Target volume delineation – primary head and neck sites

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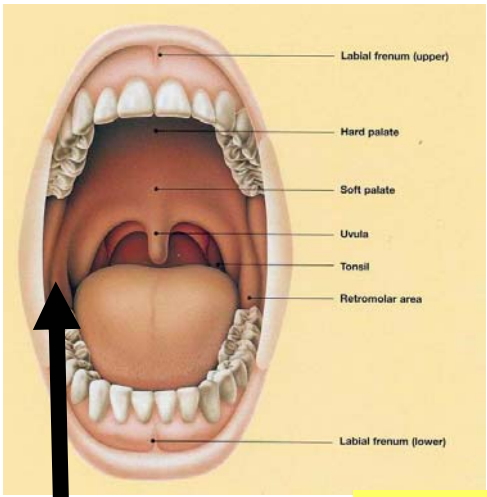
Road Map of each site

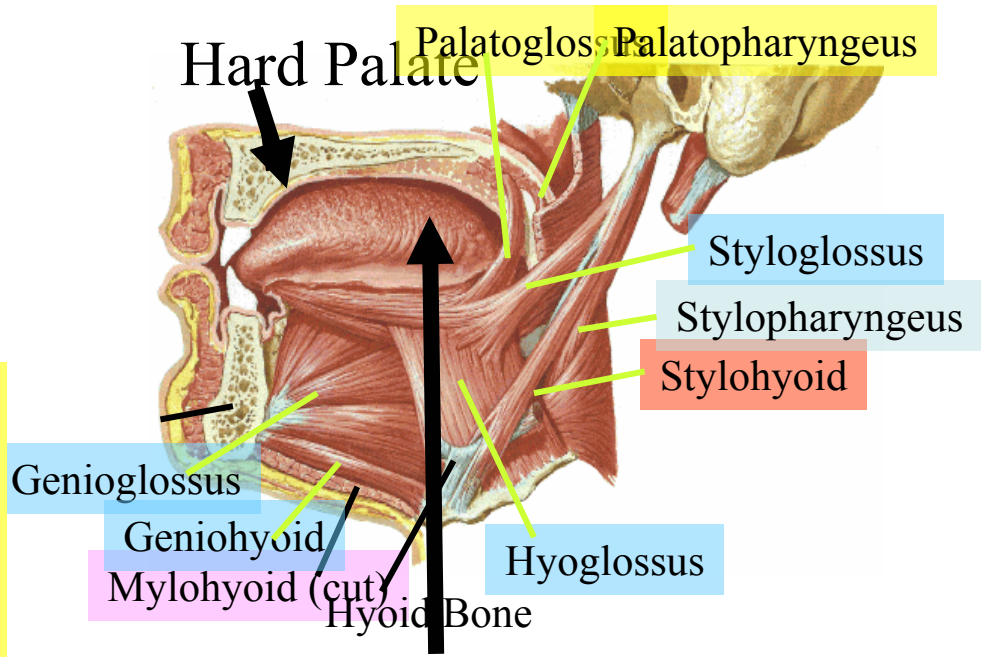
- Anatomy – different subsites
- Disease visualization on CECT scan
- Target delineation – primary GTV, CTV, PTV
- Nodal delineation with each primary site

Oral cavity – subsites



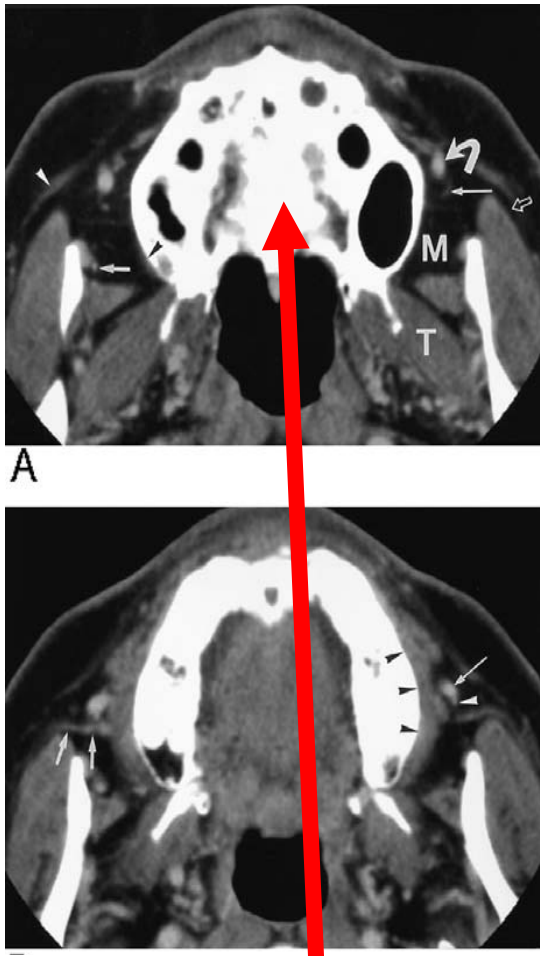
Buccal Mucosa

- Lip
- Buccal mucosa
- Anterior tongue
- Floor of mouth
- Alveolus
- Hard palate
- RMT

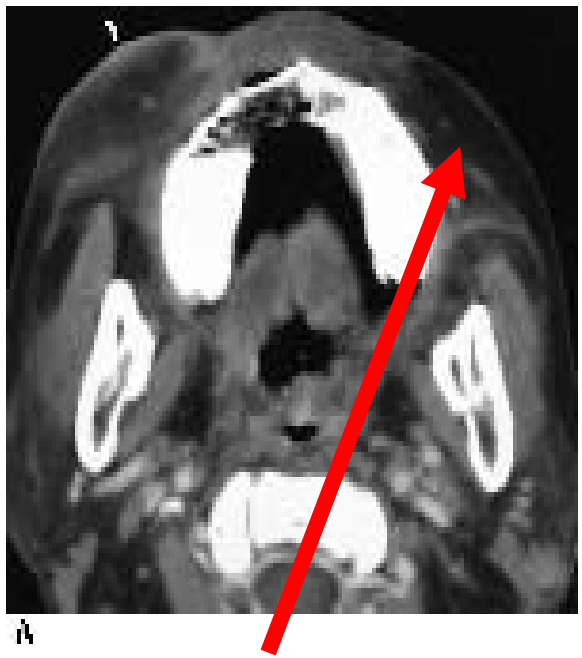


Anterior Tongue

Normal Oral Radiological Anatomy



Hard palate



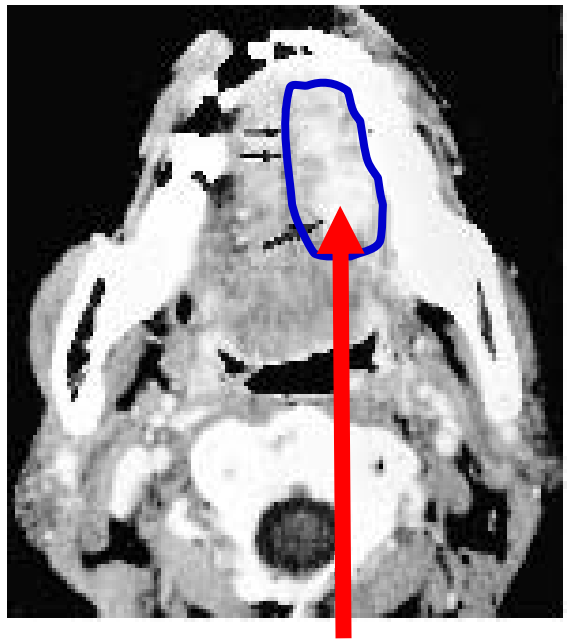
Cheek

Tongue

Imaging – CECT axial scans;
MRI complimentary, better soft tissue resolution

Oral lesions- Gross Target

GTV- clinical



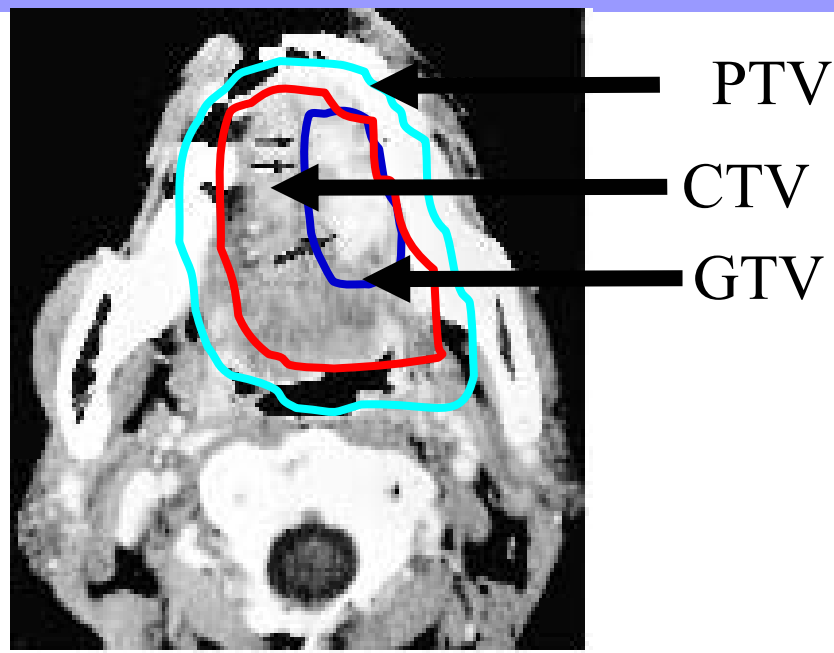
GTV- radiological

Gross Target volume – Gross palpable or radiological disease

We now need to expand and draw the CTV!

Primary oral target delineation

Primary CTV = Original GTV + 1.5 cm margin depending upon anatomical barriers



Anatomical barrier may be edited from CTV
Bone
Air

CTV & PTV expansion in CC, AP, ML directions

CTV to PTV expansion – 3-5mm. No editing

In general, CTV is an anatomy-clinical concept

- Tumor site
- Size/ stage
- Differentiation
- Morphology

Therapeutic CTV -T: high risk
Prophylactic CTV-P: Low risk

How site determines the oral CTV-T ?

	FOM Muscles	Gland	bone	tongue	Tonsil	Misc
FOM	Geniogl, geniohyoid b/l	S/mandi, s/l I/L	Part of mandible (if +ve)	partly	-	-
Tongue	Adj. FOM	-	-	Ant & BOT	GT sulcus; ATP	
BM	-	S/mandi I/L	-	-	-	GBS (CC); ITF; lip;RMT

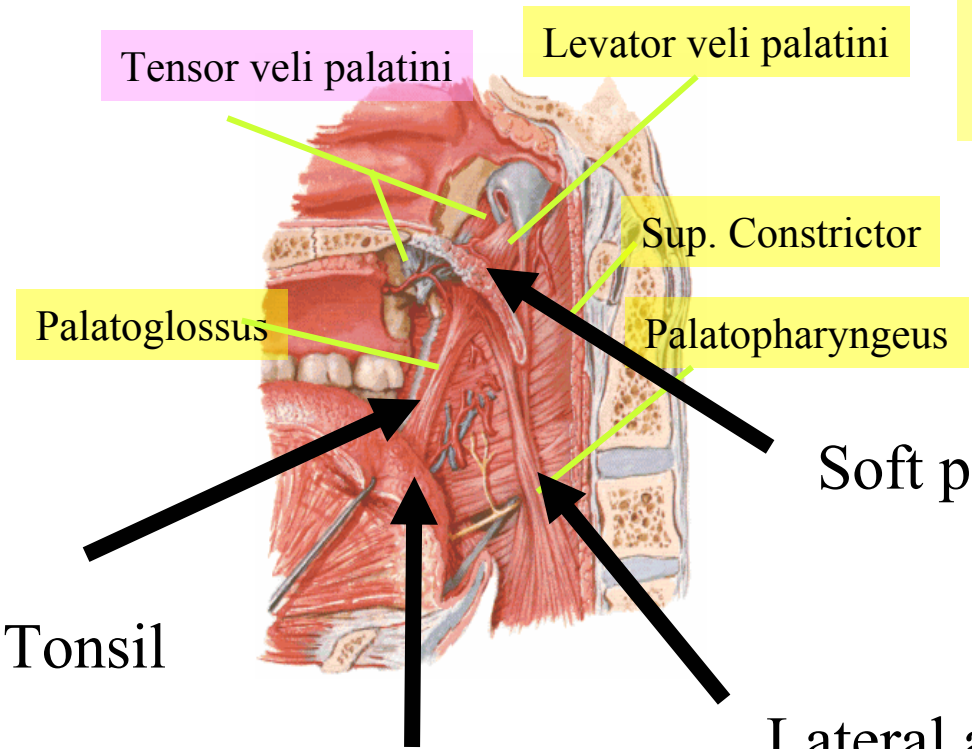
Eisbruch et al, 2002. vol12(3);238-249

Prophylactic CTV delineation of LN oral cancers

- Ipsilateral level I-III suffice in a lateralized N0 lesion eg. Buccal mucosa
- Midline crossing tumors – include both sides I-III
- Anterior tongue lesions- include level IV
- Level II LN + - include ipsilateral level V also
- Bilateral LN –Treat each site according to N stage
- Hard fixed LN –may need to include the adjacent area

Oropharynx - subsites

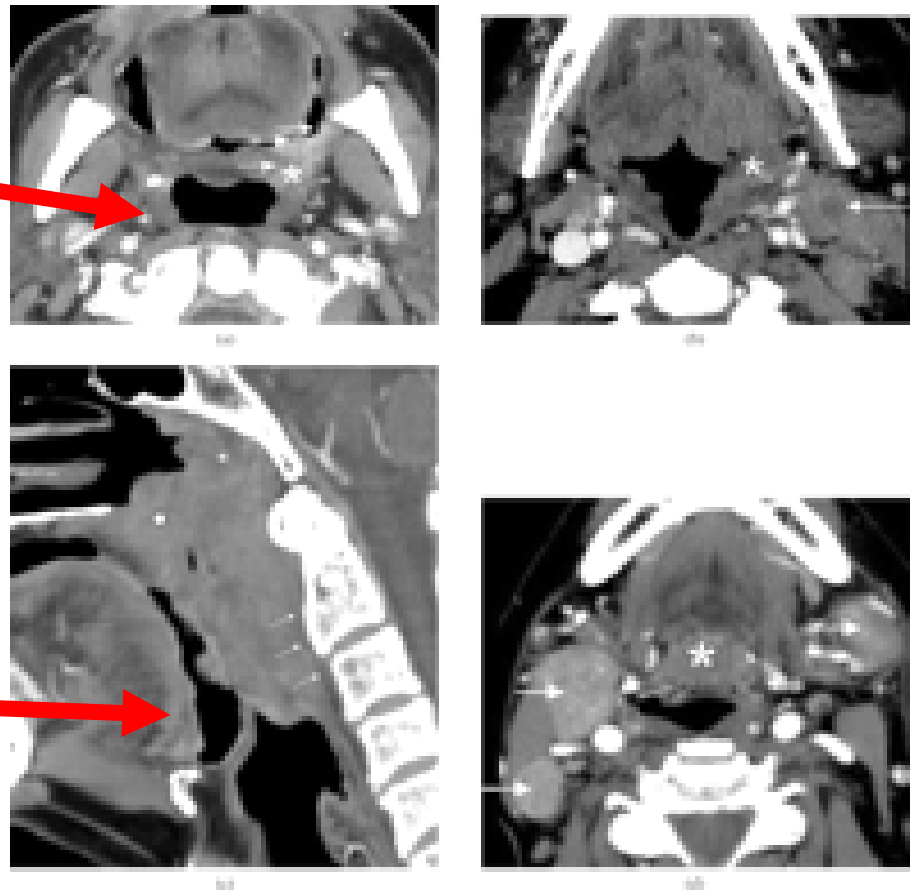
- Base tongue
- Tonsil
- Soft palate
- Lateral Pharyngeal wall



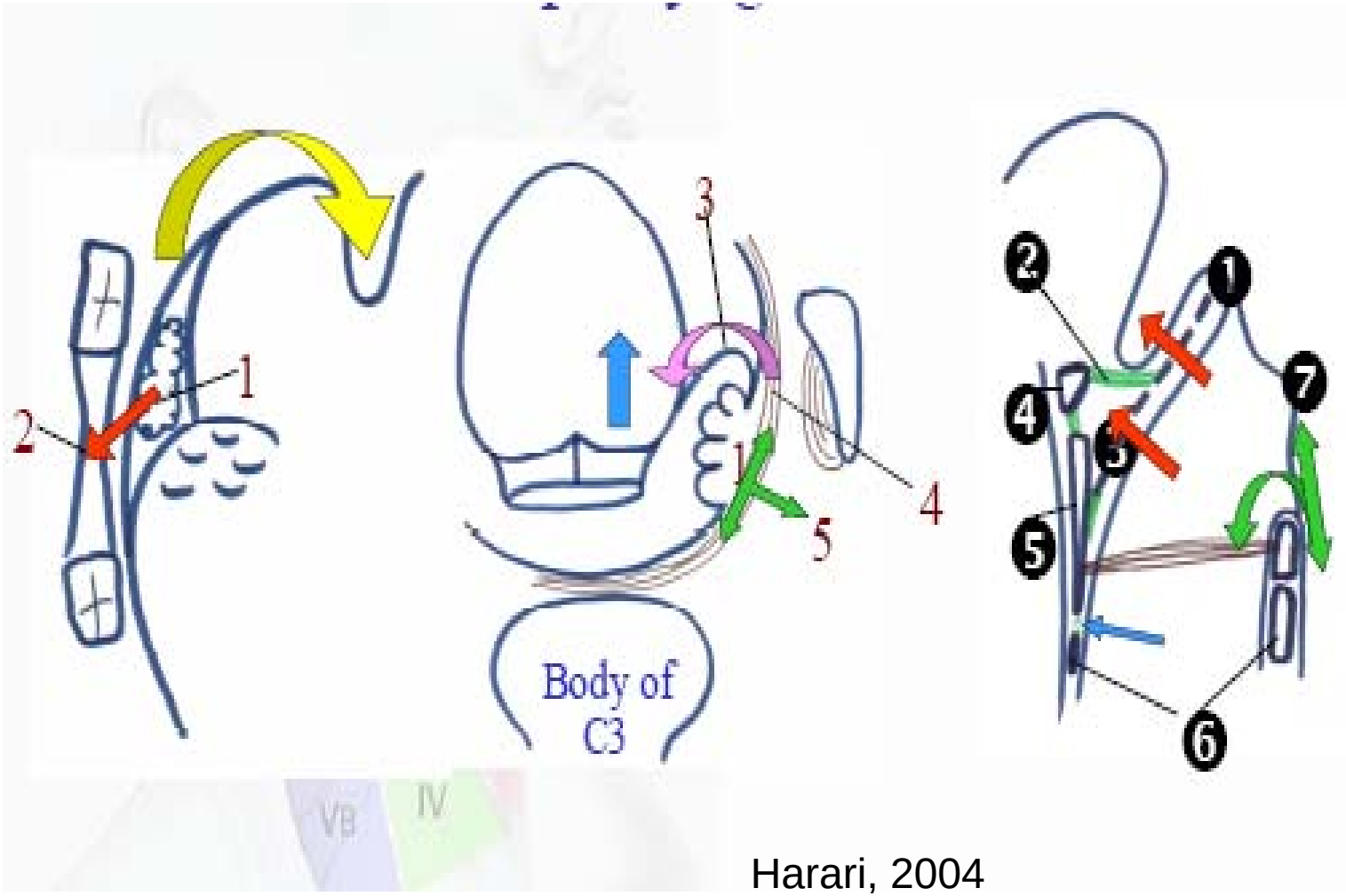
Oropharynx – Normal Radiological anatomy

Tonsil

Base Tongue



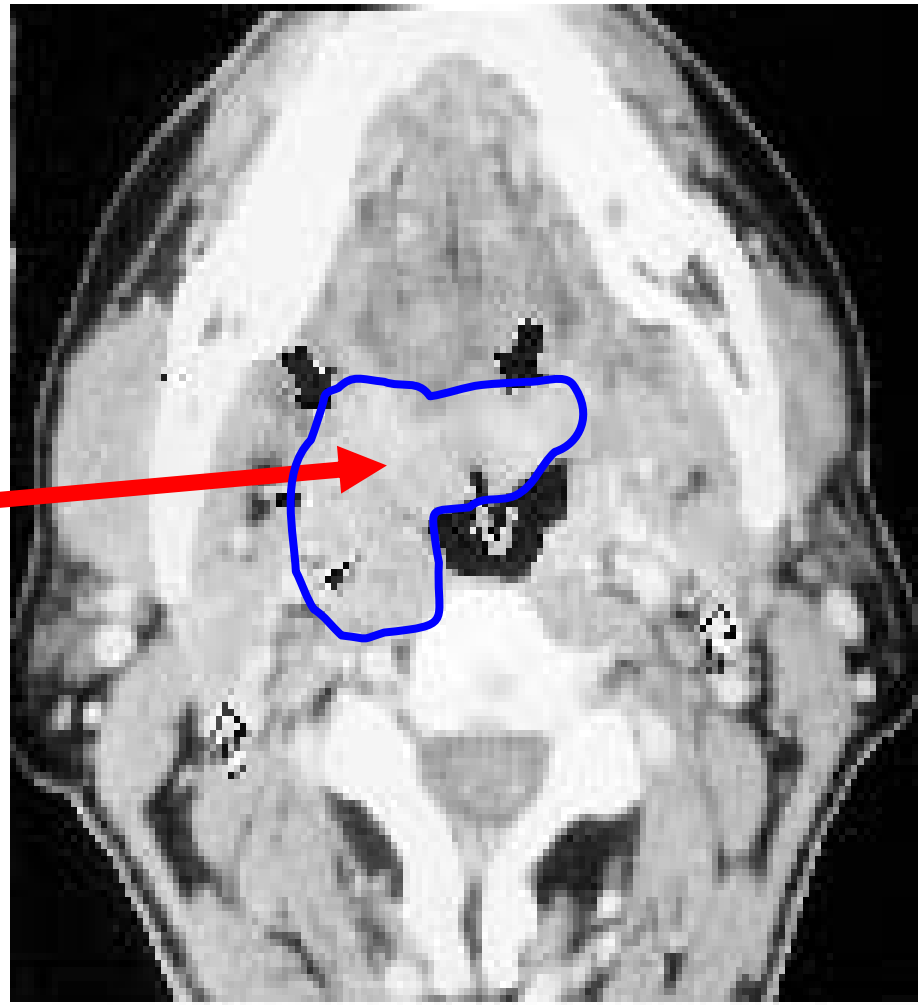
How does the tumor spread (CTV-T) in oropharynx?



Harari, 2004

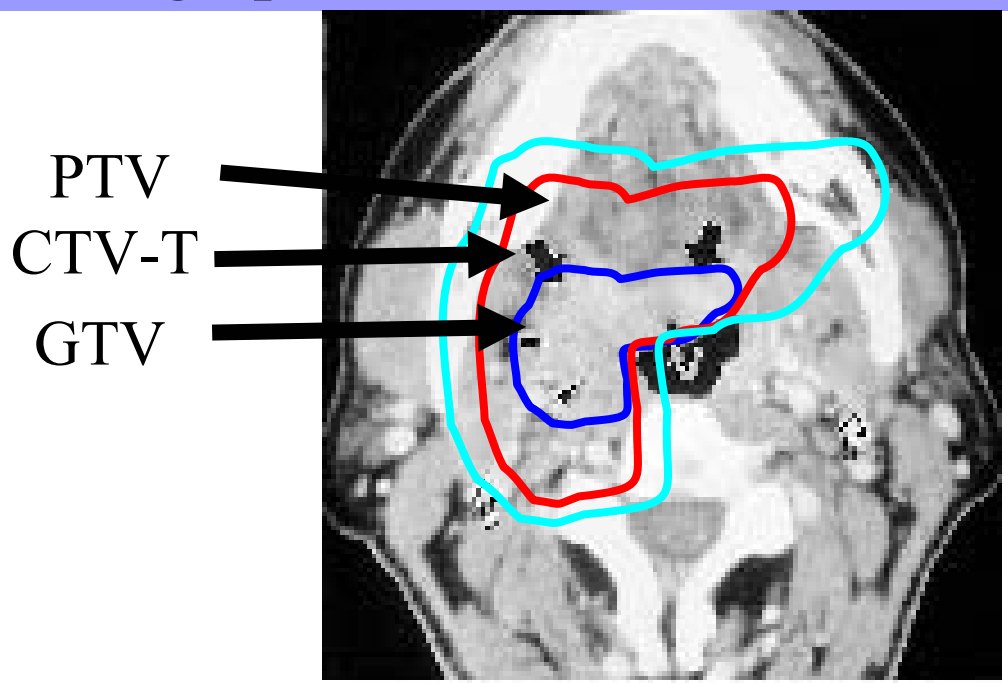
Oropharyngeal GTV on CT scan

Ca. Base tongue



Primary oropharyngeal target delineation

Primary CTV = Original GTV + adequate margin depending upon anatomical barriers



CTV to include
Ant tongue
TL sulcus
Tonsil
LPW
PES (if invaded)
Gregoire et al. Rays: 28(3);217-224,2003

CTV & PTV expansion in CC, AP, ML directions

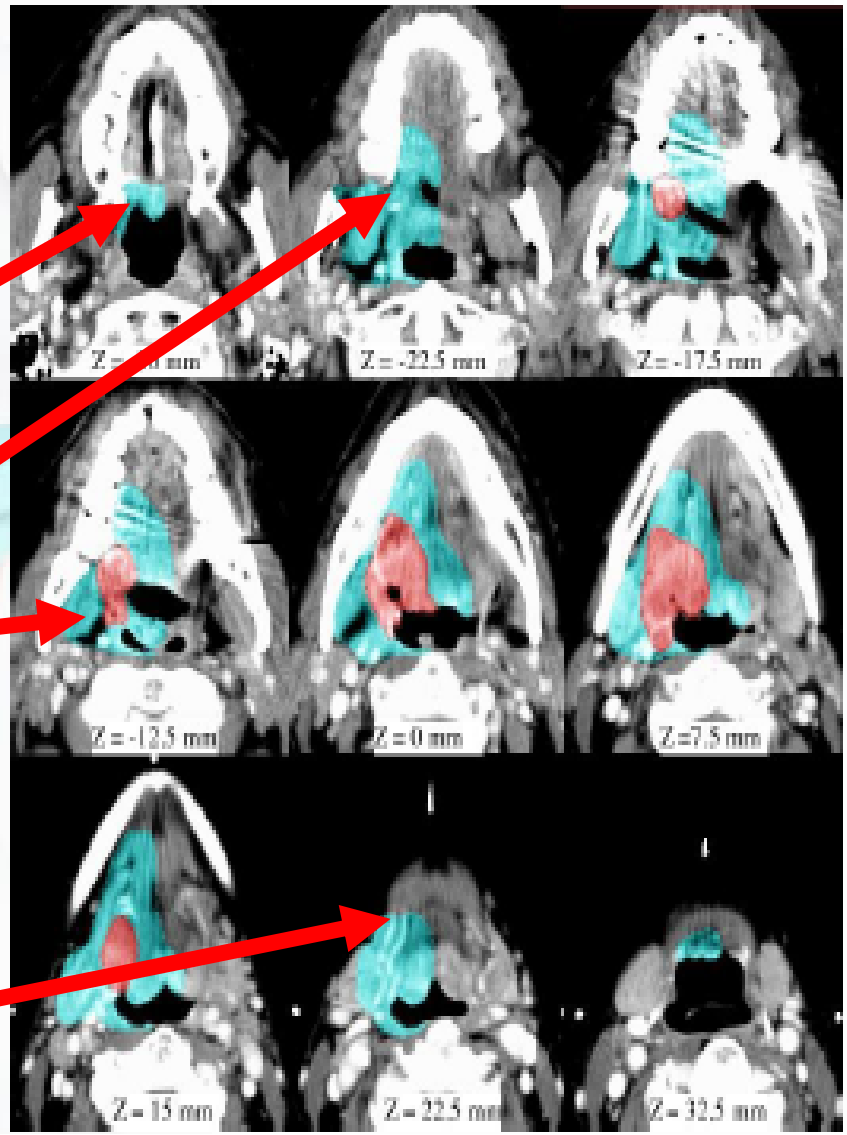
CTV to PTV expansion –3-5mm. No editing

An example

Tonsillar fossae

T4-N1-M0

- soft palate
- retro-molar trigone
- parapharyngeal space
- glosso-tonsillar sulcus
- BOT
- sub-mandibular gland
- post-floor of mouth



Dasine, 2004

How site determines the orophx CTV-T?

	Palate	BOT	Tonsil	Bone	Muscles	Misc
Tonsil	Soft palate	Part/full	total	Adv cases	Pterygoid I/l	Adj. BM; PPS
BOT	-	√ & lot of oral tongue	TLS	-	-	S/h epiglottis (inf growth)
SP	SP	-	Superior part	-	Pterygoid in adv cases	Pterygopalate fossa
PPW	-	-	-	-	-	Entire mucosa; PPS

Eisbruch et al, 2002. vol12(3);238-249

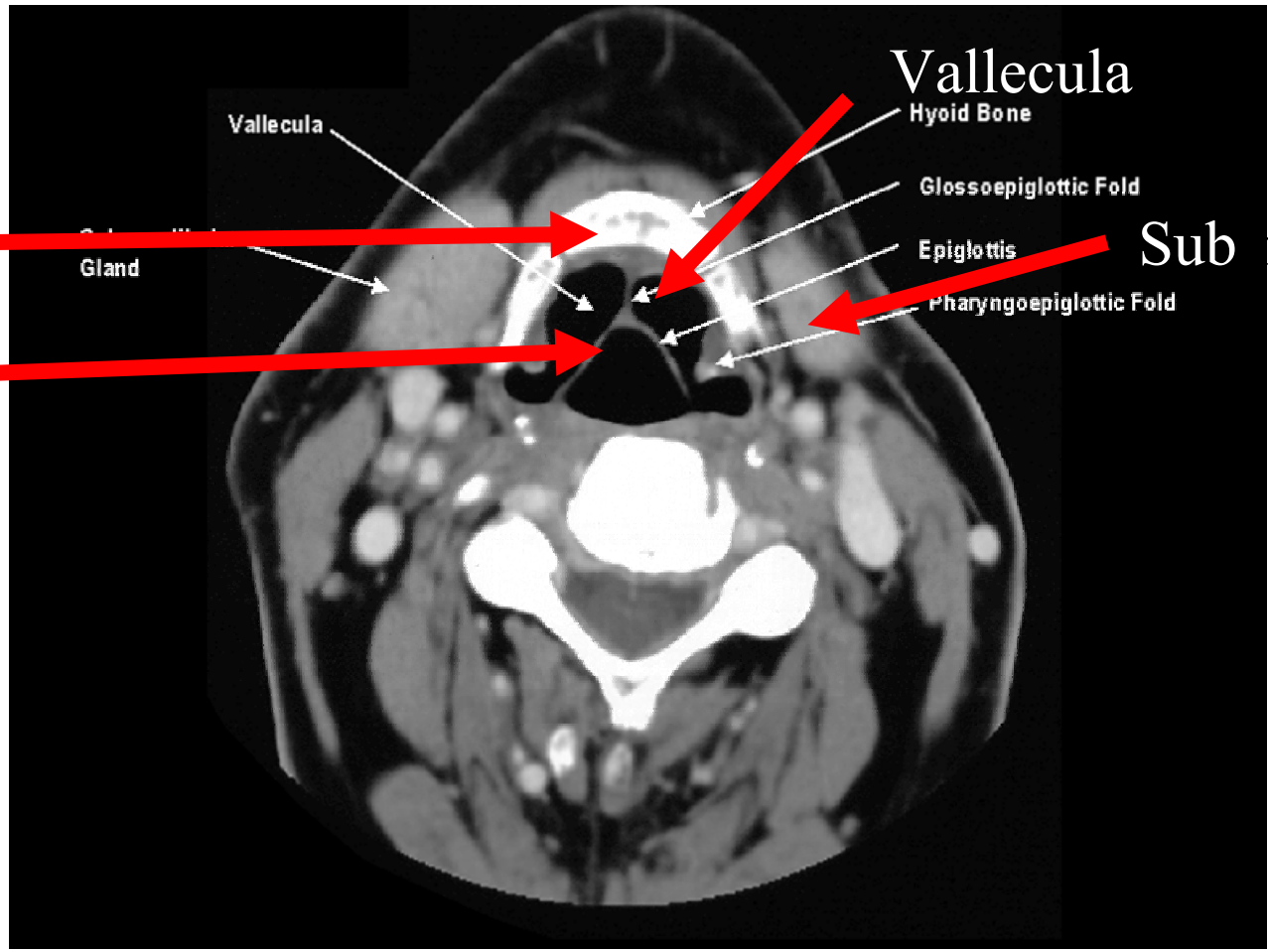
Prophylactic CTV delineation of LN – oropharyngeal lesions

- Bilateral neck to be include Ib to IV(ipsilateral) and II-IV (contralateral)
- Include Retropharyngeal LN in LN + and Postpharyngeal wall tumors.
- Level II LN + - include ipsilateral level V also
- Bilateral LN –Treat each site according to N stage
- Hard fixed LN –may need to include the adjacent area

Larynx and Hypopharynx

Site	Subsite	Structure
Larynx	Supraglottis	Epiglottis
		A E Fold
		Arytenoid
		False cord
	Glottis	True cord
	Subglottis	
Hypopharynx		Pyriform Sinus
		Postcricoid
		Post Phx wall

Normal radiological anatomy – Larynx and hypopharynx region

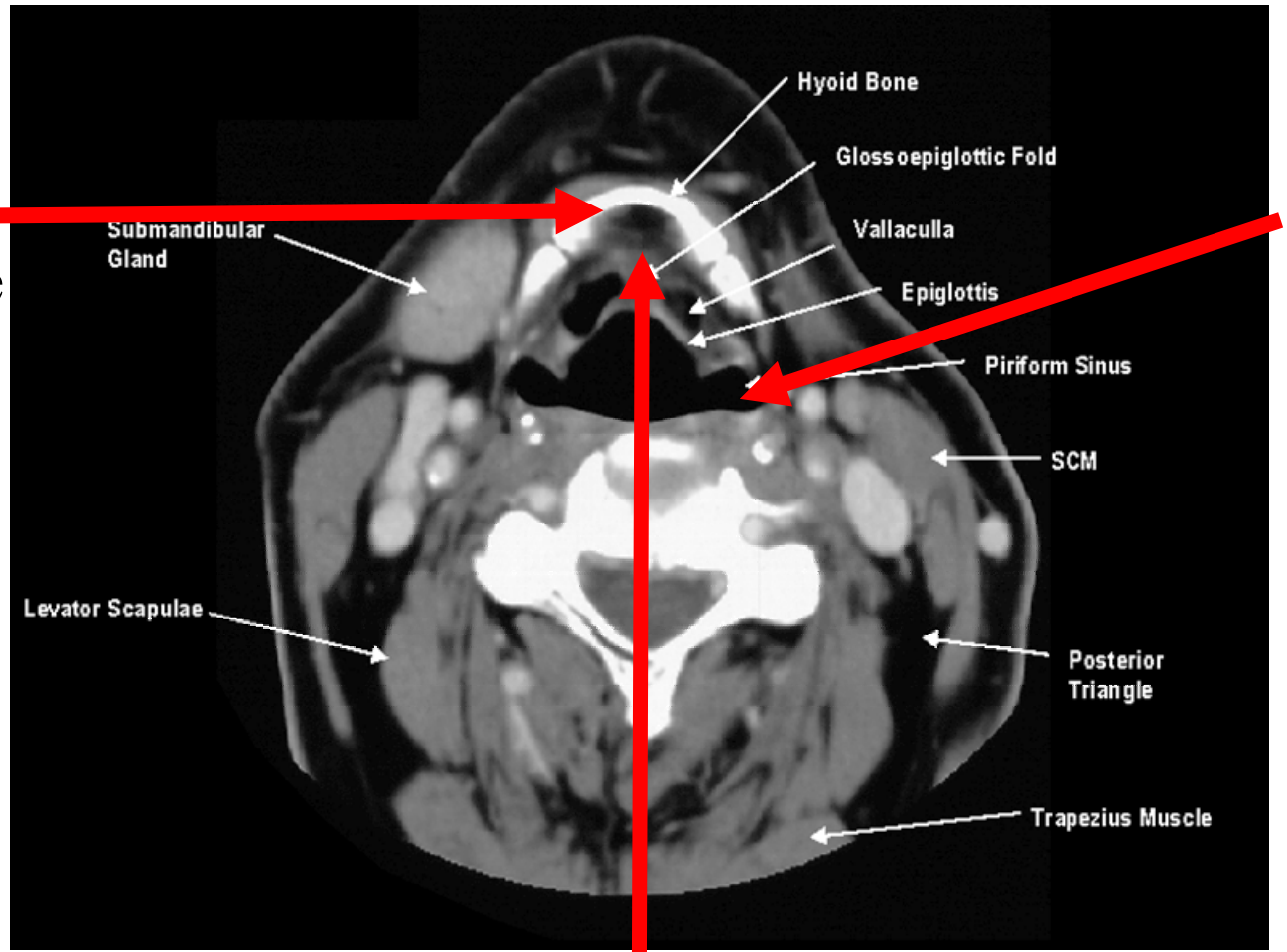


Hyoid

Epiglottis

Sub mandibular

Normal radiological anatomy – Larynx and hypopharynx region

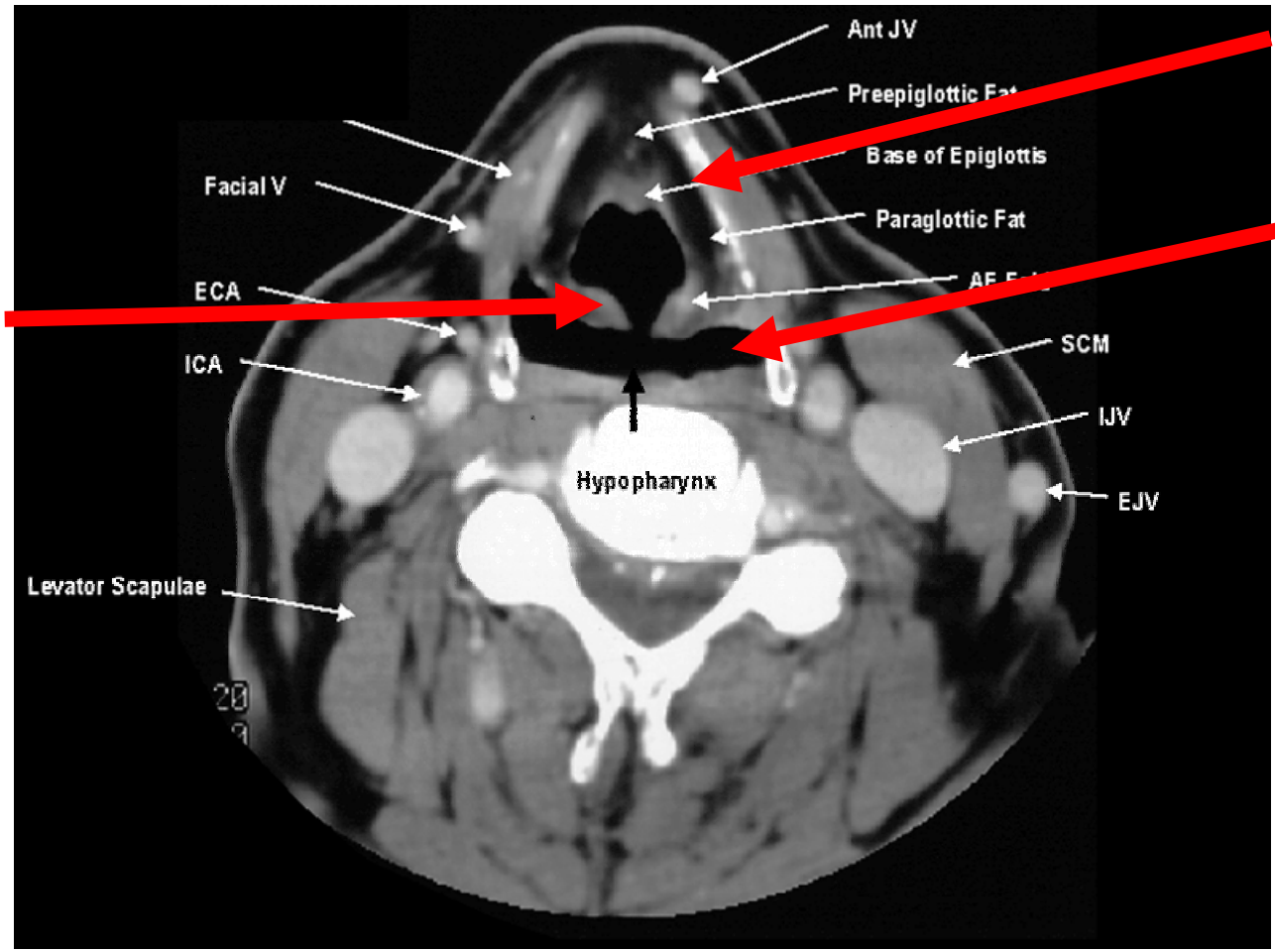


Hyoid bone

Pyriform sinus

Pre-epiglottic space

Normal radiological anatomy – Larynx and hypopharynx region

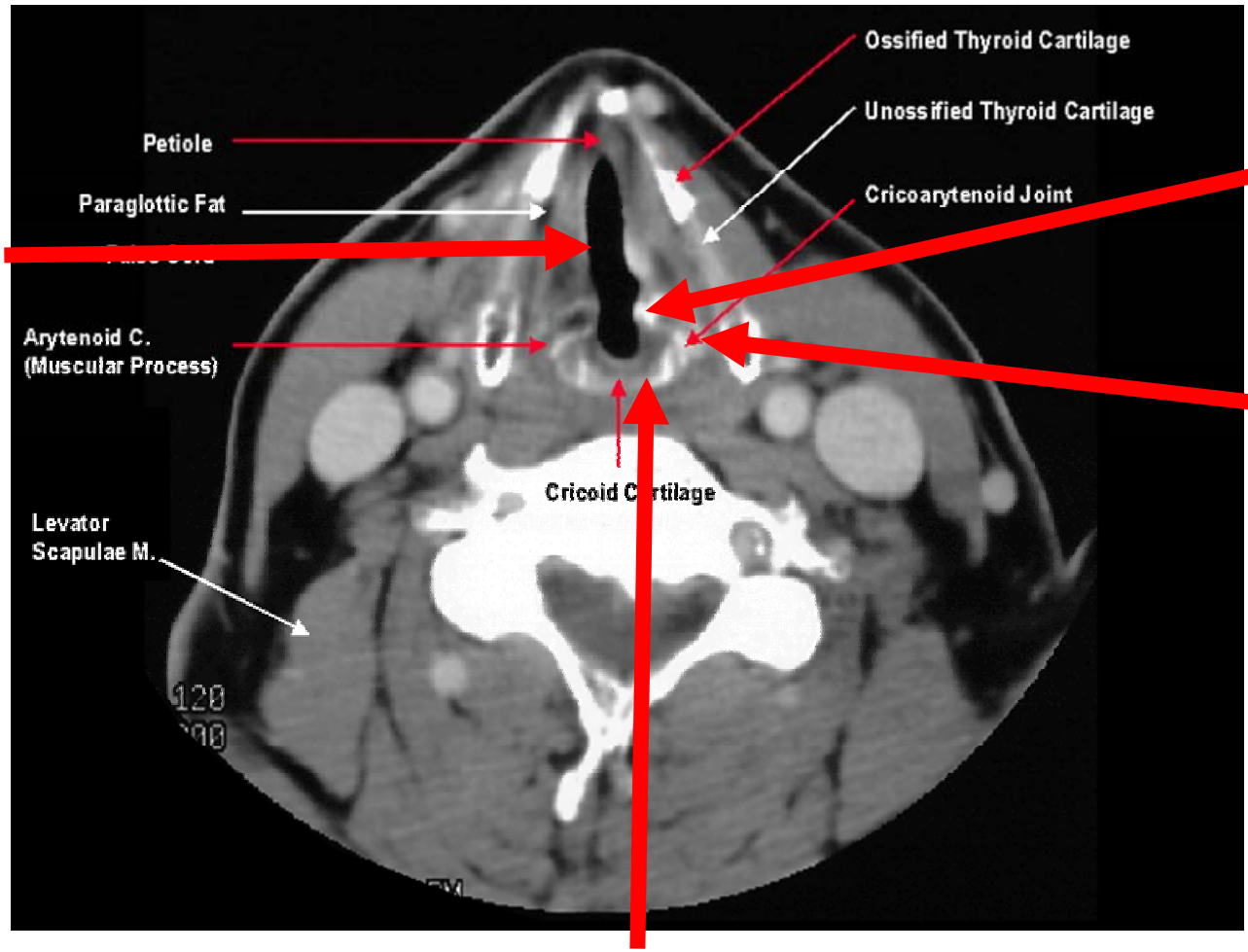


Thyroid cartilage

PFS

AE fold

Normal radiological anatomy – Larynx and hypopharynx region



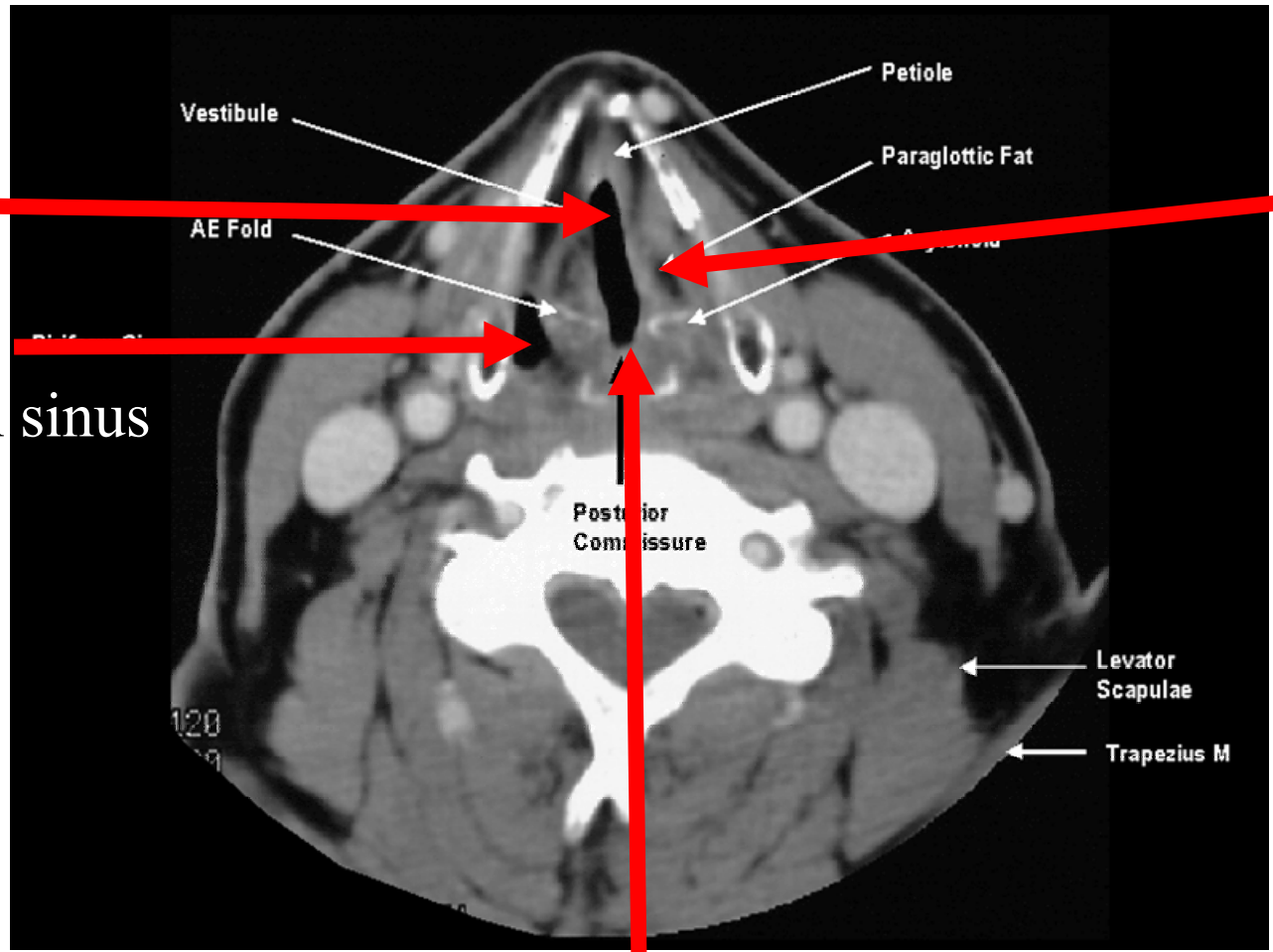
False cord

Arytenoid

Crico-are joint

Cricoid cartilage

Normal radiological anatomy – Larynx and hypopharynx region



Vestibule

Para glottic space

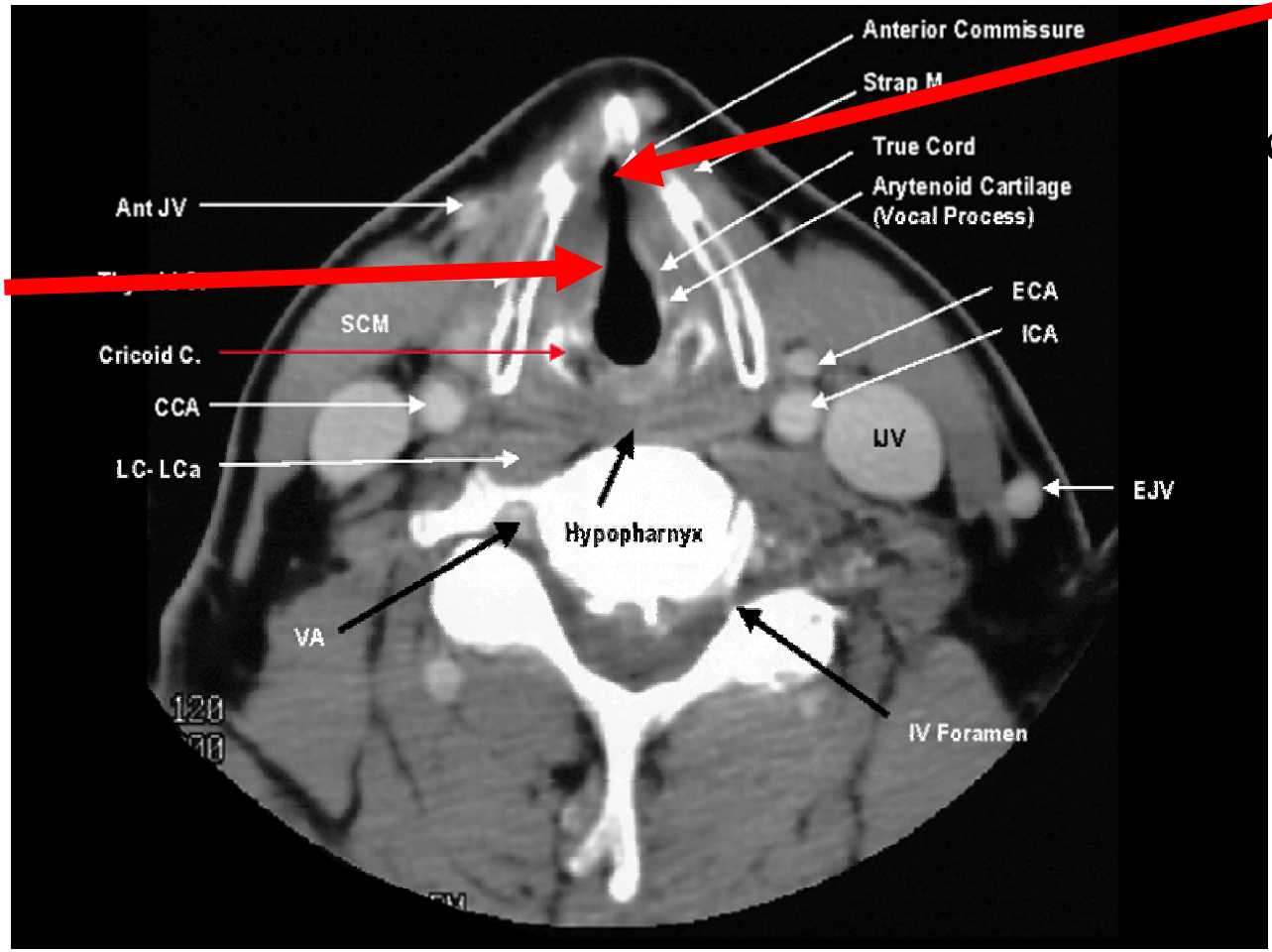
Pyriform sinus

Posterior Commissure

Normal radiological anatomy – Larynx and hypopharynx region

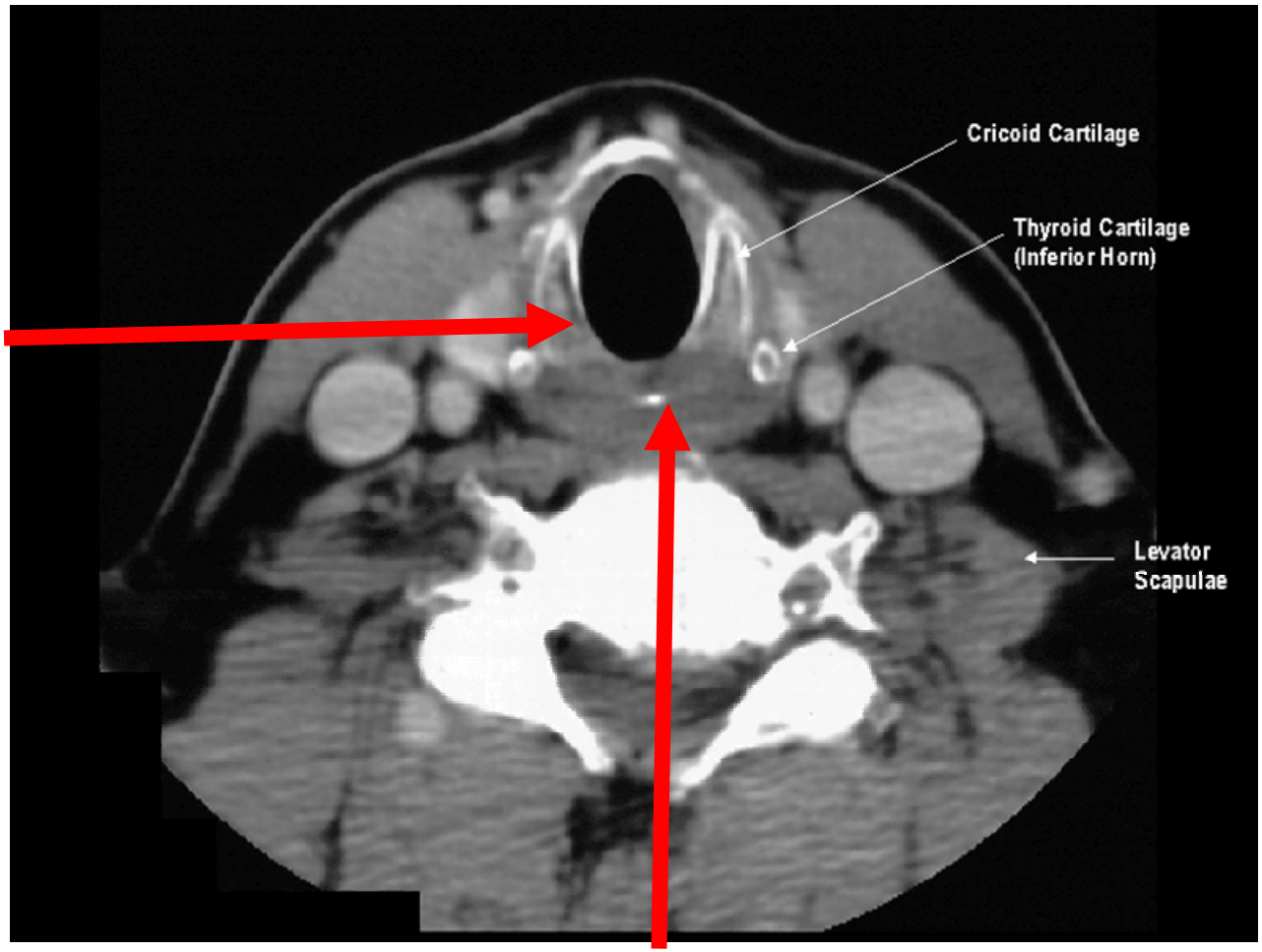
Ant. commissure

True Vocal cord



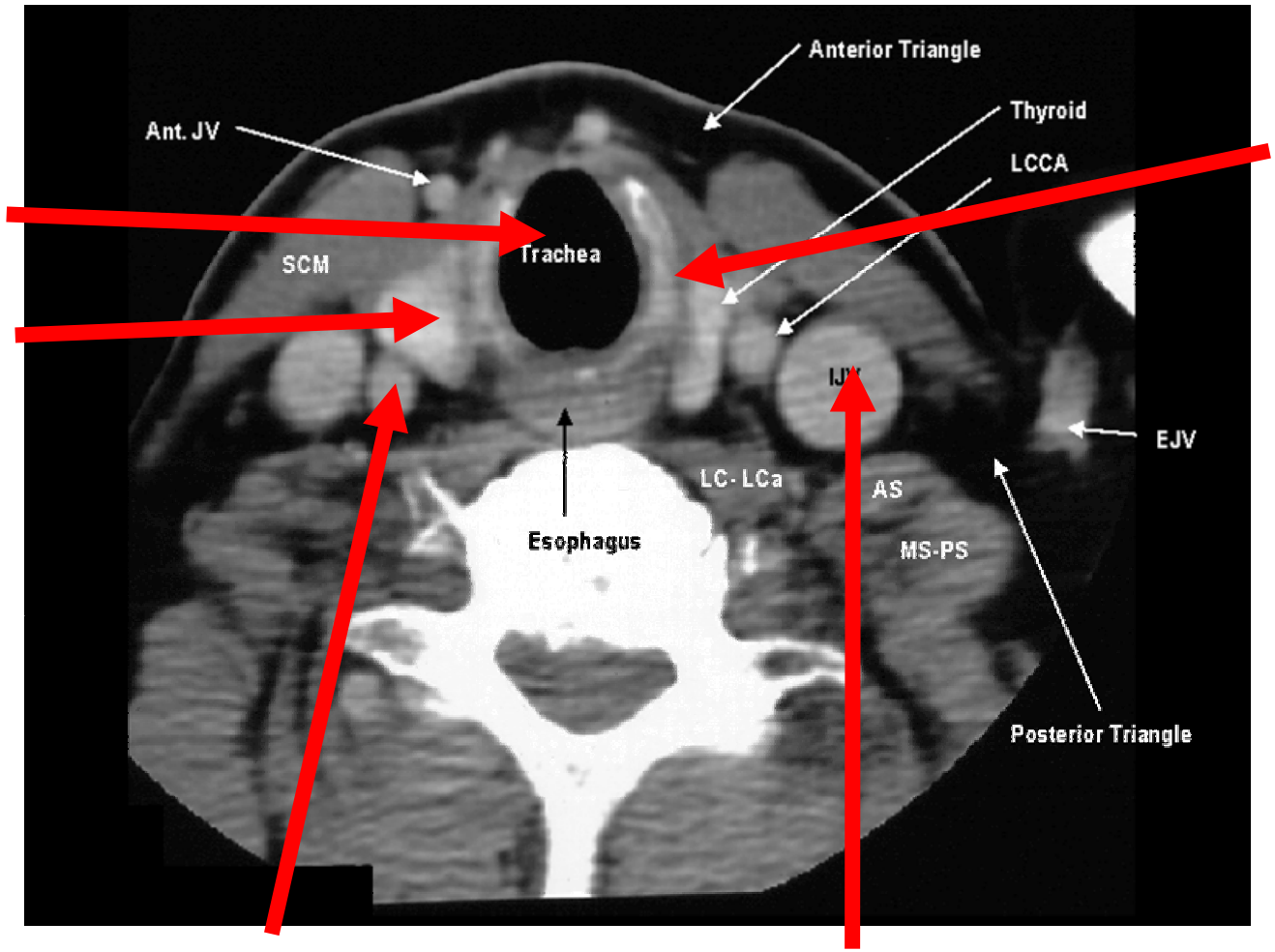
Normal radiological anatomy – Larynx and hypopharynx region

Cricoid



Cricopharyngeal region

Normal radiological anatomy – Larynx and hypopharynx region



Trachea

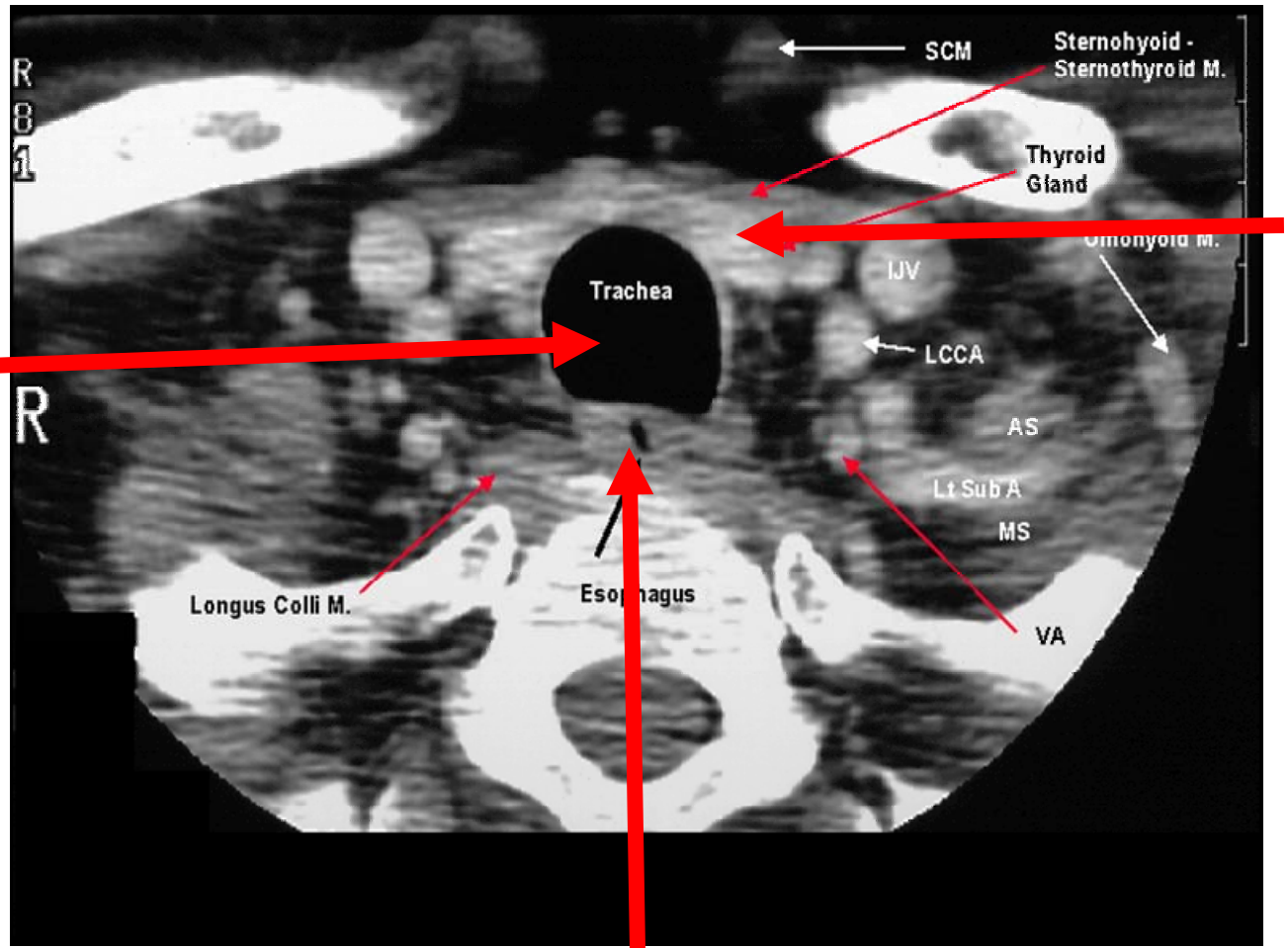
Thyroid gland

Cricoid cartlage

CCA

IJV

Normal radiological anatomy – Larynx and hypopharynx region



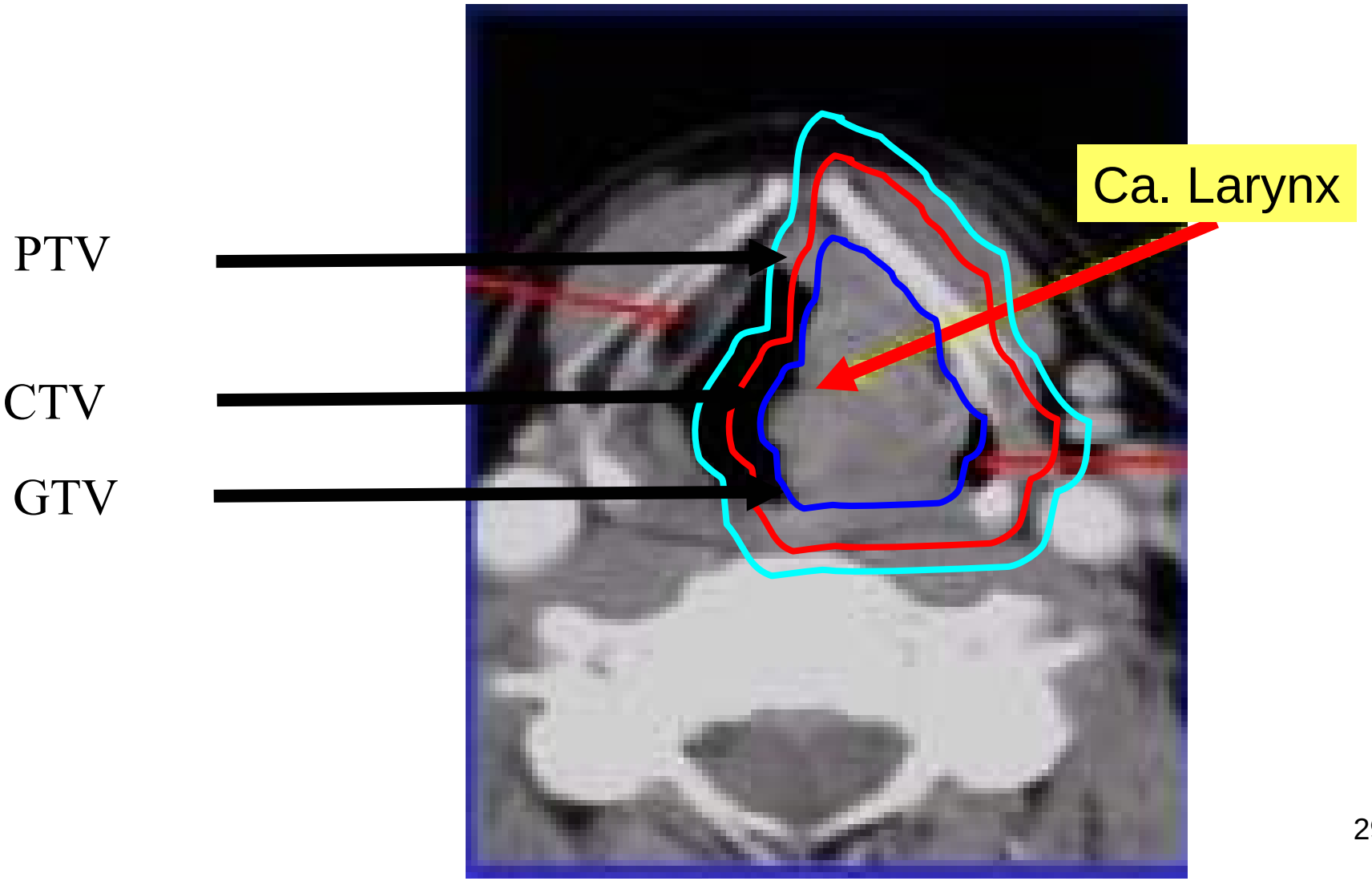
Trachea

Thyroid gland

Esophagus

Carcinoma Larynx

GTV-CTV-PTV in carcinoma larynx



Primary target delineation -larynx

Primary CTV = Original GTV + adequate margin depending upon anatomical barriers

CTV to include – PES, PGS, AEF, Vallecula (if suprohyoid ds) Hyoid (if complete PES),Pre Lx Ms & fat (if involved),Longus capitis (if involved)

Gregoire et al. Rays: 28(3);217-224, 2003

CTV & PTV expansion in CC, AP, ML directions

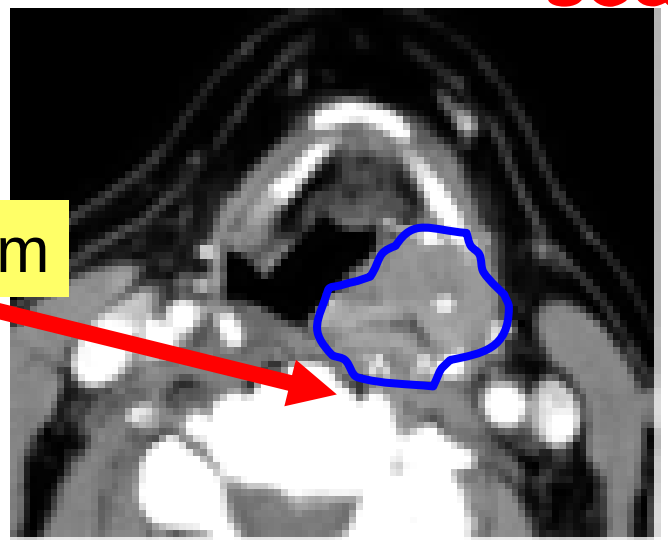
Anatomical barrier may be edited from CTV
Bone
Air

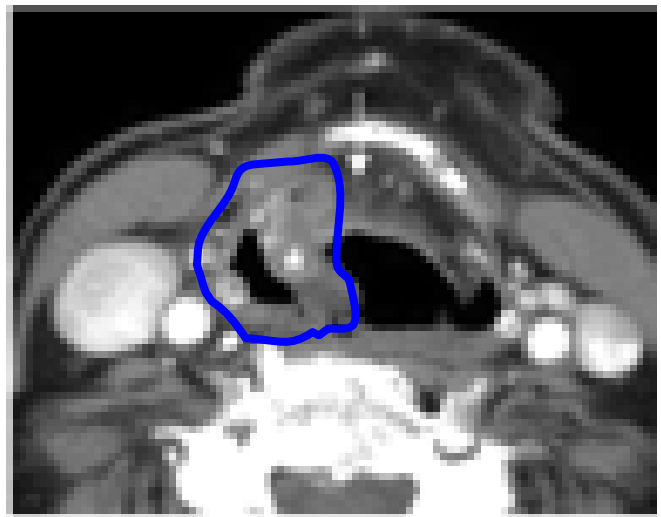
CTV to PTV expansion –3-5mm. No editing

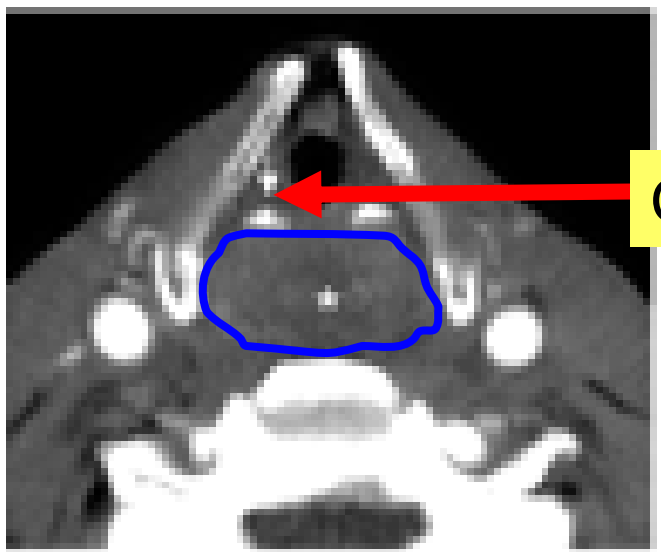
Prophylactic CTV delineation of LN – laryngeal primary (except T1N0)

- Include Level II-IV bilaterally
- In subglottic extension include level VI
- Level II LN + - include ipsilateral level V also
- Bilateral LN –Treat each site according to N stage
- Hard fixed LN –may need to include the adjacent area

Hypopharyngeal cancer- as seen on CT scan





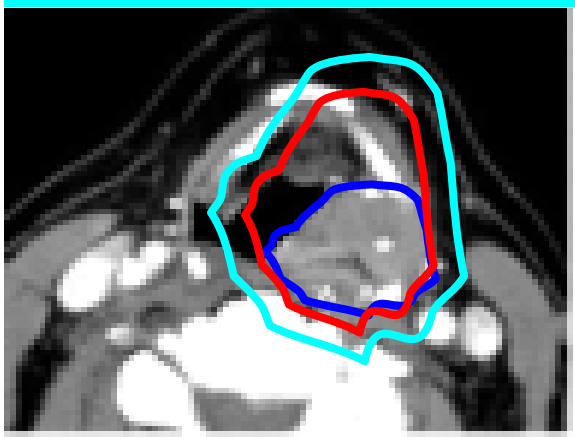


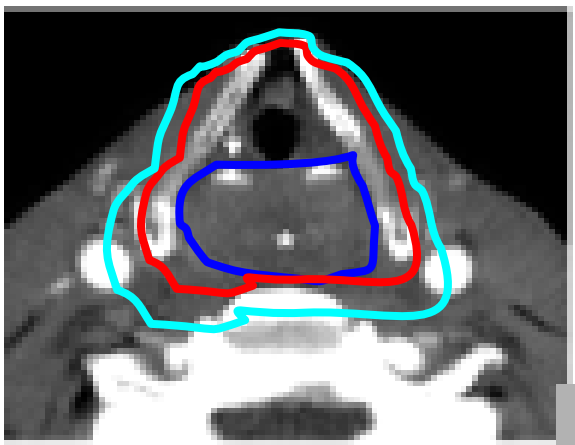
Ca. Pyriform

Ca. Postcricoid

Primary target delineation- hypopharynx

Primary CTV = Original GTV + adequate margin depending upon anatomical barriers





CTV to include

PGS

AEF

Thyroid cartilage (if PGS)

Cricoid (if arytenoid)

PPW (if Lat/Post wall)

VC (if PGS/PC)

Gregoire et al. Rays: 28(3);217-224,2003

CTV & PTV expansion - CC, AP, ML

CTV to PTV expansion –3- 5mm. No editing

How site determines the adv Larynx-hypophx CTV ?

	Larynx	PFS	vallecula	Space & Ms	Cartilage	Misc
Larynx	√	√	√	PES, PGS	Thyroid	Tracheostomy
PFS	I/L hemiLx; PPW	-	-	-	-	Submucosal; I/L Thyroid

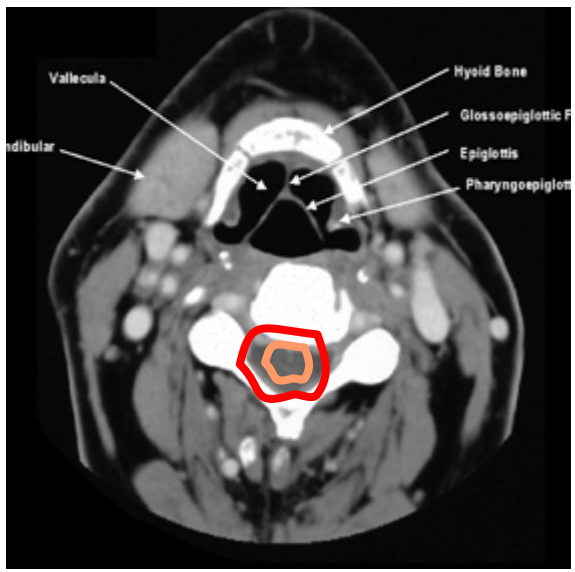
Eisbruch et al, 2002. vol12(3);238-249

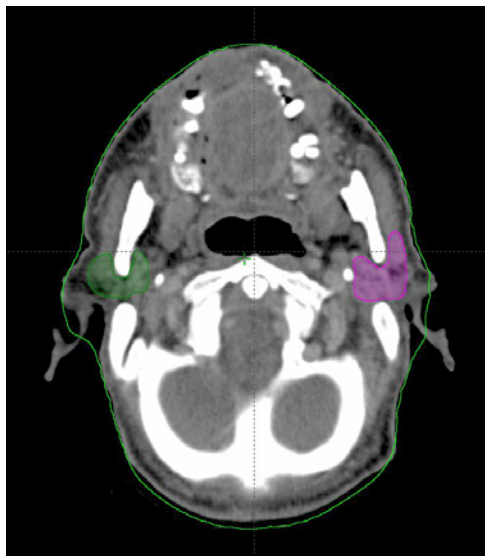
Prophylactic CTV delineation of LN – hypopharyngeal primary

- Include Level II-IV bilaterally
- In PFS and esophageal extension include level VI
- Include Retropharyngeal LN in LN + and Postpharyngeal wall tumors.
- Level II LN + - include ipsilateral level V also
- Bilateral LN –Treat each site according to N stage
- Hard fixed LN –may need to include the adjacent area

Normal structures to be delineated in all sections

- Spinal cord + Margin (PRV)
- Parotid glands





Changing patterns of failure in HN cancers

- With Conventional RT- Failures proportionate
- Dawson reported 79% LRC; 80% in-field failures. *IJROBP 2000. 46:1117-1126.*

Mendenhall says
- Previously unappreciated tumor spread e.g parotid LN
- Questioned the zeal to spare parotid in level II LN+
- Risk of radiological miss
- Prudent to give conventional RT in bilateral Level II LN+

Mendenhall et al
IJROBP:2009;73(3),645-646.

Conclusions

- Knowledge of anatomy, radiological anatomy (normal and abnormal (GTV)) required.
- Delineation is an important link in treatment.
- CTV- determined by patterns of spread and is bounded by natural barriers i.e. bone & air. It should be guided by conventional treatment portals.
- PTV- set up errors of HN site(s) at your centre.

Conclusions

- Worst complication is tumor recurrence
- Generous target delineation, high quality imaging and understanding patterns of failure
- Need for consensus for primary targets facilitating consistent selection & delineation

Lee et al, IJROBP, 2004.57:49-60