

Head and Neck Radiation

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Disclosures

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Solid tumours cured with primary radiation

- **Head and Neck Cancers**

- nasopharynx
- larynx
- hypopharynx
- Oral cavity
- Oropharynx
- Lip/scalp

- **Gynaecological cancers**

- cervical
- Vulva
- Vagina

- **Skin cancers**

- Basal Cell Carcinoma
- Squamous Cell Carcinoma

- **Colorectal cancers**

- anal cancer
- Early rectal

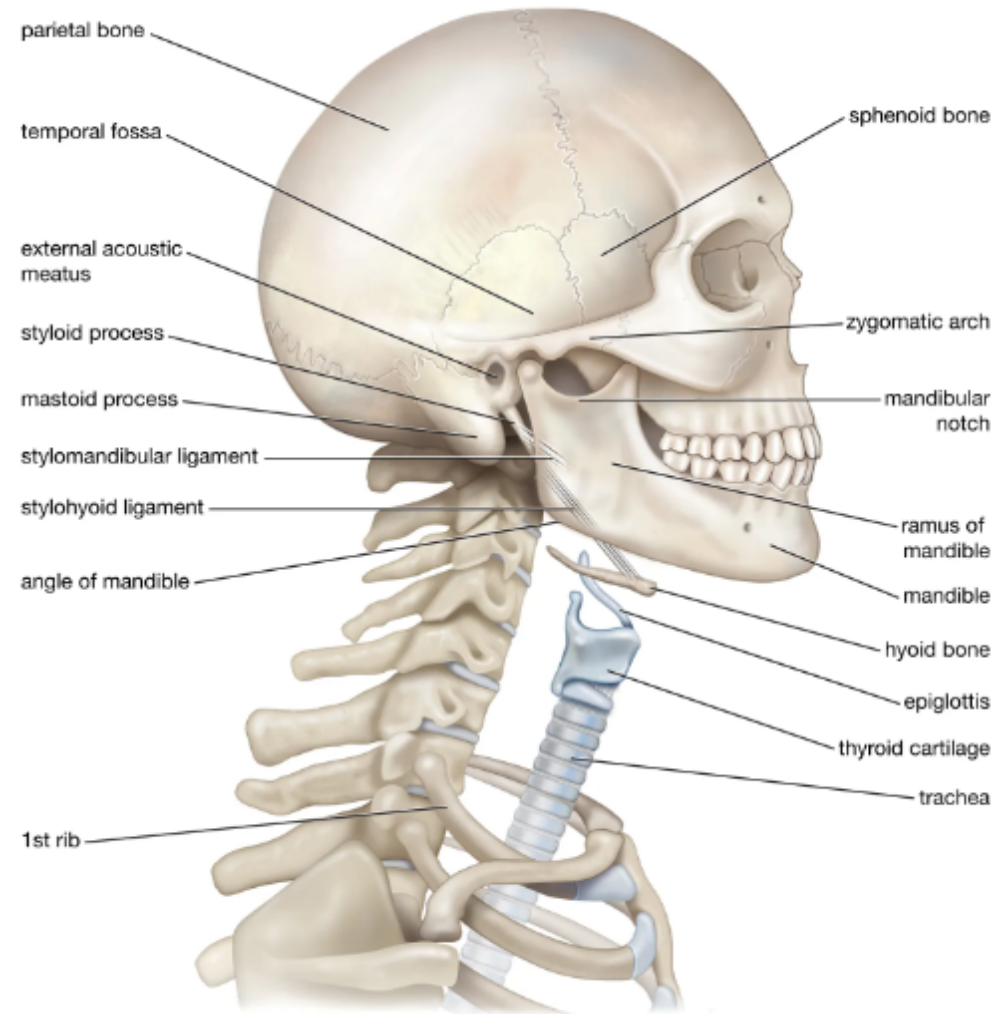
- **Hematological malignancies**

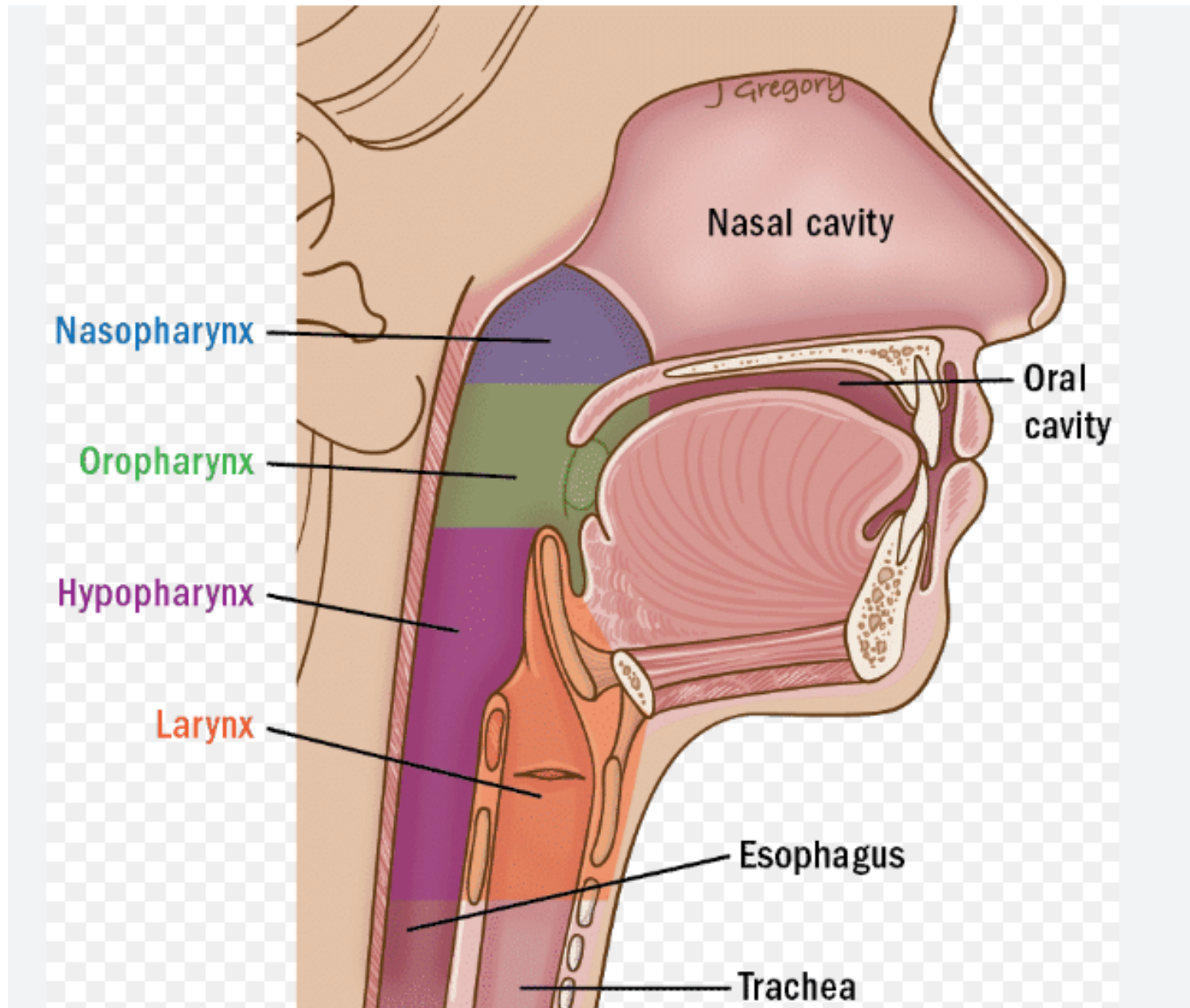
- Follicular lymphomas
- Cutaneous T cell lymphomas
- Marginal zone lymphomas
- Plasmacytomas
- Favourable Hodgkins

Outline

- Bones in the Head and neck region
- Subsites
- Base of skull foramina and its contents
- Cartilages and bones in the neck
- The constrictors
- Neck node levels
- Spaces in the neck
- Organs at risk
- Selecting target lymph node levels
- NPC

Bones in the head and neck region





Subsites

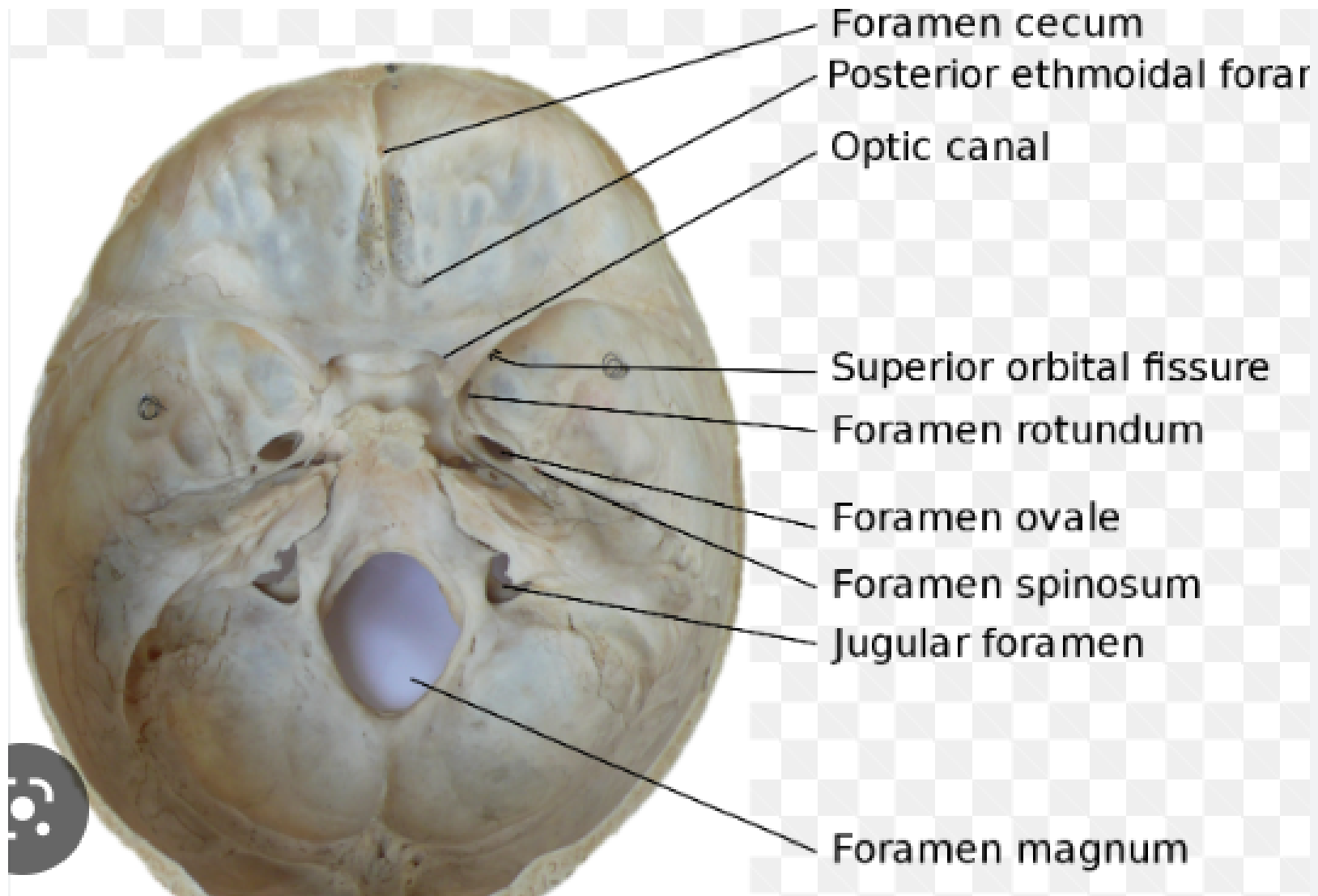
- **Larynx:**
 - Supraglottic
 - Glottic
 - Subglottic
- **Oropharynx**
 - Posterior pharyngeal wall
 - Tonsils
 - Soft palate
 - Base of tongue
- **Hypopharynx**
 - Pyriform sinus
 - Postcricoid space
 - pharyngeal wall
- **Oral Cavity**
 - Buccal
 - Floor of mouth
 - Retromolar trigone
 - Alveolus
 - Hard palate

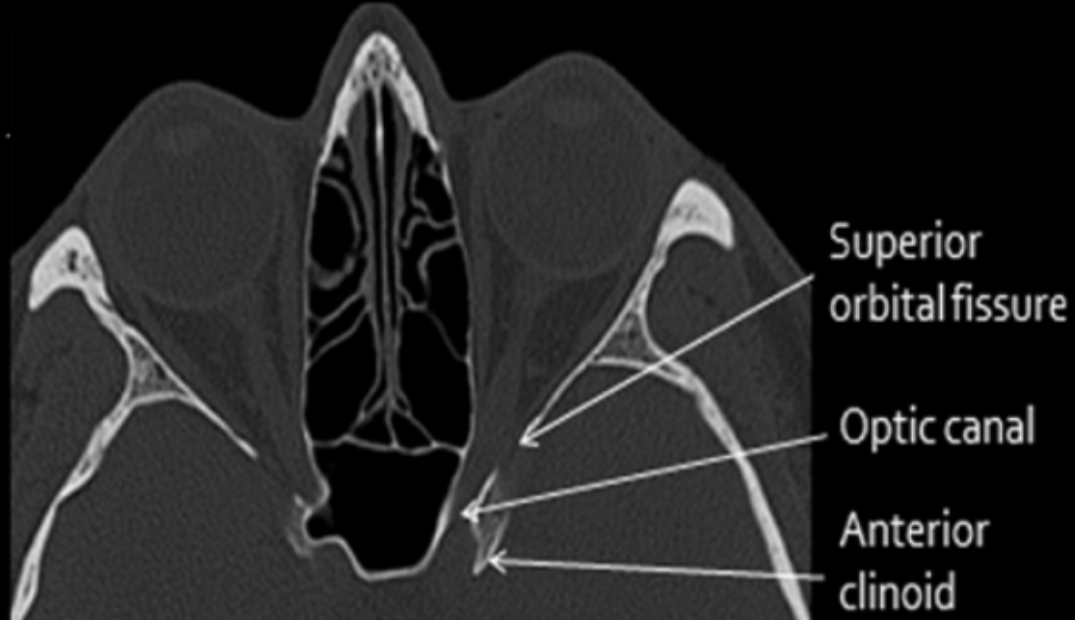
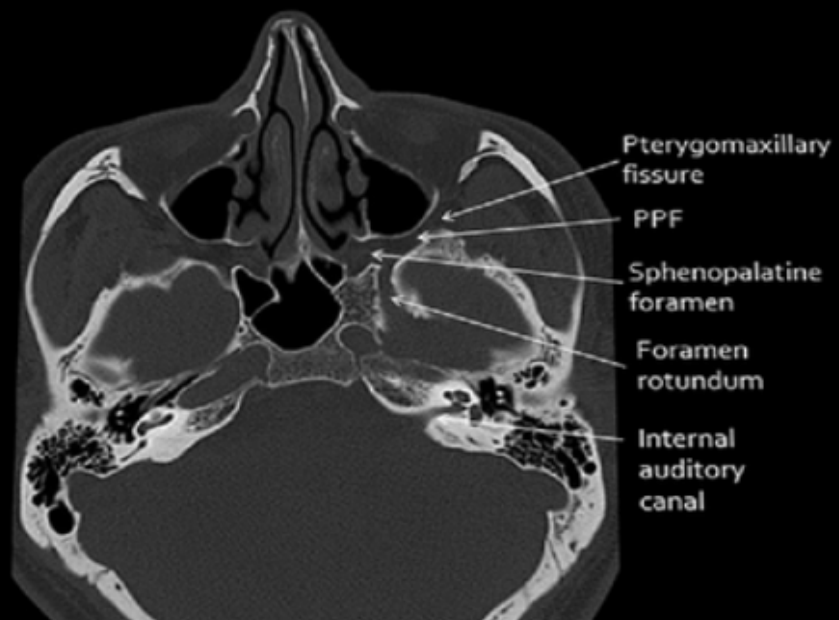
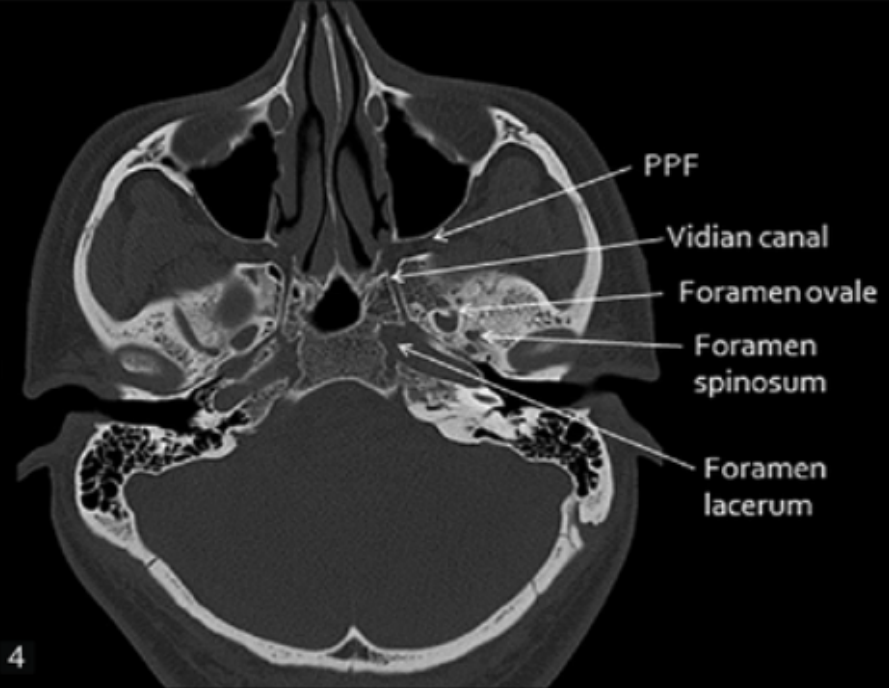
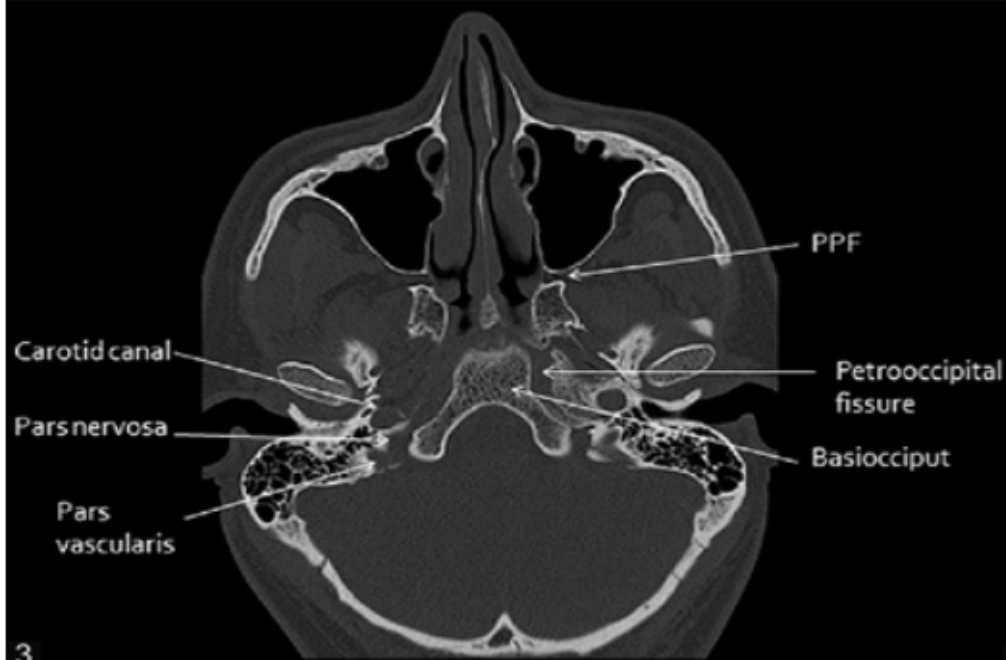
- **Salivary gland tumours**

- Parotid gland
- Submandibular gland
- Minor salivary glands

- **Nasopharyngeal carcinoma**

Base of skull foramina





Nerve		Exits Skull	Branches	Branchial motor	Somatic motor	Somatic sensory	Special sensory	Visceral sensory	Parasympathetic	Defects/Test (not complete)
I	Olfactory	Cribriform plate					Smell			No smell
II	Optic (from retinal cells)	Optic canal	2 branches cross @ chiasm				Sight			See separate notes
III	Oculomotor	Superior orbital fissure	Superior and inferior division (carries parasymp)		LPS s rectus (sup division) m, i recti inf. oblique				Ciliary n. and sphincter pupillae via ciliary ganglion and short ciliary nerves Va	Complete: ptosis and laterally deviated eye with dilated pupil (no parasymp.)
IV	Trochlear	Superior orbital fissure			Sup. oblique					Can't look in and down
Va	Ophthalmic division of trigeminal	Superior orbital fissure	Frontal, lacrimal, nasociliary: long, short, ant ethm, infratrochlear			Forehead and nose, meninges				Loss of sensation, shingles, jaw deviates to weak side when opening mouth
Vb	Maxillary division of trigeminal	Foramen rotundum	Zygomatic, infraorbital, nasopalatine, greater/lesser palatine, pharyng.			Checks to upper lip, external surface of tympanic membrane				
Vc	Mandibular division of trigeminal	Foramen ovale	Ant to muscles, post: lingual, inf alveolar, auriculotemporal	1 st arch muscles of mastication plus MATT		Lower lip and jaw				
VI	Abducent	Superior orbital fissure			Lat. rectus					Eye deviates med when looking laterally
VII	Facial (motor root and nervous intermedius)	Int. auditory meatus Motor fibres exit via stylomastoid foramen	- Greater petrosal - chorda tympani - n. to stapedius - n. to post digastric, occul, stylohyoid - temporal, zygomatic, buccal, mandibular, cervical (from parotid)	2 nd arch muscles of facial expression plus POSS		Ear and tympanic membrane		Taste to ant 2/3 of tongue	Lacrimal and hayfever glands via pterigopalatine ganglion, sublingual and submandibular glands via submandibular ganglion	Loss of taste to ant. 2/3 of tongue, muscles of facial expression, Bell's palsy
VIII	Vestibulocochlear	Int. auditory meatus					Hearing, Balance			Hearing and balance impaired

Nerve		Exits Skull	Branches	Branchial motor	Somatic motor	Somatic sensory	Special sensory	Visceral sensory	Parasympathetic	Defects/Test (not complete)
IX	Glossopharyngeal	Jugular foramen	Lesser petrosal, to stylopharyngeus, sensory, taste and to carotid sinus and body	3 rd arch: stylopharyngeus		Sensation to posterior 1/3 of tongue, int. surface of tymp. membrane		Taste to post 1/3 of tongue	Parotid gland via otic ganglion	Function of carotid baroreceptors impaired, no gag reflex
X	Vagus	Jugular foramen	Pharyngeal, internal and external superior laryngeal, recurrent laryngeal, cardiac, left/right = ant/post vagus	4 th arch sup. laryngeal = cricothyroid, pharyngeal plexus = m. of the palate and pharynx, 6 th arch rec. laryngeal		External ear		Pharynx, larynx, viscera	Neck, thorax, abdomen	Deviation of uvula towards normal side
XI	Accessory	Jugular foramen	Spinal and cranial root		Spinal root: sternocleidomastoid, trapezius, cranial root to					Can't turn head or shrug shoulders
XII	Hypoglossal	Hypoglossal canal	To tongue and ansa cervicalis (geniohyoid and thyrohyoid)		Muscles of tongue except palato-glossus (pharyngeal plexus)					Tongue deviates towards lesion

Yellow: special sensory, orange: branchial motor, blue: somatic motor

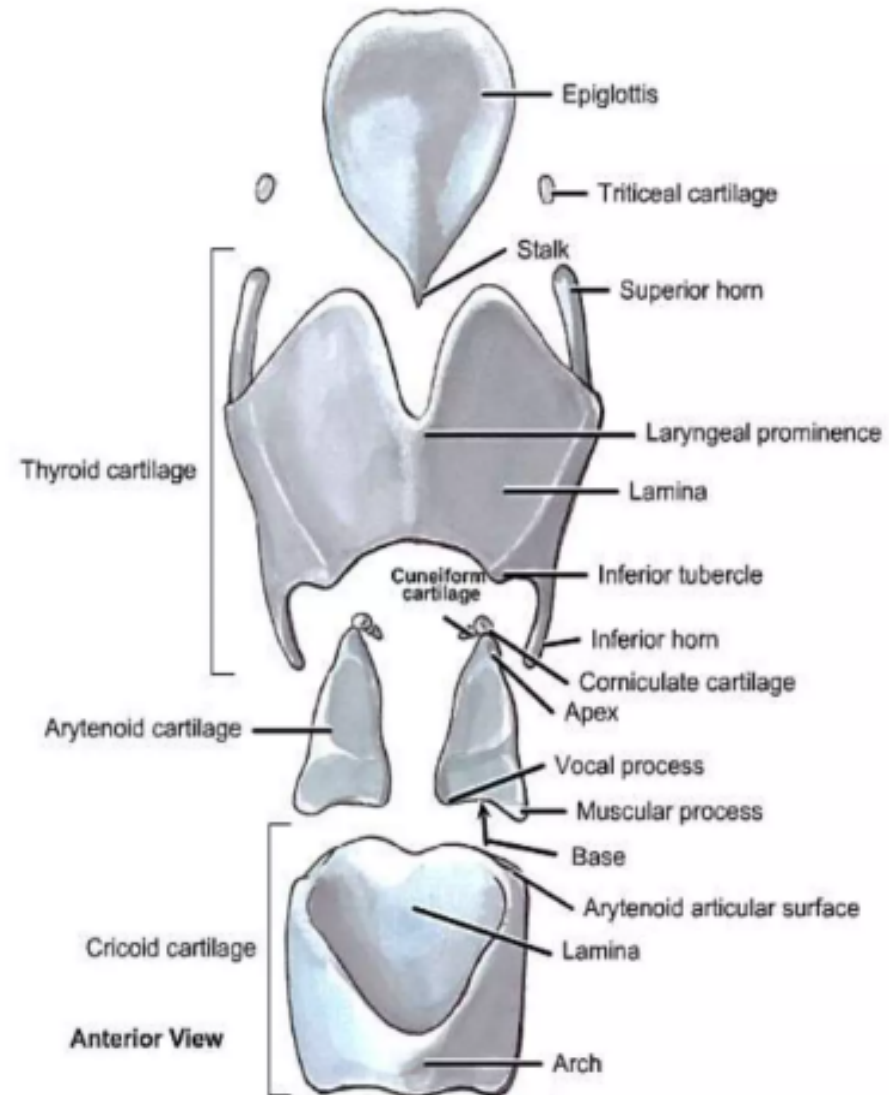
Cartilages

3 Unpaired

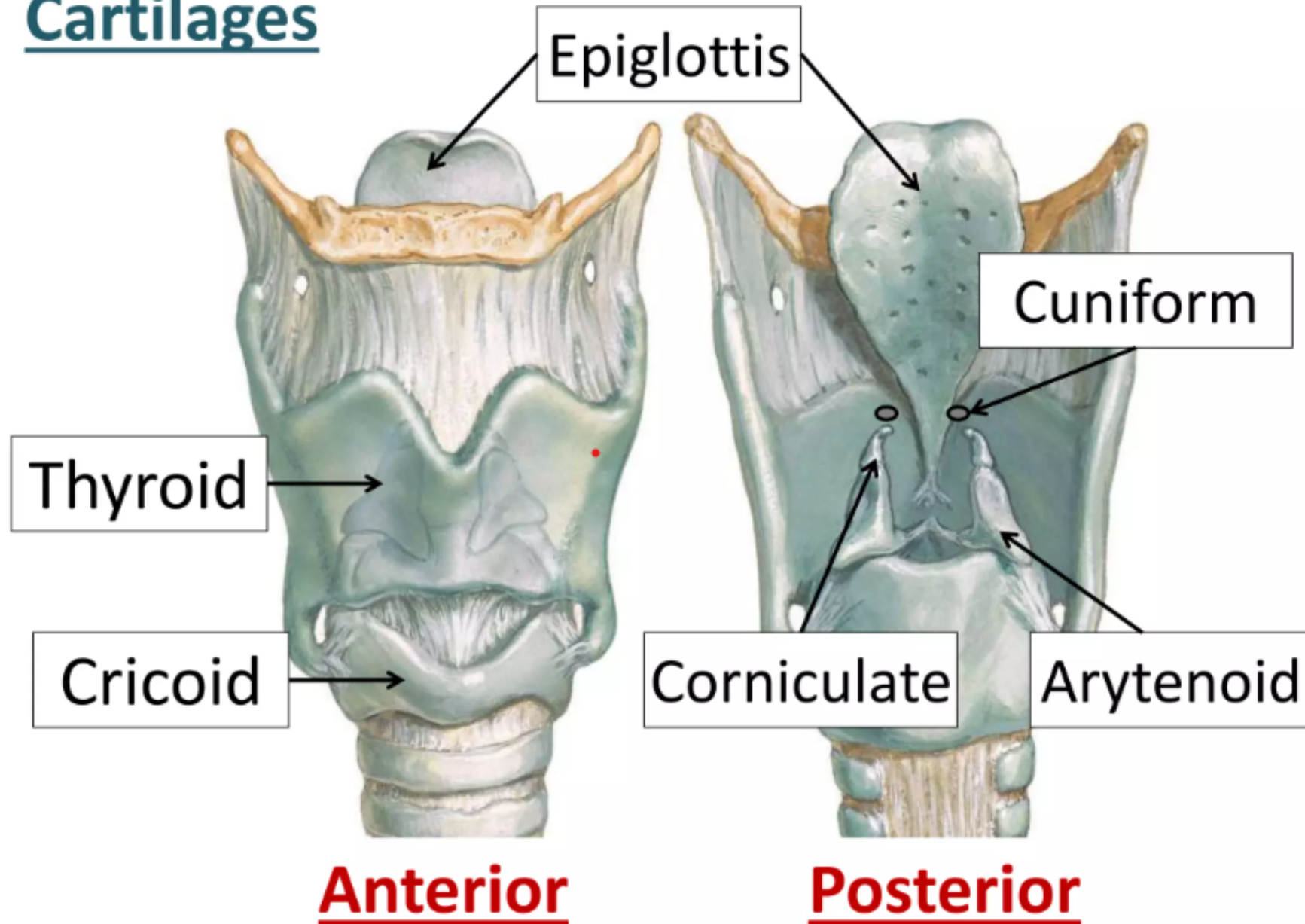
- Thyroid
- Cricoid
- Epiglottis

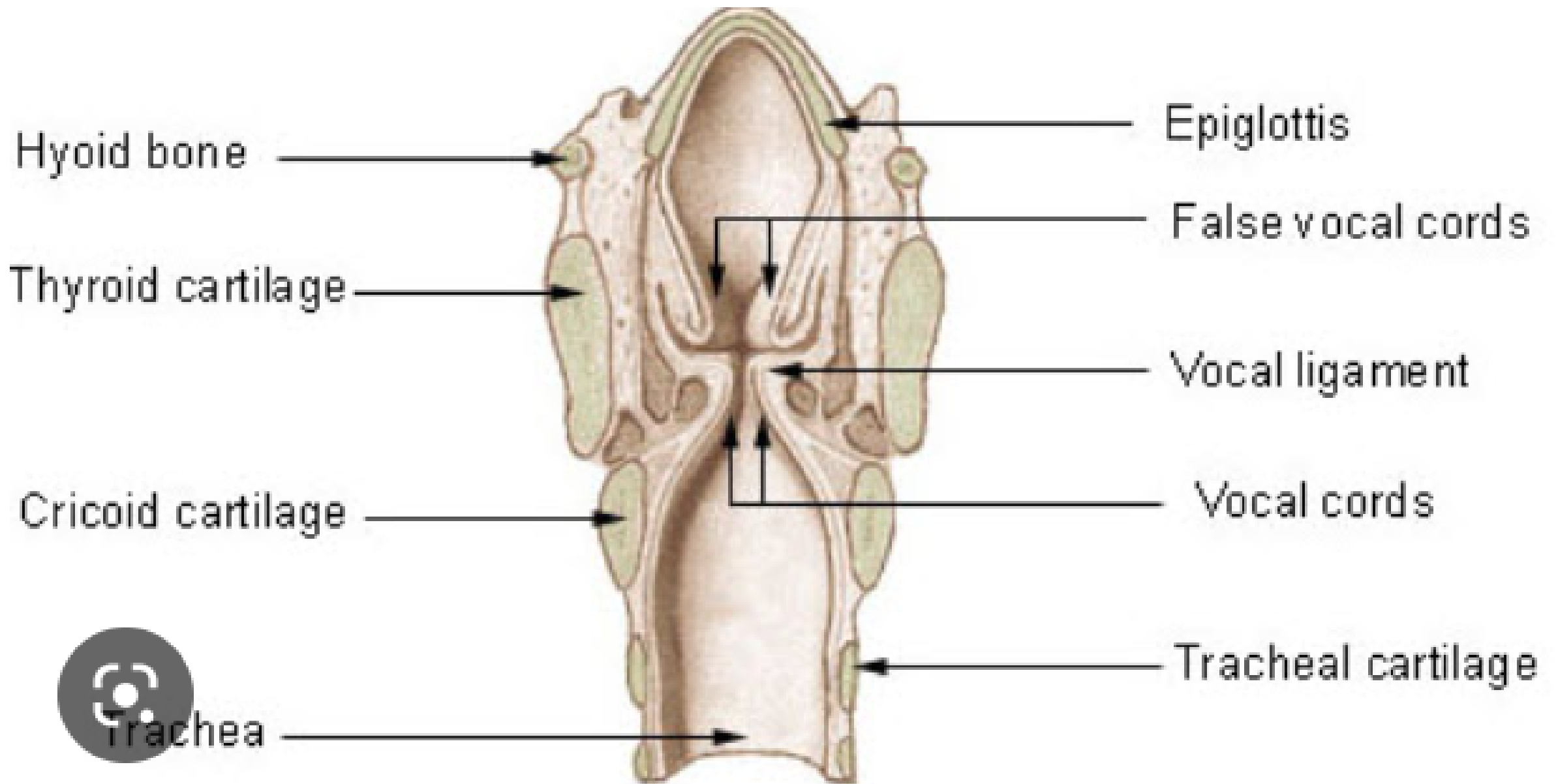
3 Paired

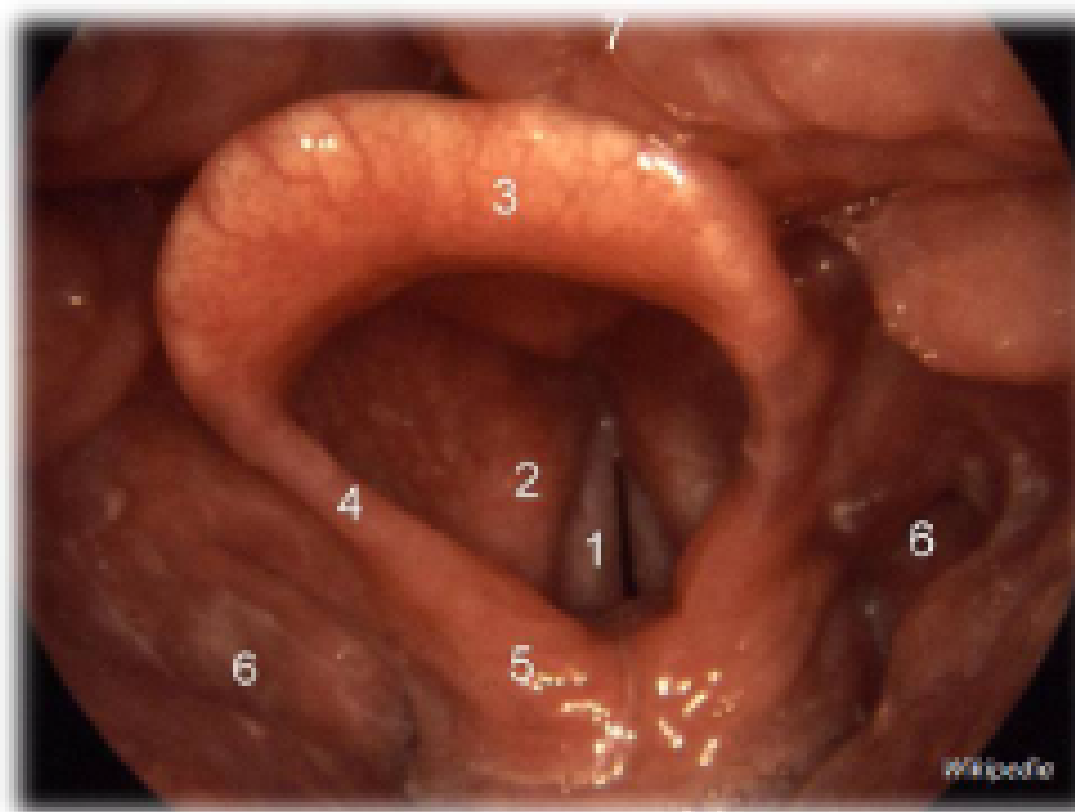
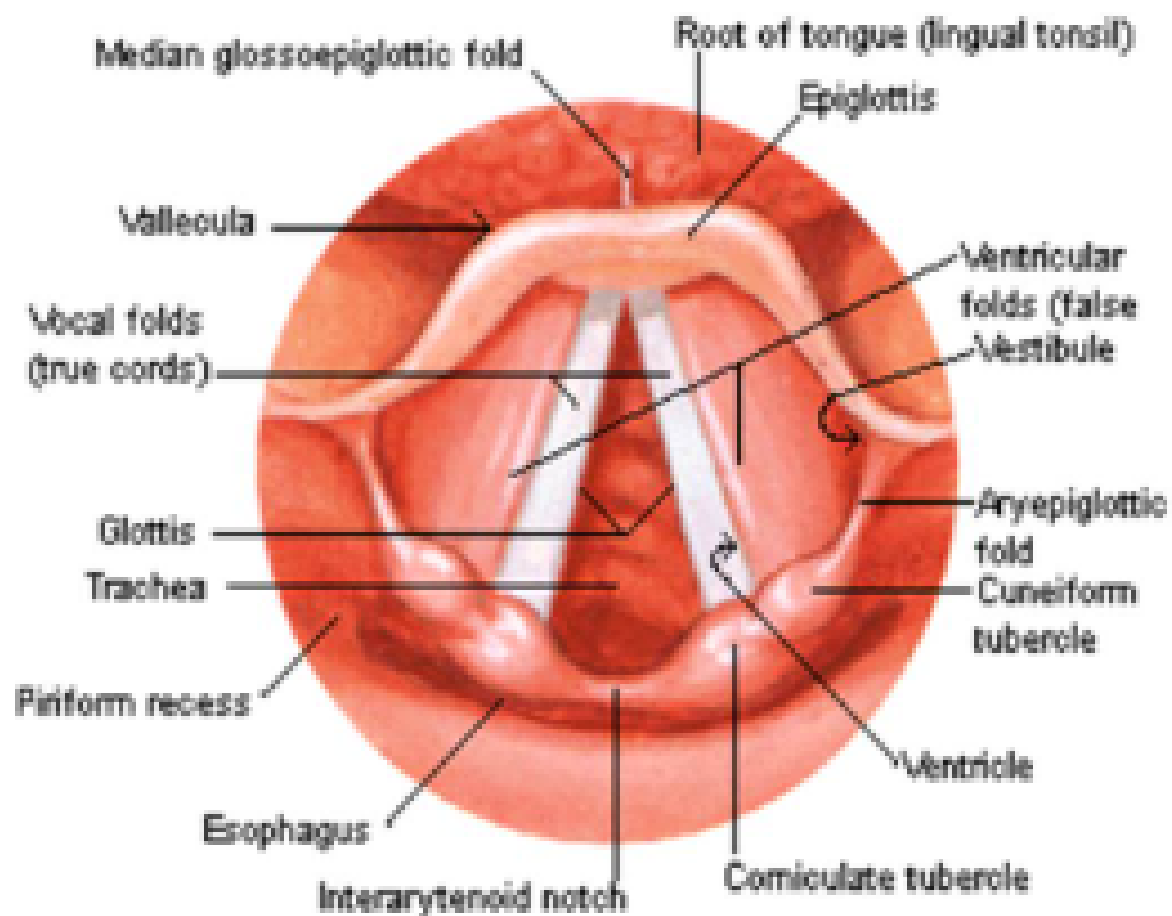
- Arytenoid
- Corniculate
- Cuneiform



Cartilages







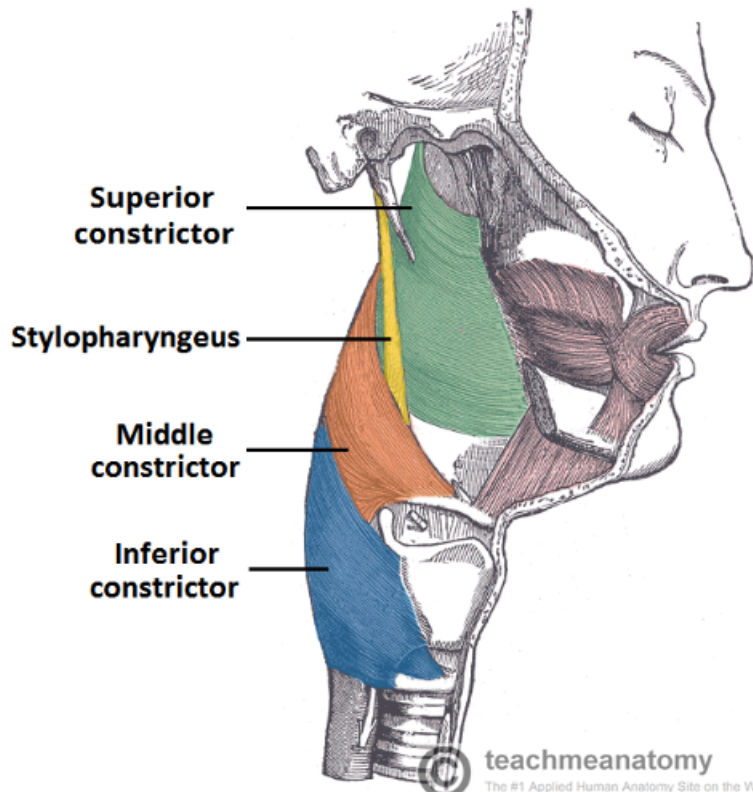
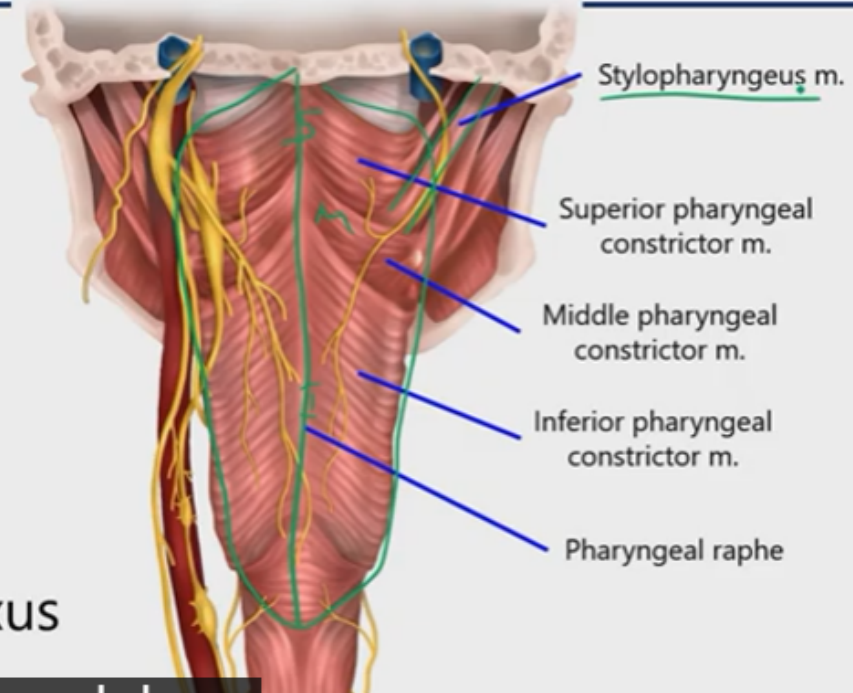
***Mirror Laryngoscopy, image is inverted.**

1. True vocal cords
2. False cords
3. Epiglottis

4. Aryepiglottic folds
5. Arytenoids
6. Piriform sinuses
7. Tongue base

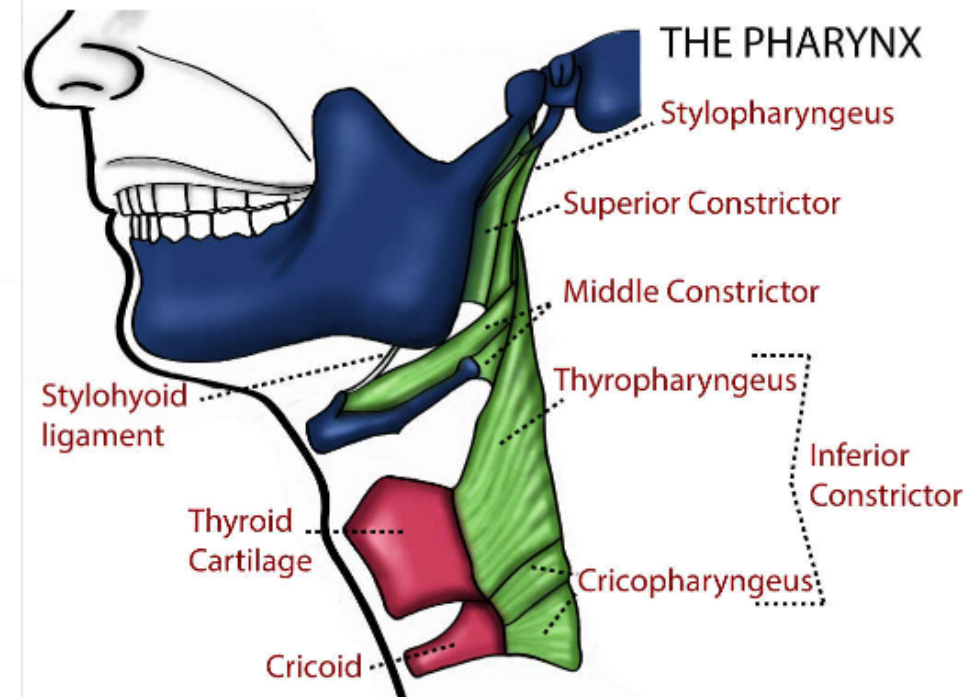
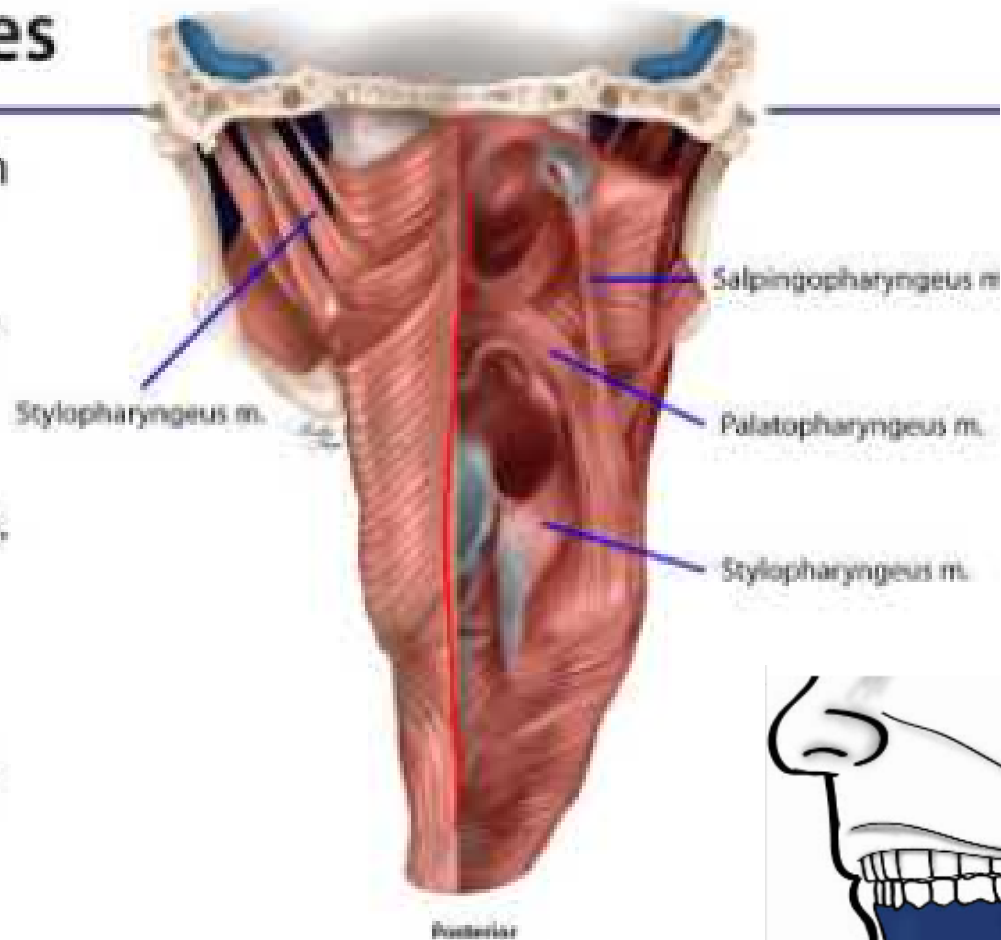
Pharyngeal Muscles

- 3 pairs constrictor mm.
 - Skull, hyoid, & larynx
 - Pharyngeal raphe
- 3 pairs longitudinal mm.
 - Elevate larynx
 - Shorten & widen pharynx
- Raphe – seam of connective tissues
- Innervated by pharyngeal plexus
 - Except stylopharyngeus m.

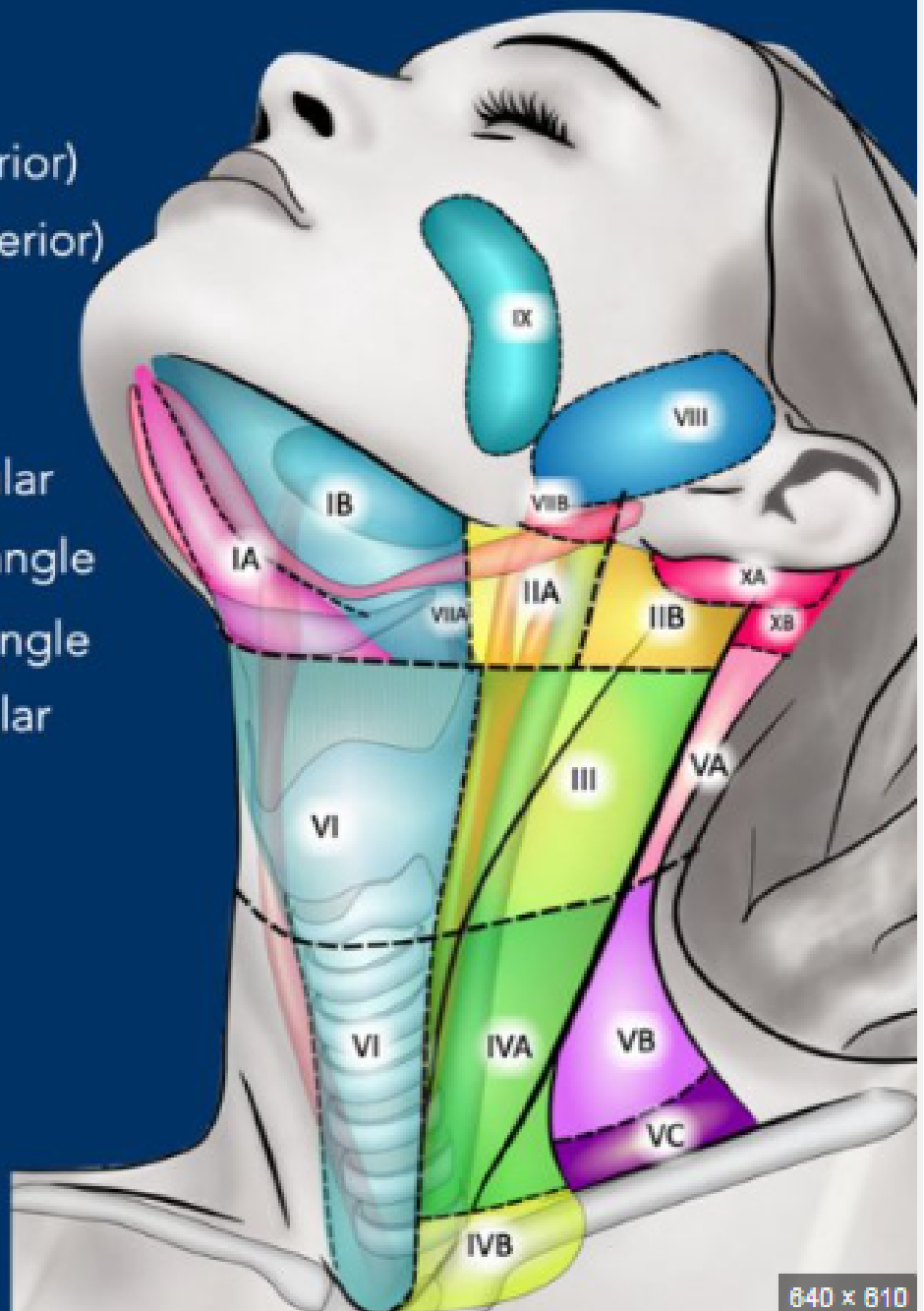


Longitudinal Muscles

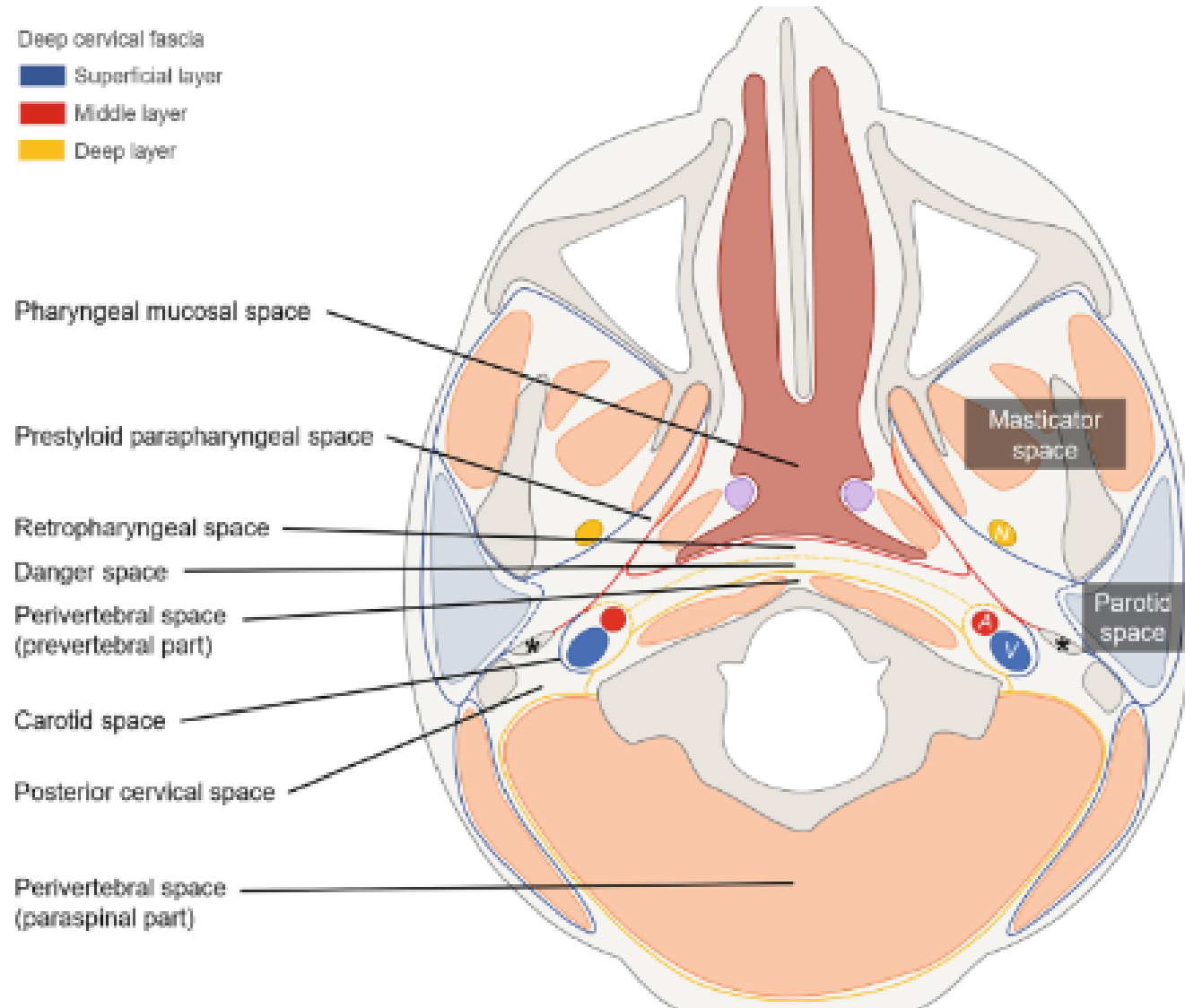
- Elevate larynx & Shorten & widen pharynx
- **Stylopharyngeus m.**
 - Styloid process of temporal bone
 - Thyroid & pharyngeal wall
- **Salpingopharyngeus m.**
 - Auditory tube
 - Blends with palatopharyngeus m.
 - Thyroid & pharyngeal wall
- **Palatopharyngeus m.**
 - Soft palate
 - Thyroid & pharyngeal wall
 - Blends with salpingopharyngeus m.
 - Posterior border of fauces
 - Palatopharyngeal arch



- IA Submental
- IB Submandibular
- IIA Upper jugular (anterior)
- IIB Upper jugular (posterior)
- III Mid jugular
- IVA Lower jugular
- IVB Medial supraclavicular
- VA Upper posterior triangle
- VB Lower posterior triangle
- VC Lateral supraclavicular
- VI Anterior cervical
- VIIA Retro-pharyngeal
- VIIIB Retro-styloid
- VIII Parotid
- IX Bucco-facial
- XA Retro-auricular
- XB Occipital



Spaces in the Head and Neck region



Masticator space

Mucosa

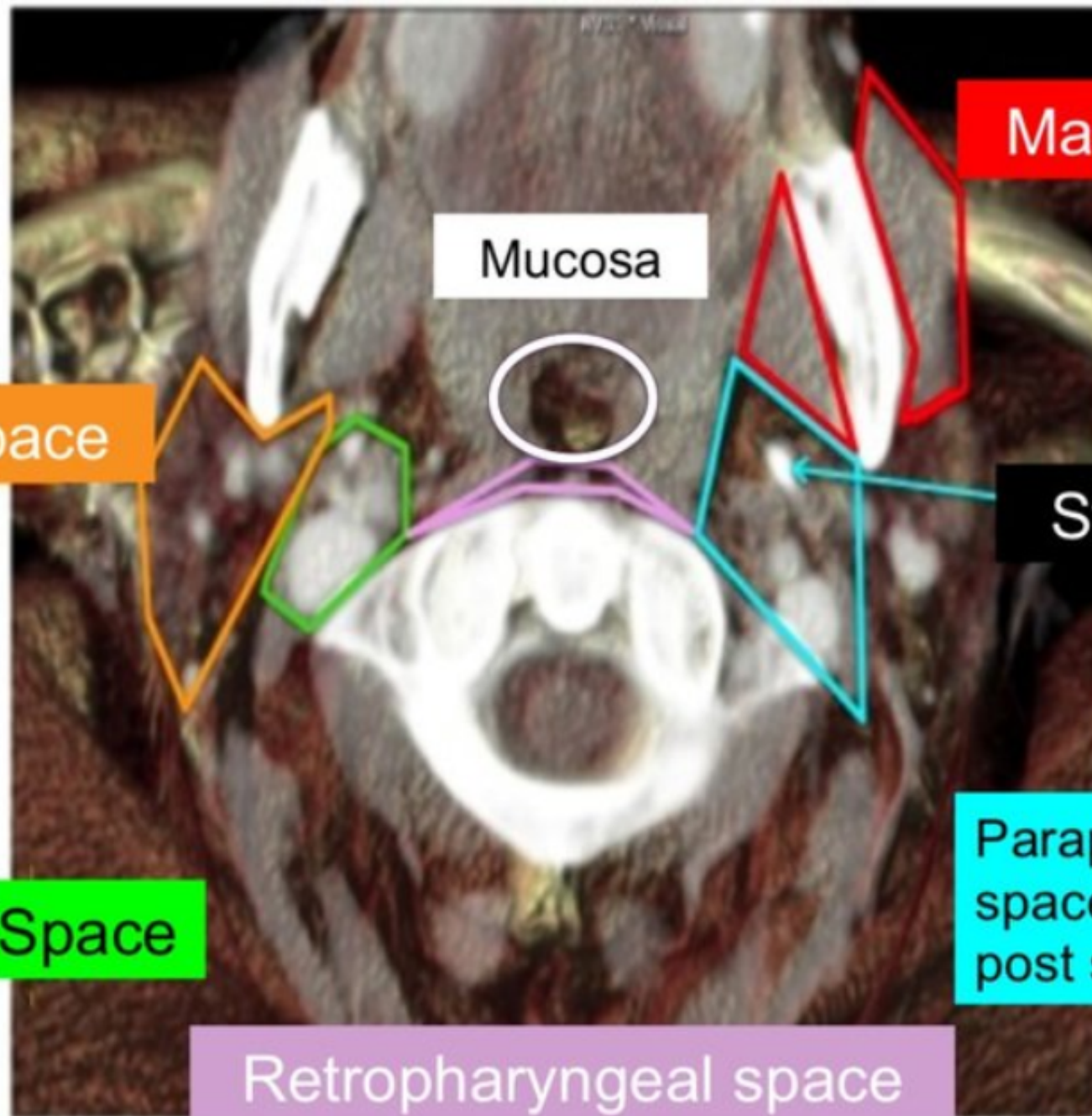
Parotid Space

Styloid process

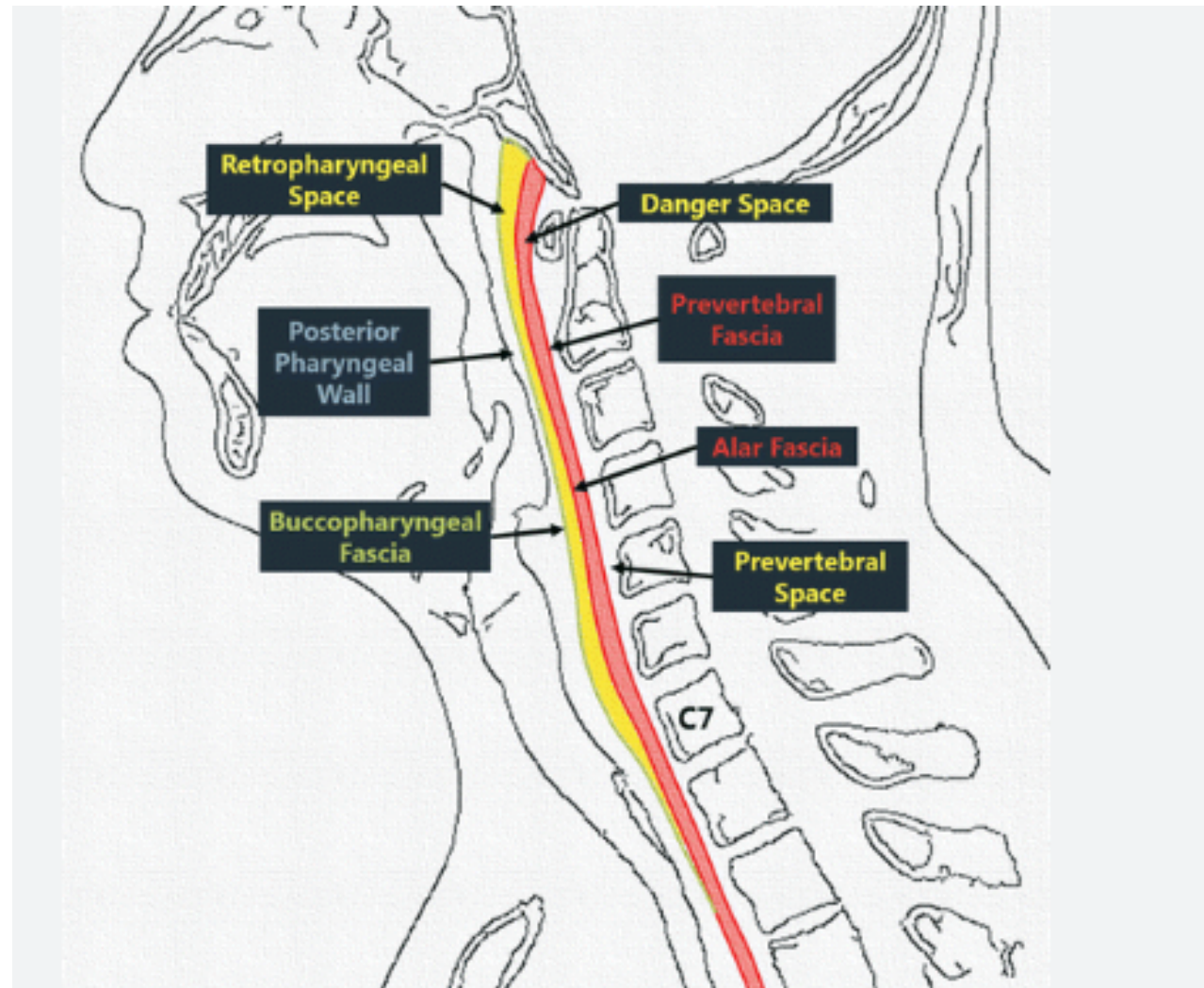
Carotid Space

Parapharyngeal space, pre and post styloid

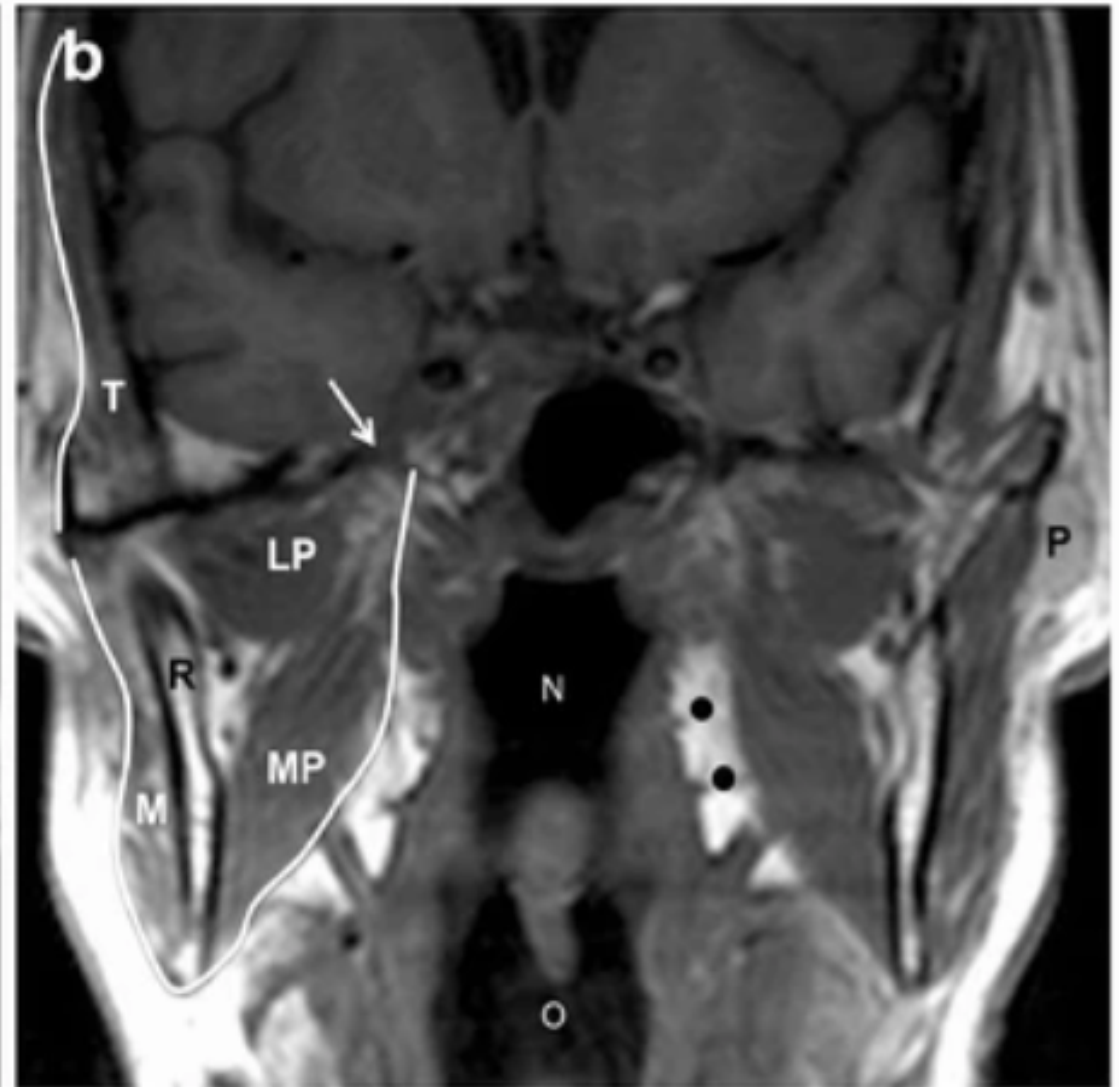
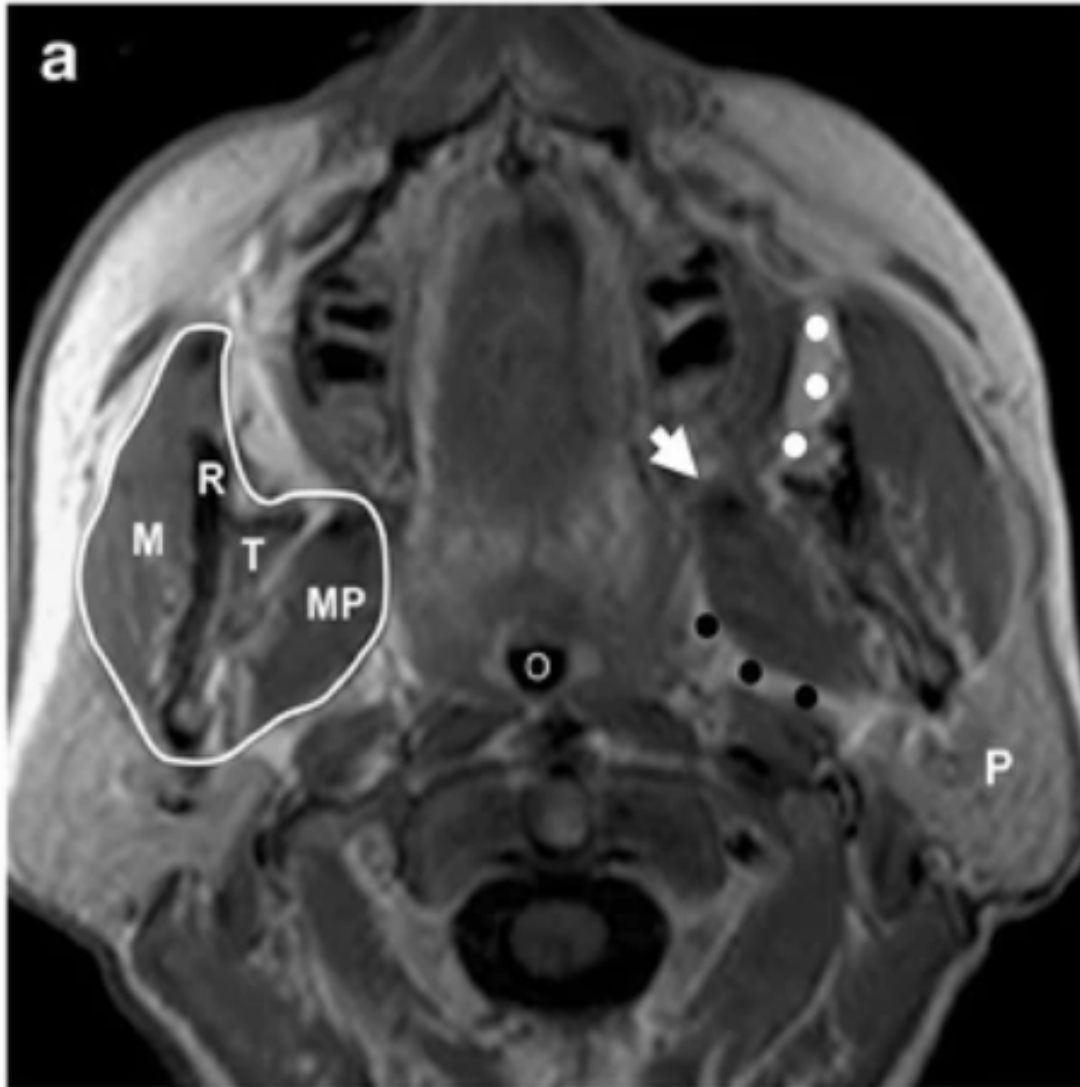
Retropharyngeal space



Retropharyngeal space

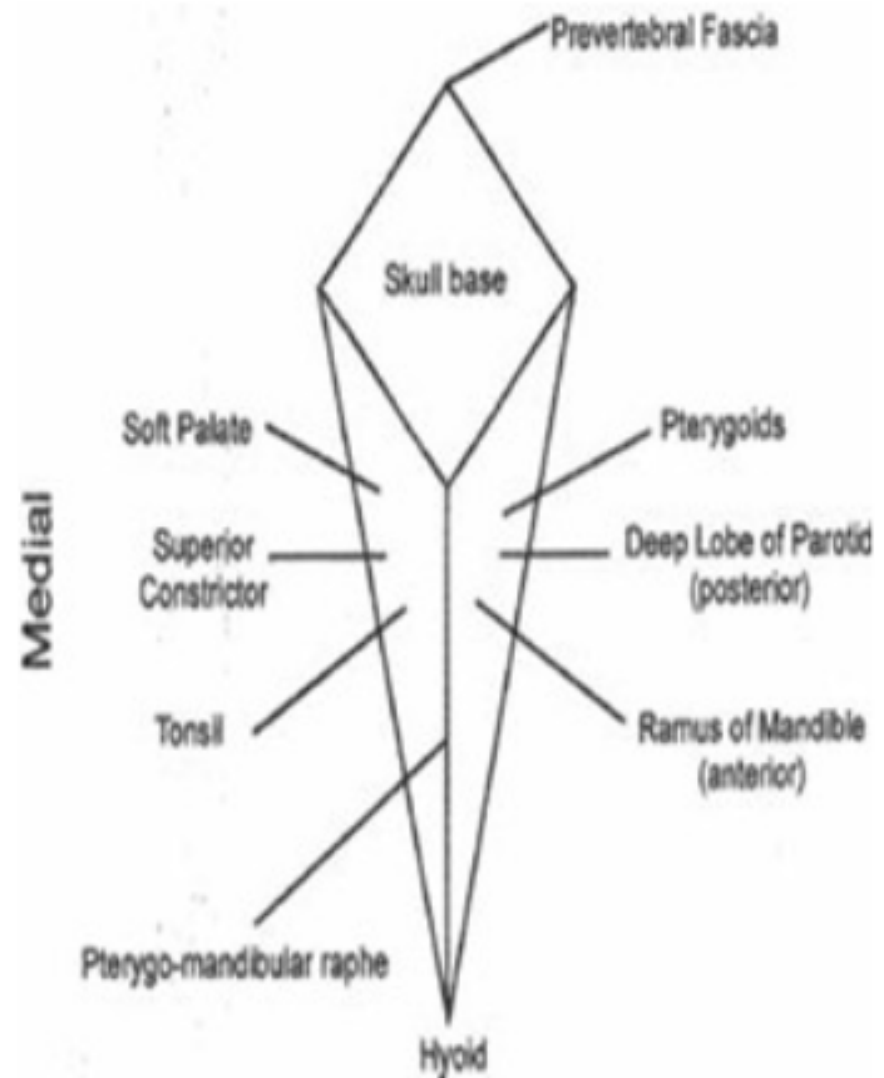


Masticator space



Parapharyngeal Space

- Suprahyoid
- Superior- skull base
- Inferior- hyoid
- Anterior pterygomandibular raphe.
- Posterior- prevertebral fascia
- Medial- buccopharyngeal fascia.
- Lateral- superficial layer of deep fascia.



Indications for radiation

- Post op vs radical radiation
- Depending on tumour stage, histology
- pT3/T4 disease
- Inadequate surgery
- Positive lymph nodes
- Positive margins
- High grade disease
- Perineural invasion (adenoid cystic carcinomas)

Preradiation assessment (as important as preoperative assessment)

- Patient's fitness
- Comorbidities
- EUA, scope findings
- Imaging (CT/ MRI/ PET)
- Intraoperative notes
- Nutrition
- Dentition
- Swallowing assessments
- Side effect management
- Guidelines
- PRACTICE
- Plan reviews
- Following up patients

OAR contouring

Organs at risk with specification of anatomic boundaries. Ant. = anterior, post. = posterior, lat. = lateral, med. = medial, m. = muscle.

Organ at risk	Remarks	Anatomic boundaries					
		Cranial	Caudal	Anterior	Posterior	Lateral	Medial
Parotid gland	Include carotid artery, retromandibular vein and extracranial facial nerve.	External auditory canal, mastoid process	Post. part submandibular space	Masseter m., post. border mandibular bone, med. and lat. pterygoid m.	Ant. belly sternocleidomastoid m., lat. side post. belly of the digastric m. (posterior-medial)	Subcutaneous fat, platysma	Post. belly of the digastric m., styloid process, parapharyngeal space
Submandibular gland		Med. pterygoid m., mylohyoid m.	Fatty tissue	Lat. Surface mylohyoid m., hyoglossus m.	Parapharyngeal space, sternocleidomastoid m.	Med. surface med. pterygoid m., med. surface mandibular bone, platysma	Lat. surface mylohyoid m., hyoglossus m., superior and middle pharyngeal constrictor m., anterior belly of the digastric m.
Extended oral cavity	Posterior to mandible and maxilla, no inner surface of the lips	Hard palate mucosa and mucosal reflections near the maxilla	The base of tongue mucosa and hyoid posteriorly and the mylohyoid m. and ant. belly of the digastric m. anteriorly	Inner surface of the mandible and maxilla	Post. borders of soft palate, uvula, and more inferiorly the base of tongue	Inner surface of the mandible and maxilla	
Lips		Hard palate (lateral), anterior nasal spine (at the midline)	Lower edge teeth sockets, cranial edge mandibular body	Outer surface of the skin	Mandibular body, teeth, tongue, air (if present)	Depressor anguli oris m., buccinator m., levator anguli oris m./risorius m. Buccinator	
Buccal mucosa		Bottom of maxillary sinus	Upper edge teeth sockets	Lips, teeth	Med. pterygoid m.	Buccal fat	Outer surface of the mandible and maxilla, oral cavity/base of tongue/soft palate
Pharyngeal constrictor muscle	Thickness ~3 mm	Caudal tips of pterygoid plates	Caudal edge of arytenoid cartilages	Superior: hamulus of pterygoid plate; mandibula; base of tongue; pharyngeal lumen. Middle: base of tongue; hyoid. Inferior: soft tissue of supraglottic/glottic larynx	Prevertebral muscle	Superior: medial pterygoid muscle. Middle: greater horn of hyoid bone. Inferior: superior horn of thyroid cartilage	
Supraglottic larynx		Tip of epiglottis	Cranial edge of arytenoid cartilages	Hyoid bone, pre-epiglottic space, thyroid cartilage	Inferior PCM, pharyngeal lumen	Thyroid cartilage	Pharyngeal lumen (lumen excluded)
Glottic area		Cranial edge of arytenoid cartilages	Caudal edge of ant. part of thyroid cartilage		Cricoid, anterior border arytenoids		
Cricopharyngeal inlet		Caudal edge of arytenoid cartilages	1 cm caudal to the lower edge of the cricoid cartilage	Tracheal lumen	Vertebral body		
Cervical esophagus		1 cm caudal to the lower edge of the cricoid cartilage	Caudal edge of C7				
Brachial plexus	If the brachial plexus is wrapped around the vascular bundle on the most inferior slices, the vascular structure is included in the contour	Cranial border of C5, vertebral body	Cranial border of T3, vertebral body	Post. border of: anterior scalene m., subclavian artery, axillary vein	Ant. border of: middle scalene m., serratus anterior m., subscapularis m.	Lat. border of: ant. and middle scalene m., pectoralis major, teres major	Inter vertebral foramen (bony vertebral body), lat. border of 1st rib

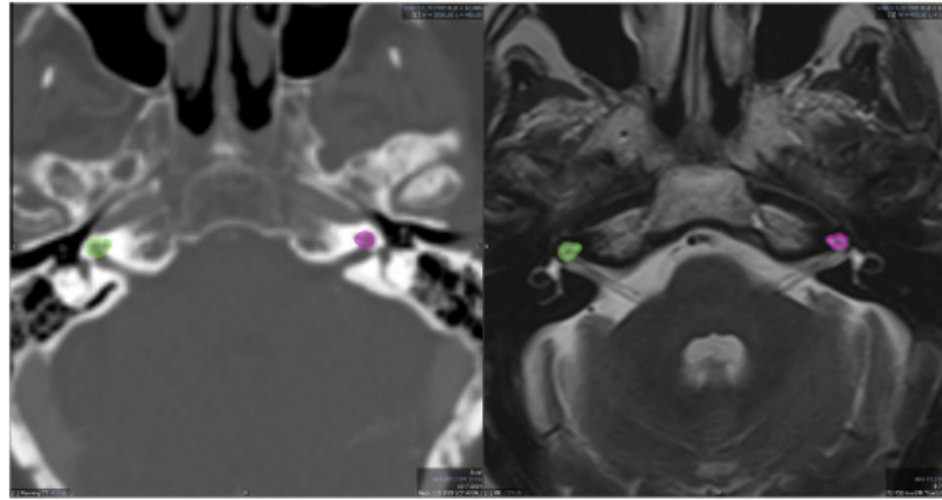


Fig. 2. Delineation of the cochlea in CT bone settings (left), matched to MRI-T2 (right).

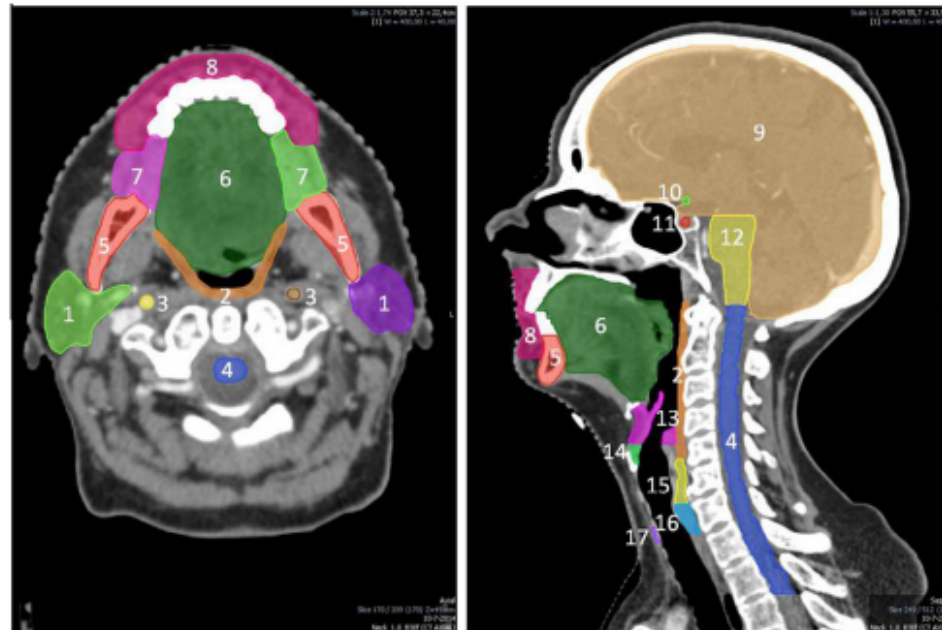


Fig. 3. Axial (left) and sagittal (right) view of the consensus delineations of the parotid glands (1), pharyngeal constrictor muscles (2), carotid arteries (3), spinal cord (4), mandible (5), extended oral cavity (6), buccal mucosa (7), lips (8), brain (9), chiasm (10), pituitary gland (11), brainstem (12), supraglottic larynx (13), glottic area (14), cricopharyngeal inlet (15), cervical esophagus (16) and thyroid (17). (For the full atlas, the reader is referred to the [Supplemental material](#).)

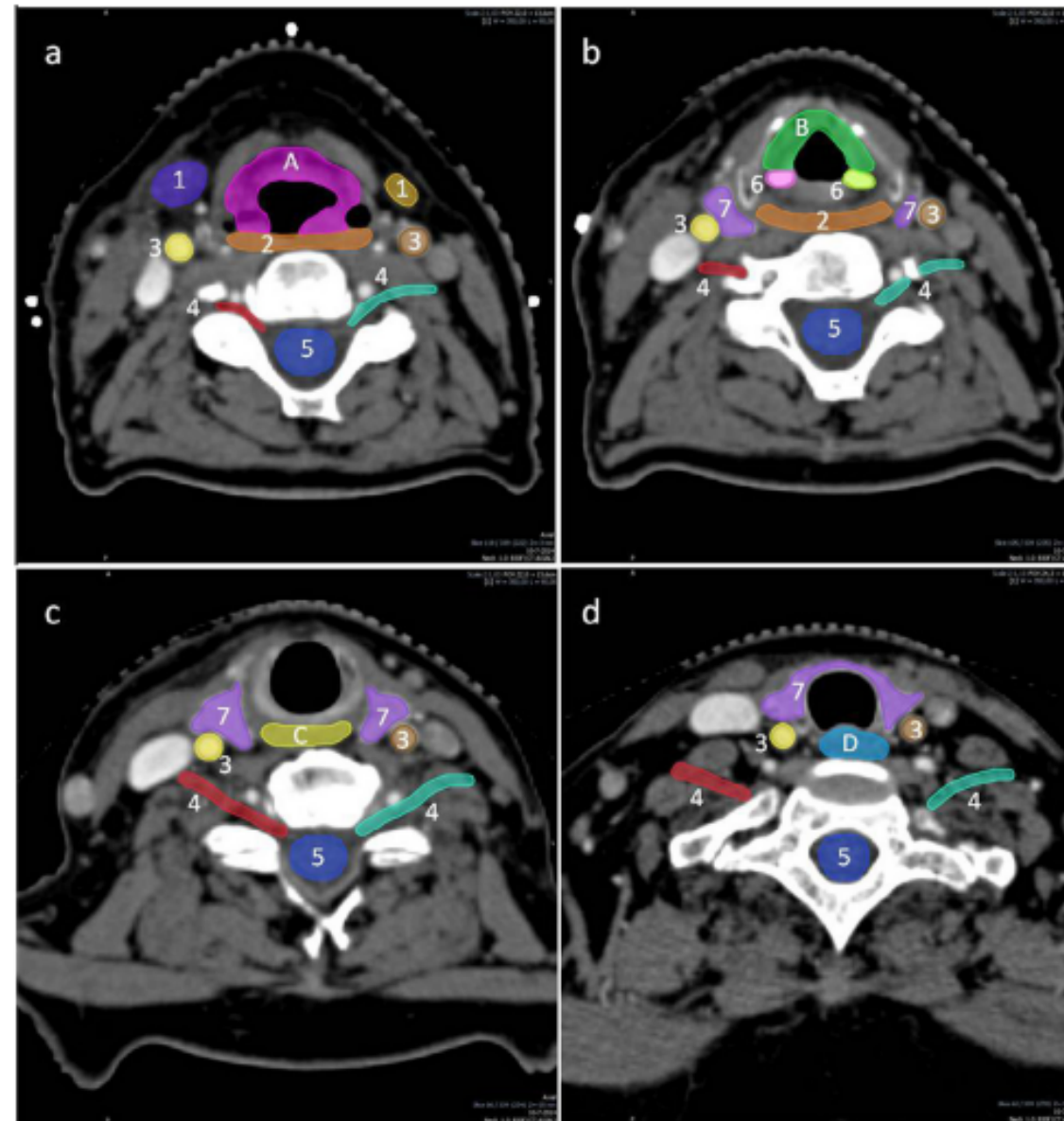
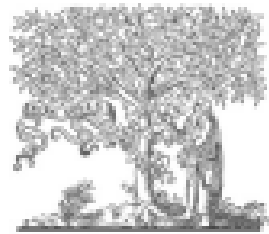


Fig. 4. Axial CT slices showing the delineation of the supraglottic larynx (A) (a), glottic area (B) (b), crico-pharyngeal inlet muscle (C) (c), and cervical esophagus (D) (d). Other organs at risks visible are the submandibular glands (1), pharyngeal constrictor muscles (2), carotid arteries (3), brachial plexus (4), spinal cord (5), arytenoids (6) and thyroid (7). (For the full atlas, the reader is referred to the [Supplemental material](#).)

- Gross Tumour Volume (GTV)
- Clinical Target Volume (CTV)
 - High risk
 - Intermediate risk
 - Low risk (prophylactic)
- Planning Target Volume (PTV)



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Selection of lymph node target volumes for definitive head and neck radiation therapy: a 2019 Update



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Selecting the target lymph node levels

Table 2

Selection of low risk nodal target volumes for p16+ and p16– oropharyngeal cancers.

Nodal Category (AJCC/UICC 8th ed.)	Levels to be included in CTV-N-LR	
	Ipsilateral Neck	Contralateral Neck ¹
N0-1 (in level II, III, or IV)	(Ib) ² , II, III, IVa ³ , +VIIa for posterior pharyngeal wall tumor	II, III, IVa, +VIIa for posterior pharyngeal wall tumor
N2a-b	Ib, II, III, IVa ³ , Va,b, +VIIa, +VIIb ⁴	II, III, IVa, +VIIa for posterior pharyngeal wall tumor
N2c	According to N category on each side of the neck	According to N category on each side of the neck
N3	Ib, II, III, IVa, Va,b, +VIIa, +VIIb ⁴	II, III, IVa, +VIIa for posterior pharyngeal wall tumor

AJCC, American Joint Committee on Cancer; UICC, Union for International Cancer Control; CTV-N-LR, low risk nodal clinical target volume.

¹ Unilateral treatment is recommended for N0-N2a tonsil fossa tumor not infiltrating the soft palate nor the base of tongue; and discussed for N2b patients.

² Any tumor with extension to the oral cavity (e.g., retromolar trigone, mobile tongue, inferior gum, oral side of anterior tonsillar pillar), and/or in case of anterior involvement of level II.

³ Level IVb should be included in case of involvement of level IVa.

⁴ Level VIIb should be included in case of bulky involvement of the upper part of level II.

Selection of low risk nodal target volumes for laryngeal cancers (glottic T1 excluded).

Nodal Category (AJCC/UICC 8th ed.)	Levels to be included in the CTV-N-LR	
	Ipsilateral Neck	Contralateral Neck
N0-1 (in level II, III, or IV)	II ^{1,2} , III, IVa ³ , +VI for transglottic or subglottic extension	II ¹ , III, IVa, +VI for transglottic or subglottic extension
N2a-b	II ^{2,3,4} , III, IVa ³ , Va,b, +VI for transglottic or subglottic extension	II ¹ , III, IVa, +VI for transglottic or subglottic extension
N2c	According to N category on each side of the neck	According to N category on each side of the neck
N3	Ib, II, III, IVa ³ , Va,b, +VIIb ⁴ + VI	II ¹ , III, IVa, +VI for transglottic or subglottic extension

AJCC, American Joint Committee on Cancer; UICC, Union for International Cancer Control; CTV-N-LR, low risk nodal clinical target volume.

¹ Level IIb could be omitted if no cervical lymph nodes involvement on the same side.

² Level Ib should be included in case of anterior involvement of level II.

³ Level IVb should be included in case of involvement of level IVa.

⁴ Level VIIb should be included in case of bulky involvement of the upper part of level II.

Selection of low risk nodal target volumes for hypopharyngeal cancers.

Nodal Category (AJCC/UICC 8th ed.)	Levels to be included in the CTV-N-LR	
	Ipsilateral Neck	Contralateral Neck ¹
N0	II, III, IVa, +VIIa for posterior pharyngeal wall tumor + VI for apex of piriform sinus, postcricoid and/or esophageal extension	II ² , III, IVa, +VIIa for posterior pharyngeal wall tumor + VI for esophageal extension
N1, N2a-b	Ib, II, III, IVa ³ , Va,b, +VIIa + VIIb ⁴ + VI for apex of piriform sinus, postcricoid, esophageal extension, and/or possibly N2b	II ² , III, IVa, +VIIa for posterior pharyngeal wall tumor + VI for esophageal extension
N2c	According to N category on each side of the neck	According to N category on each side of the neck
N3	Ib, II, III, IVa ³ , Va,b, +VIIa + VIIb ⁴ , +VI	II ² , III, IVa, +VIIa for posterior pharyngeal wall tumor + VI for esophageal extension

AJCC, American Joint Committee on Cancer; UICC, Union for International Cancer Control; CTV-N-LR, low risk nodal clinical target volume.

¹ Unilateral neck treatment for small tumor of the lateral wall of the piriform sinus.

² Level IIb could be omitted if no cervical lymph nodes involvement on the same side.

³ Level IVb should be included in case of involvement of level IVa.

⁴ Level VIIb should be included in case of bulky involvement of the upper part of level II.

Nasopharyngeal Carcinoma

- History
 - Headache
 - Double vision/ blurring
 - Ear symptoms
 - Differences in symptoms after chemo?
 - Paresthesia
 - Dentition
- Clinical examination – eye assessment
 - Cranial nerves
 - Swallowing , speech
 - Hearing
 - Neck stiffness

PATTERNs of SPREAD

- **ANT** : nasal cavity
- **POST** : prevertebral muscles, jugular foramen, hypoglossal canal, clivus, careful with the prepontine space
- **SUPERIORLY**: pterygopalatine fossa , foramen rotundum inferior orbital fissure -> orbital apex -> superior orbital fissure
Foramen lacerum -> cavernous sinus -> intracranial extension
- **LATERALLY** : parapharyngeal spaces(directly through pharyngobasillar fascia or indirectly through sinus of Morgagni (fascia's point of weakness) -> infratemporal fossa / perineurally along V3 -> Foramen ovale -> cavernous sinus

Tumour invasion into anatomic sites surrounding the nasopharynx.

Author	Liang et al. [13]	Li et al. [14]
Cohort	2003–2004	2003–2008
No of patients	943	2366
	Percent	Percent
<i>High risk</i>		
Parapharyngeal space	67.7	
Levator veli palatine muscle	65.5	
Prestyloid compartment	64.2	
Tensor veli palatine muscle	57.2	66.4
Poststyloid compartment	50.6	
Nasal cavity	47.8	51.7
Basis of sphenoid bone	44.3	46.7
Pterygoid process	46.3	44.9
Clivus	38.3	39.5
Petrous apex	38.7	39.4
Prevertebral muscle	38.5	37
Foramen lacerum	35.9	34.9
<i>Medium risk</i>		
Foramen ovale	23.2	23.5
Great wing of sphenoid bone	22.3	23.4
Oropharynx	19.8	21.5
Medial pterygoid muscle	19.9	19
Cavernous sinus	17.4	17.9
Pterygopalatine fossa	17.2	17.2
Sphenoidal sinus	17.3	15.8
Hypoglossal canal	10.2	10.8
Lateral pterygoid muscle	10.6	9.3
Foramen rotundum	9.2	
Ethmoid sinus	5.3	5.2
Jugular foramen	5.1	5.1
<i>Low risk</i>		
Orbit		3.9
Inferior orbital fissure	3.7	
Infratemporal fossa	2.9	3.1
Cervical vertebrae	3.3	2.3
Maxillary sinus	2.6	2.2
Cistern	2.1	
Temporal lobe	1.8	
Meninges	1.4	
Orbital apex	1.1	
Superior orbital fissure	0.6	
Hypopharynx	0.5	0.9
Frontal sinus	0.2	0.2

Comparison of published protocols.

	RTOG 0225 [7]	RTOG 0615 [8]	NRG HN001 [15]	PYNEH/HKU [9]	China [16]	AIRO [17]	Current
<i>High dose clinical target volume (CTVp1)</i>							
Margin from GTVp	GTVp + 5 mm	GTVp + 5 mm	GTVp + 3 mm	GTVp + 5 mm + whole NP	GTVp + 5–10 mm + whole NP	GTVp + ≥5 mm (can be 0–1 mm if anatomical barriers are present)	GTVp + 5 mm (±whole NP)
Minimal margin if tumour in close proximity to critical OARs	GTVp + 1 mm	GTVp + 1 mm	GTVp + 0 mm	GTVp + 1–2 mm	Not stated	Not stated	GTVp + 1 mm
<i>High dose clinical target volume (CTVn1)</i>							
Margin from GTVn	GTVn + 5 mm	GTVn + 5 mm	GTVn + 3 mm	GTVn(RP) + 5 mm GTVn (cervical) + 5–10 mm	GTVn(RP) + 5–10 mm GTVn (cervical) + 2–5 mm → PTV directly	Not stated	GTVn + 5 mm (consider 10 mm if ECE)
<i>Intermediate dose clinical target volume (CTVp2)</i>							
Margin from GTV	GTVp + 10 mm + whole NP	GTVp + 10 mm + whole NP	GTVp + 8 mm + whole NP	GTVp + 10 mm	GTVp + 5–10 mm	GTVp + ≥10 mm margin + whole NP (caudal border at soft palate)	GTVp + 10 mm + whole NP
Nasal cavity – Posterior part	1/3	1/3–1/4	1/4	1/3	5 mm from choana	1/3–1/4	At least 5 mm from choana
Maxillary sinuses – Posterior part	1/3	1/3–1/4	1/4	1/3	5 mm from posterior wall	1/3–1/4	At least 5 mm from posterior wall
Posterior ethmoid sinus	Not stated	Not stated	Not stated	Part	Part	Not stated	Include vomer
Skull base	+	Cover foramina ovale & rotundum	Cover foramina ovale & rotundum	Cover foramina ovale & rotundum & petrous tip	Cover foramina ovale & rotundum & lacerum	Cover foramina ovale & rotundum	Cover foramina ovale, rotundum, lacerum & petrous tip
Cavernous sinus	Not stated	If T3–4	If T3–4 (involved side only)	If T3–4	Not stated	If T3–4 or bulky disease involving the roof of NP	If T3–4 (involved side only)
Pterygoid fossae	+	+	+	+	+	+	+
Parapharyngeal spaces	+	+	+	+(to styloid process)	+	+(to styloid process & retrostyloid space)	Full coverage
Sphenoid sinus	Inferior	Inferior if T1–2; whole if T3–4	Inferior if T1–2; whole if T3–4	Inferior 1/2 if T1–2; whole if T3–4	Sphenoid floor	Inferior half; whole if T4	Inferior 1/2 if T1–2; whole if T3–4
Clivus	+	1/2–2/3 if no invasion; whole if invasion	1/3 if no invasion; whole if invasion	1/2 if no invasion; whole if invasion	1/3 (+ anterior 1/3 of vertebral body)	1/3 if no invasion; whole if invasion	1/3 if no invasion; whole if invasion
Minimal margin if tumour in close proximity to critical OARs	Not stated	Not stated	GTVp + 1 mm	GTVp + 2–3 mm	2 mm	Not stated	GTVp + 2 mm
<i>Intermediate dose clinical target volume (CTVn2)</i>							
Margin from GTVn	Not stated	GTVn + 10 mm	GTVn + 8 mm	GTVn (dubious) + 5 mm GTVn (gross) + 10–15 mm	GTVn (RP) + 5–10 mm	Not stated	CTVn1 + 5 mm
Lymph nodes – bilateral RP, level II, III & Va	+	+	+	+ plus at least ipsilateral one level below the involved levels	+	+	+, level VIIIb plus at least ipsilateral one level below the involved levels
Level Ib	Not stated	Not stated	Optional if T1/2N0	<ul style="list-style-type: none"> • Ib LN +ve • Submandibular gland • Bulky level II LN (>2 cm) • ECE • Structures that drain 	<ul style="list-style-type: none"> • Ib LN +ve • Ila LN >3 cm • ipsilateral >4 levels involved • invasion to >1/3 nasal cavity/soft palate/alveolar 	Include in case of neck node positivity	<ul style="list-style-type: none"> • Ib LN +ve • Submandibular gland • Level II LN with ECE • Structures that drain to level Ib as 1st echelon site • Otherwise Ib can be omitted

Table 2 (continued)

	RTOG 0225 [7]	RTOG 0615 [8]	NRG HN001 [15]	PYNEH/HKU [9]	China [16]	AIRO [17]	Current
<i>Low dose clinical target volume (CTVn3)</i>							
Levels IV & Vb down to clavicle	+	+	+	+ if cervical LN involved/suspicious Omit if N0 or N1 based solely on RPLN involvement	+ if upper LN involved/suspicious Omit if N0	If level III is involved	+ if cervical LN involved/suspicious Omit if N0 or N1 based solely on RPLN involvement Note difference between 2013 LN consensus guidelines and 8th edition AJCC/UICC
<i>Planning target volume (PTV)</i>							
Margin from CTV	5 mm (reduce to 1 mm if CTV adjacent to BS)	5 mm (reduce to 1 mm if CTV adjacent to BS)	5 mm (3 mm if IGRT) (reduce to 0 mm if CTV adjacent to BS, SC)	All IGRT 3 mm – above caudal border of C1 5 mm – below caudal border of C1	2–5 mm	5 mm (3 mm if IGRT)	Not stated

Abbreviations: BS, brainstem; CTV, clinical target volume; ECE, extracapsular extension; GTV, gross target volume; IGRT, image-guided radiotherapy; LN, lymph node; NP, nasopharynx; PTV, planning target volume; RP, retropharyngeal; SC, spinal cord.

Plan evaluation

- Dose homogeneity
- Dose conformity
- Hot spots
- Entrance and exit doses
- OAR doses
- DVH

JABATAN RADIOTERAPI & ONKOLOGI
HOSPITAL KUALA LUMPUR

IMRT/VMAT HEAD & NECK DOSE SUMMARY

General Information			
Patient Name	:		IC Number :
Oncologist	:		RT Number :

DIAGNOSIS :

TREATMENT SITE :

PLAN TECHNIQUE :

PRESCRIPTION DOSE : PLAN HOTSPOT:

TARGET PLANNING	AIM	PLANNING	REMARKS
PTV 1 (Gy)	D _{95%}		
	D _{95% ≥ 95 -100}		
	D _{50% ≥ 100}		
	D _{2% <107}		
PTV 2 (Gy)	D _{95%}		
	D _{95% ≥ 95 -100}		
	D _{50% ≥ 100}		
	D _{2% <107}		
PTV 3 (Gy)	D _{95%}		
	D _{95% ≥ 95 -100}		
	D _{50% ≥ 100}		
	D _{2% <107}		

OAR	GUIDELINE	PLANNING	REMARKS
Chiasm PRV	D _{max} <60Gy		
Chiasm	D _{max} <54Gy		
BS PRV (3mm)	D _{max} <60Gy		
BS	D _{max} <54Gy		
SC PRV (5mm)	D _{max} <50Gy		
SC	D _{max} <45Gy		
ON LT PRV (3mm)	D _{max} <60Gy		
ON LT	D _{max} <54Gy		
ON RT PRV (3mm)	D _{max} <60Gy		
ON RT	D _{max} <54Gy		
Lens LT	D _{max} <10Gy		
Lens RT	D _{max} <10Gy		
Temporal Lobe	D _{0.03cm³} ≤ 65 Gy		

OAR	GUIDELINE	PLANNING	REMARKS
Eye LT	D _{max} <45Gy		
Eye RT	D _{max} <45Gy		
Cochlea LT	D _{mean} <45Gy		
Cochlea RT	D _{mean} <45Gy		
Parotid LT	D _{mean} <26 Gy		As low as possible
Parotid RT	D _{mean} <26 Gy		As low as possible
Oral Cavity	D _{mean} <40Gy		
Oesophagus	D _{mean} <34Gy		
Thyroid	V ₃₀ <62.5%		
Larynx	D _{mean} <44Gy		
Brachial Plexus*	D _{max} <60-66Gy		
Mandible & TMJ	D _{2%} < 70Gy		
Glottic larynx	Mean ≤ 35 Gy		

References: 1) QUANTEC

2) RTOG 1008*for Brachial Plexus: Dmax < 60Gy if no involved low neck nodes, Dmax < 66Gy if low neck nodes involved

Long term toxicities

- Xerostomia
- Hypopituitarism
- Neck , jaw stiffness
- Swallowing dysfunction
- Skin changes

THANK YOU