid gland
- Parathyroid gland
- Oesophagus
- Larynx
- Hypopharynx
- Trachea
- Recurrent laryngeal nerve
- Lymph nodes (level VI)



Visceral space	
Content	Pathology
Larynx	Laryngocele - Squamous cell ca Chondrosarcoma
Hypopharynx / Esophagus	Zenker's diverticulum Squamous cell ca
Trachea	Carcinoma Benign stenosis
Thyroid gland	Goiter, Colloid cyst, Carcinoma: papillary, follicular, anaplastic Hashimoto's thyroiditis
Parathyroid	Adenoma - Hyperplasia
Embryological remnants	Thyroglossal duct 3rd branchial cyst
Paratracheal lymphnodes	Metastases - Lymphoma
Recurrent nerve	Paralysis





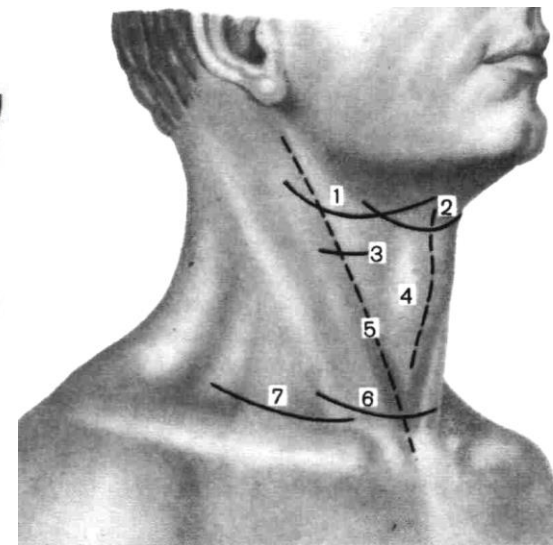
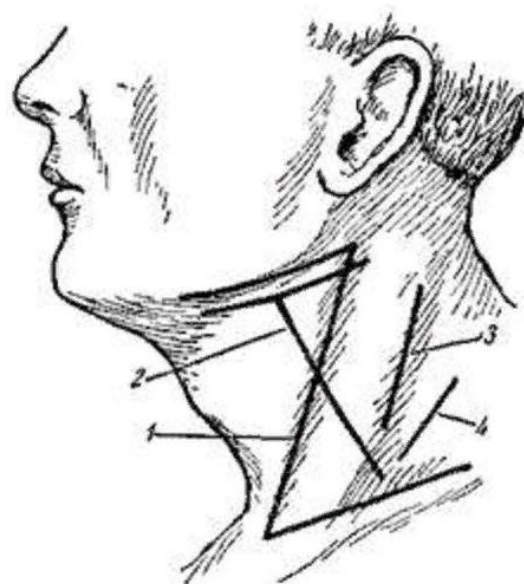
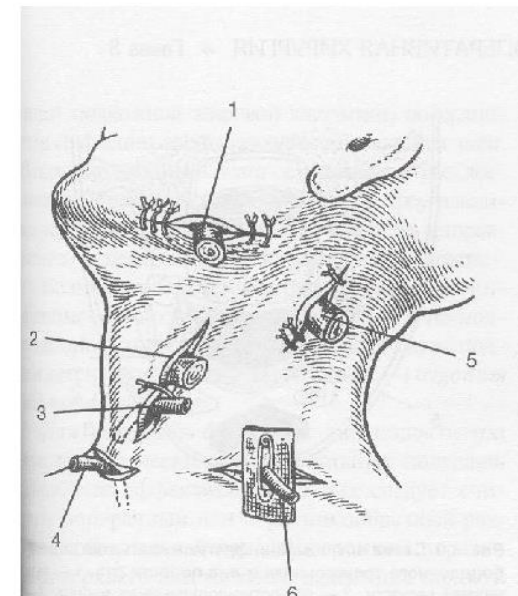
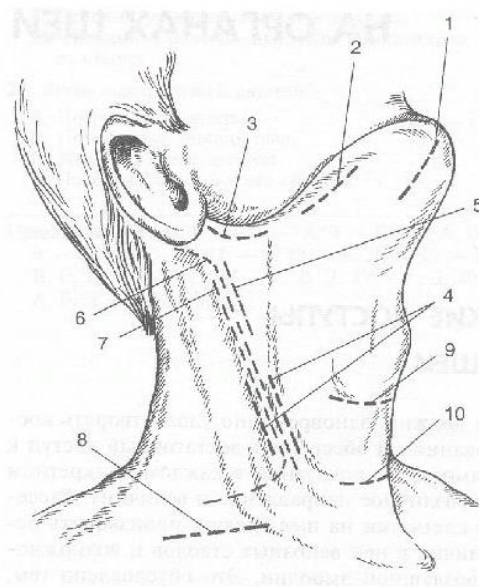
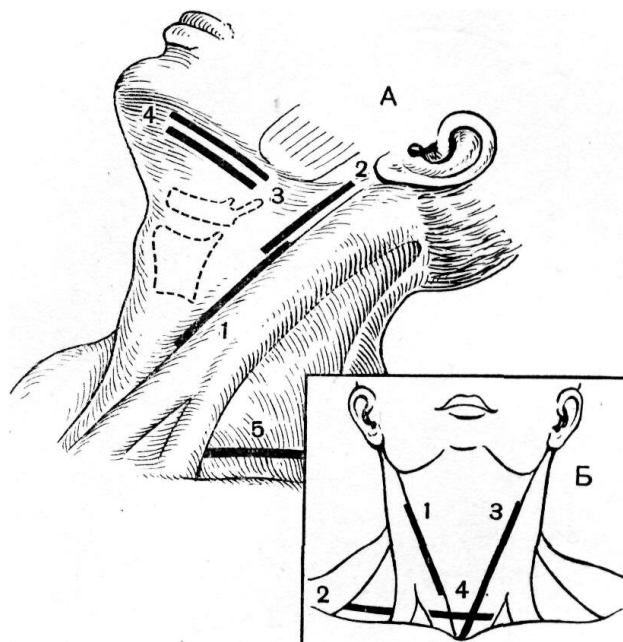




# Incisions in the neck

Operational access groups on the neck:

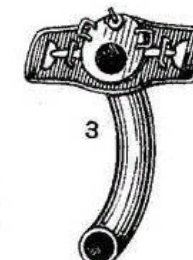
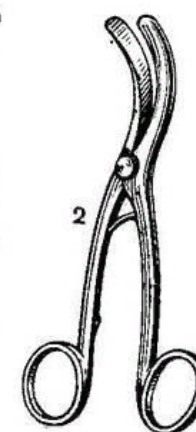
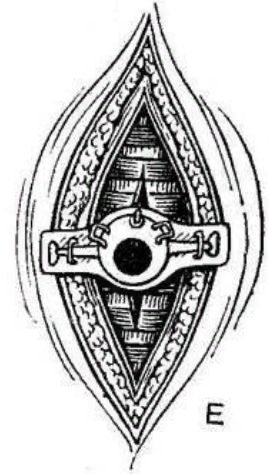
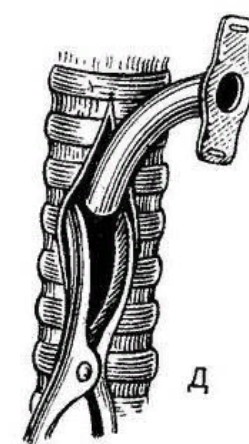
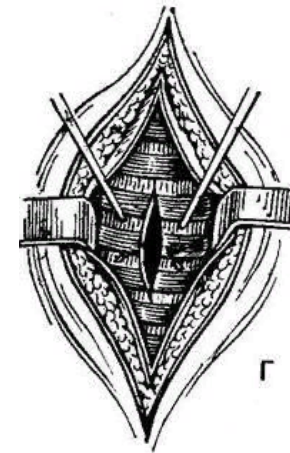
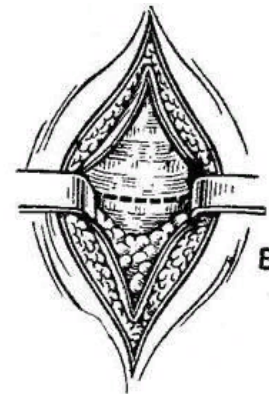
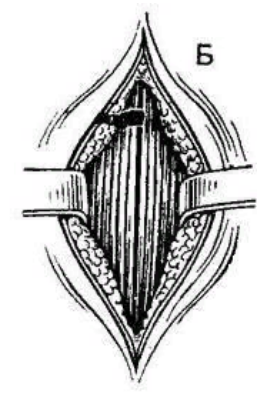
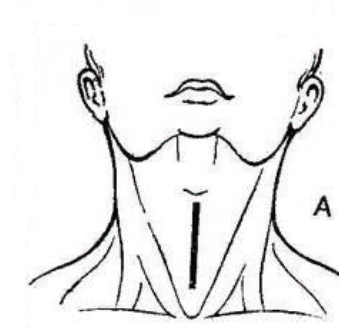
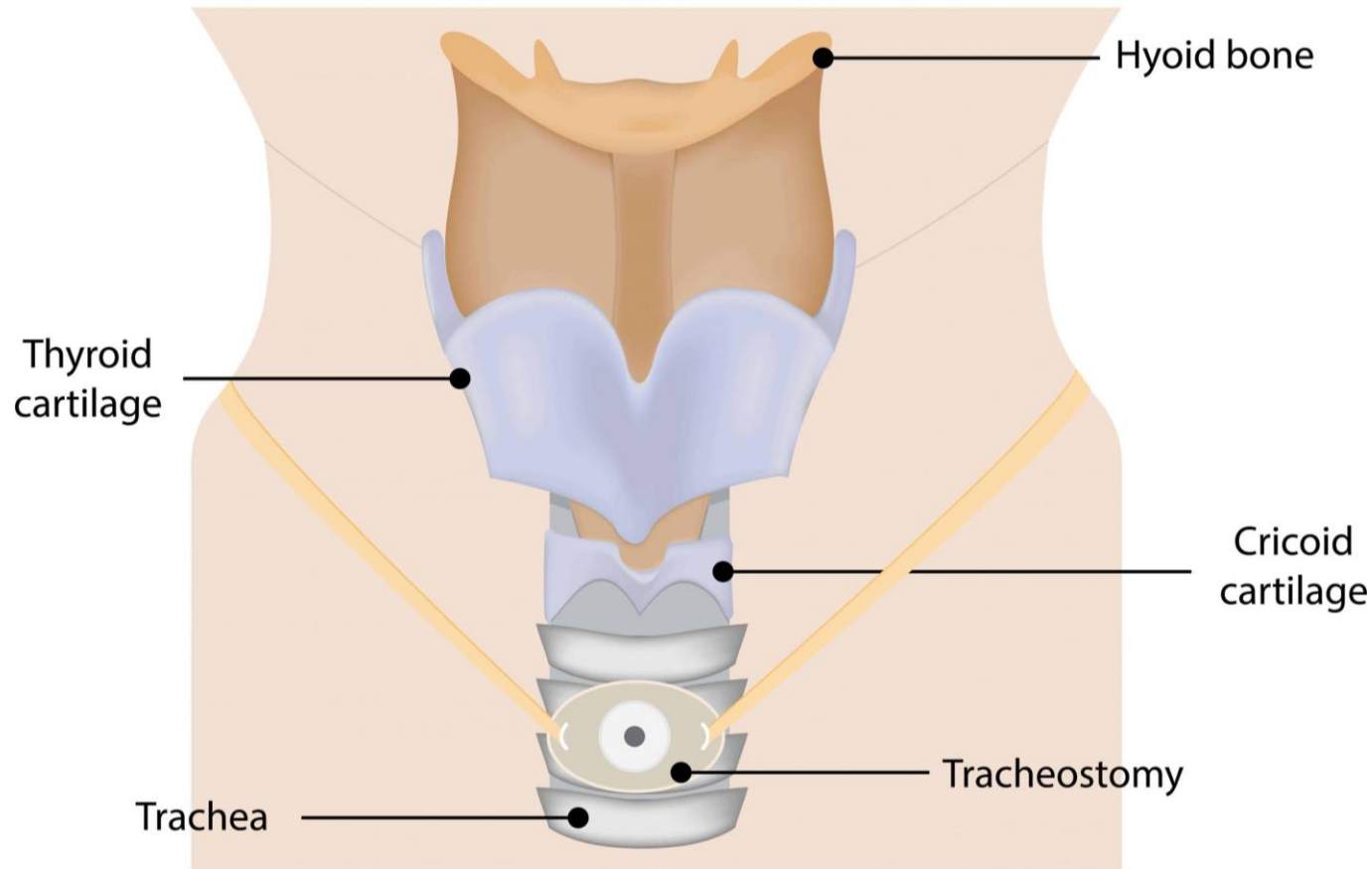
- vertical (along the median line of the neck)
- oblique (along the anterior or posterior edge of the nodding muscle)
- transverse (to expose the thyroid gland)
- combined





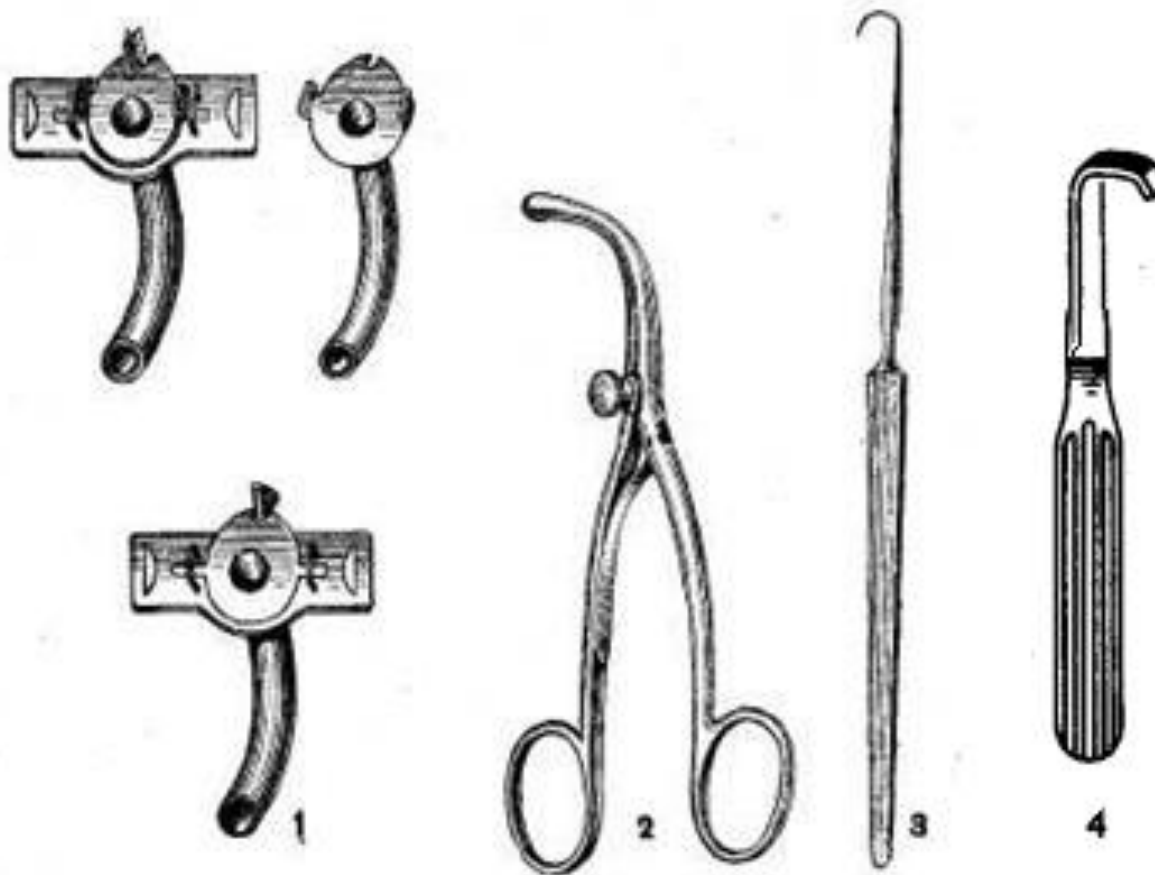
# TRACHEOSTOMY

the operation of opening the trachea, followed by the introduction of a cannula into its lumen in order to give immediate air access to the lungs in case of obstruction of the overlying respiratory tract





## Instruments for tracheostomy



1). Канюля Люэра 2). Трахеорасширитель Труссо 3). Крючок Шассиньяка 4). Крючок Кохера

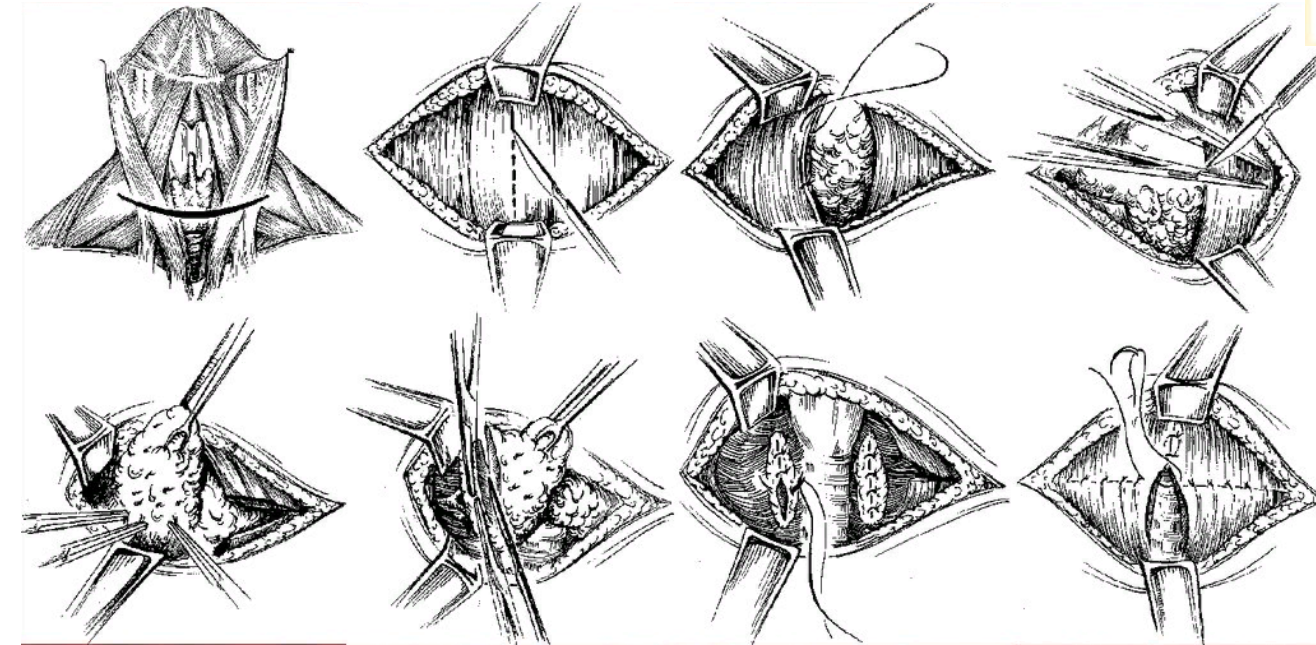
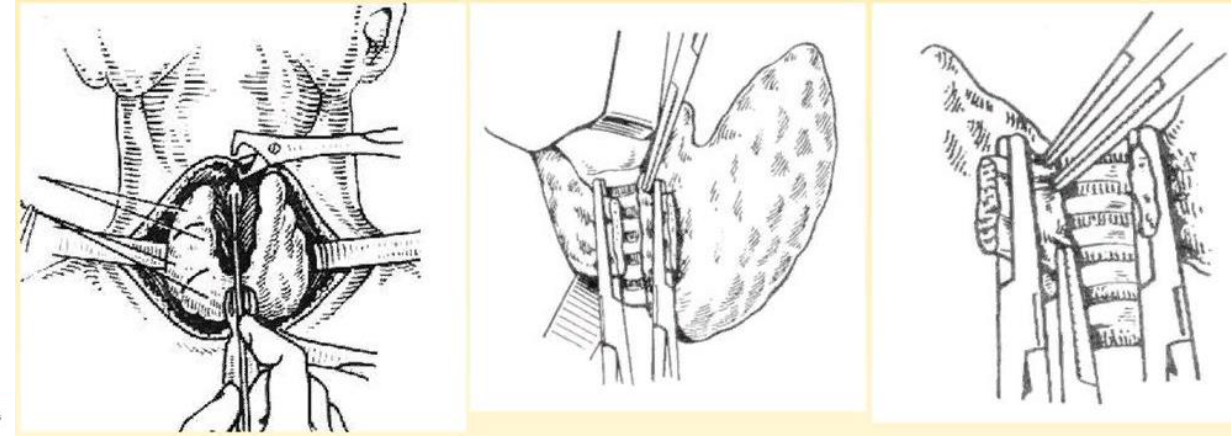


# Thyroid surgery

## Types of thyroid surgery:

- resection;
- enucleation (node peeling);
- combination of resection with enucleation;

**Extirpation** is a complete removal, usually with malignant organ damage.



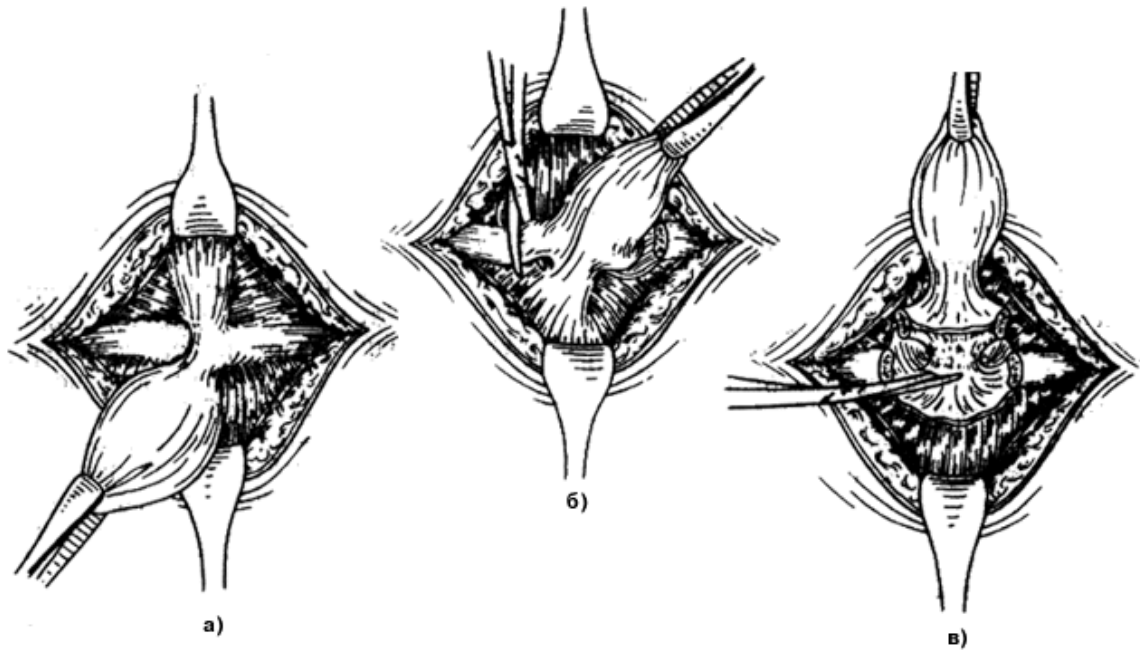
## Subtotal subfascial resection according to Nikolaev

Not all of the gland (subtotal) is removed, but the posteromedial parts of the gland, to which the parathyroid glands adhere, are preserved.

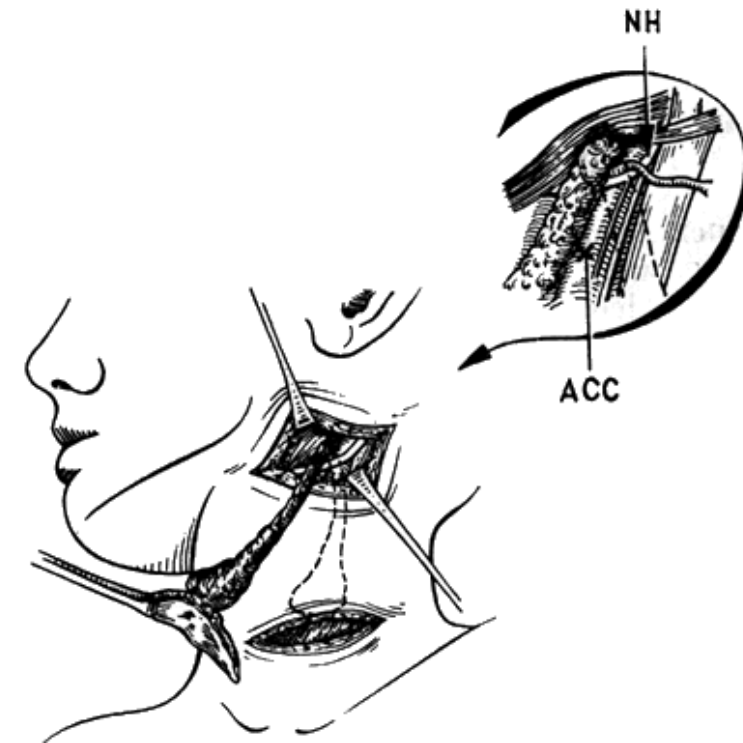
- Ligation of blood vessels supplying the thyroid gland is performed in the space between the visceral leaf of the intramuscular fascia and the gland's own capsule.
- The stump of the gland is covered with a visceral fascia leaf (subfascial).



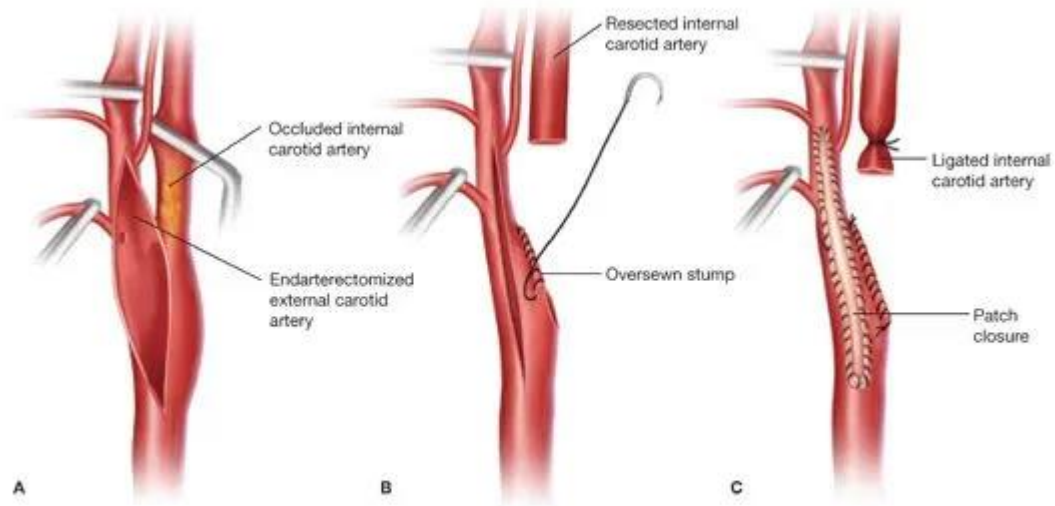
## Removal of the median cyst of the neck



## Removal of a lateral cyst of the neck.



# Carotid artery ligation



**FIG 7** • Carotid ligation. The occluded ICA is amputated and removed (A), and the ICA stump is oversewn (B). The plaque in the CCA and ECA is removed, and the arteriotomy is closed with a patch (C).

