

NECK ANATOMY AND MALIGNANCY;CASE BASED IMAGING REVIEW

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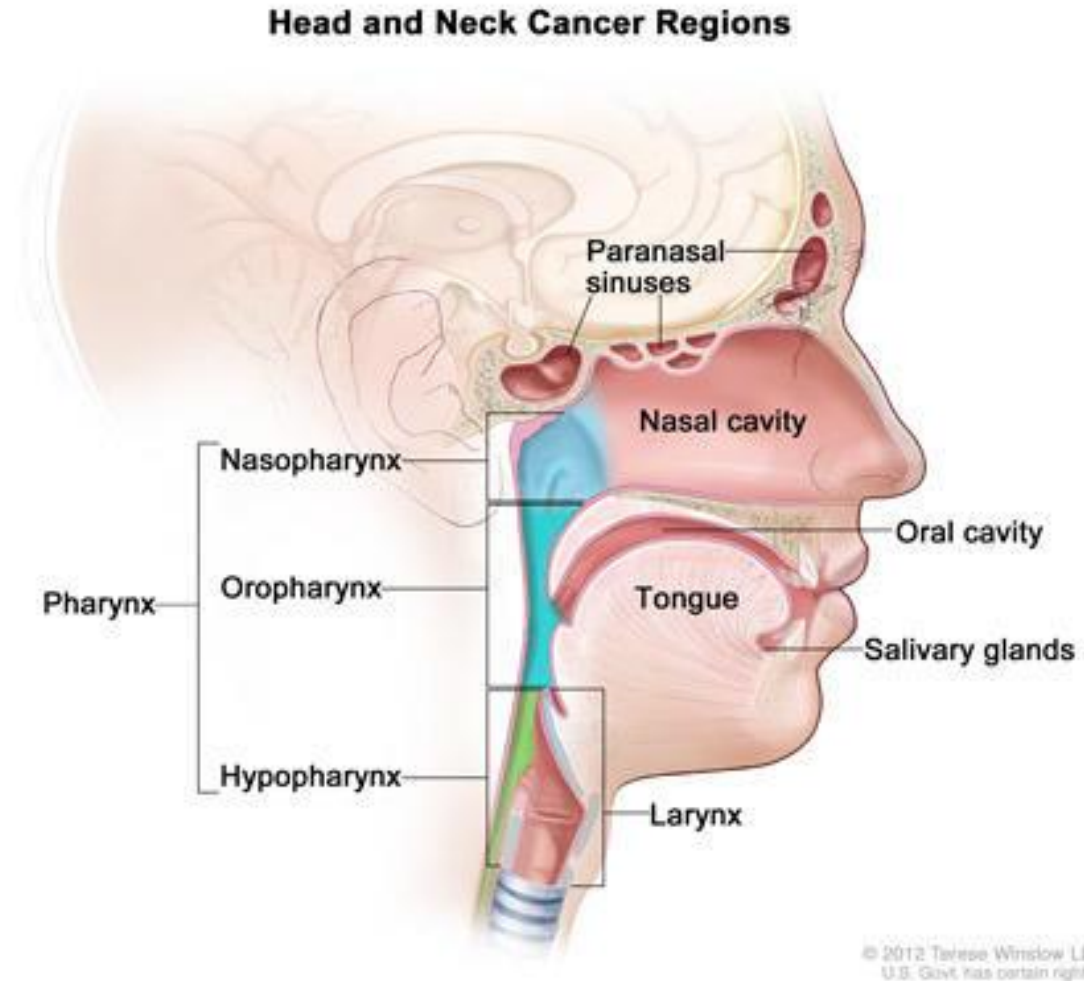
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No Disclosures

Objectives of the lecture

- Anatomy of the airway
- Epidemiology of neck cancer
- Techniques of head and neck imaging
- Imaging of common pathology

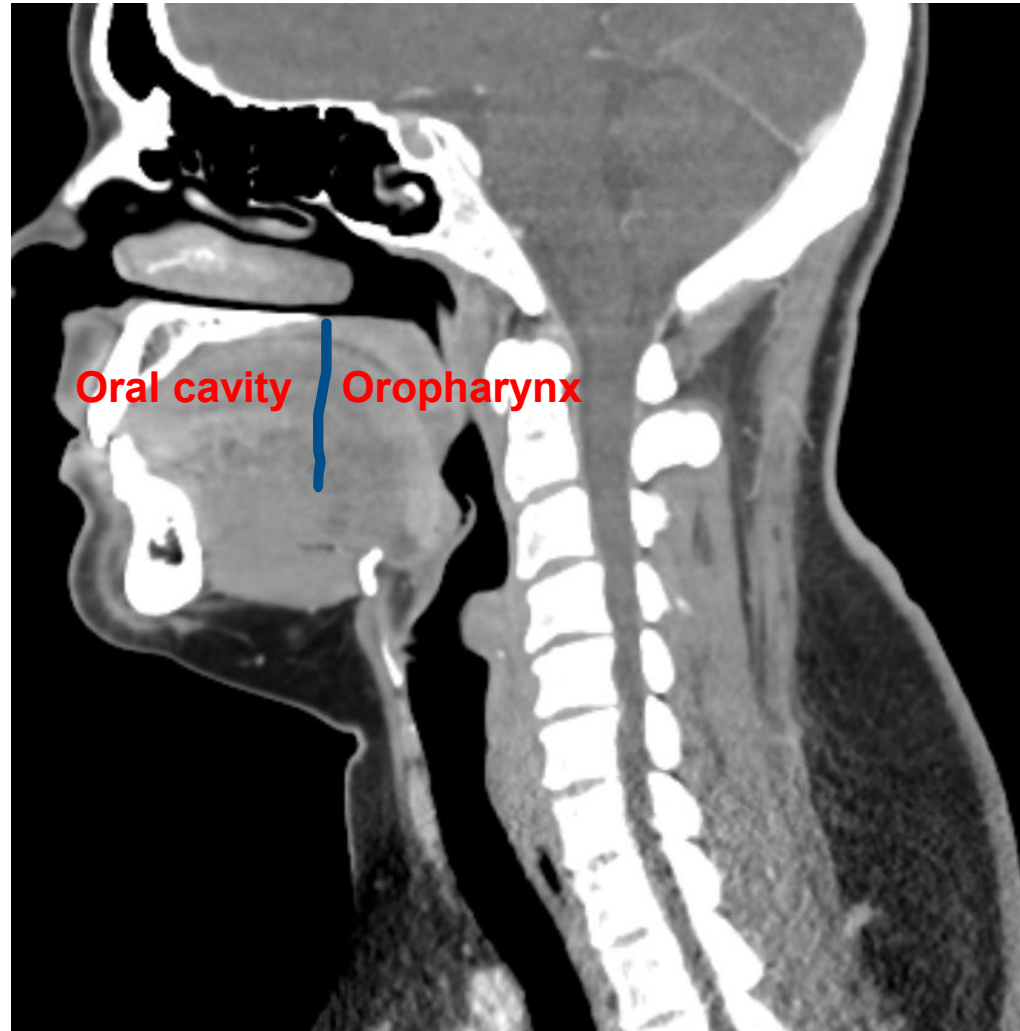
ANATOMY OF THE AIRWAY



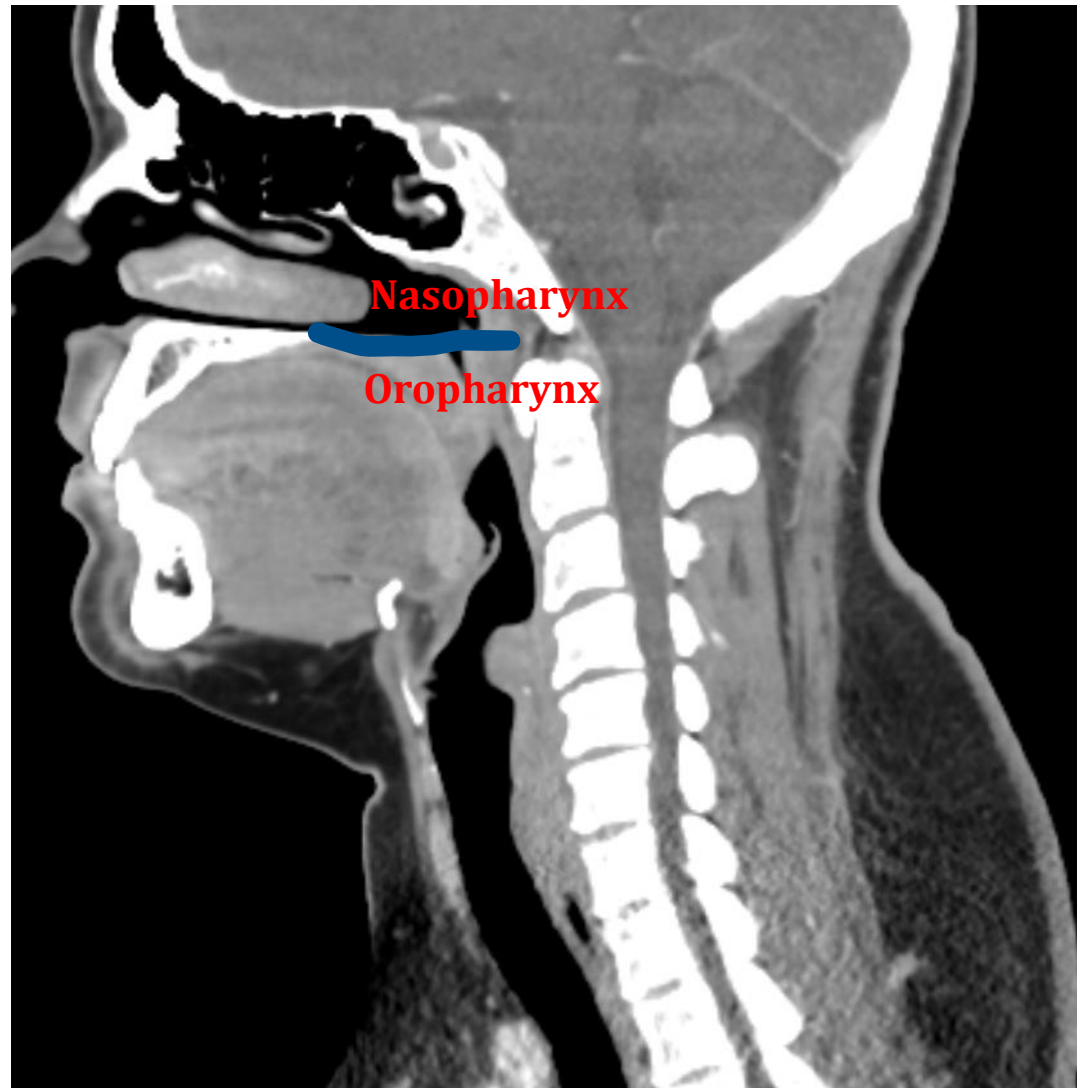
Axial CT



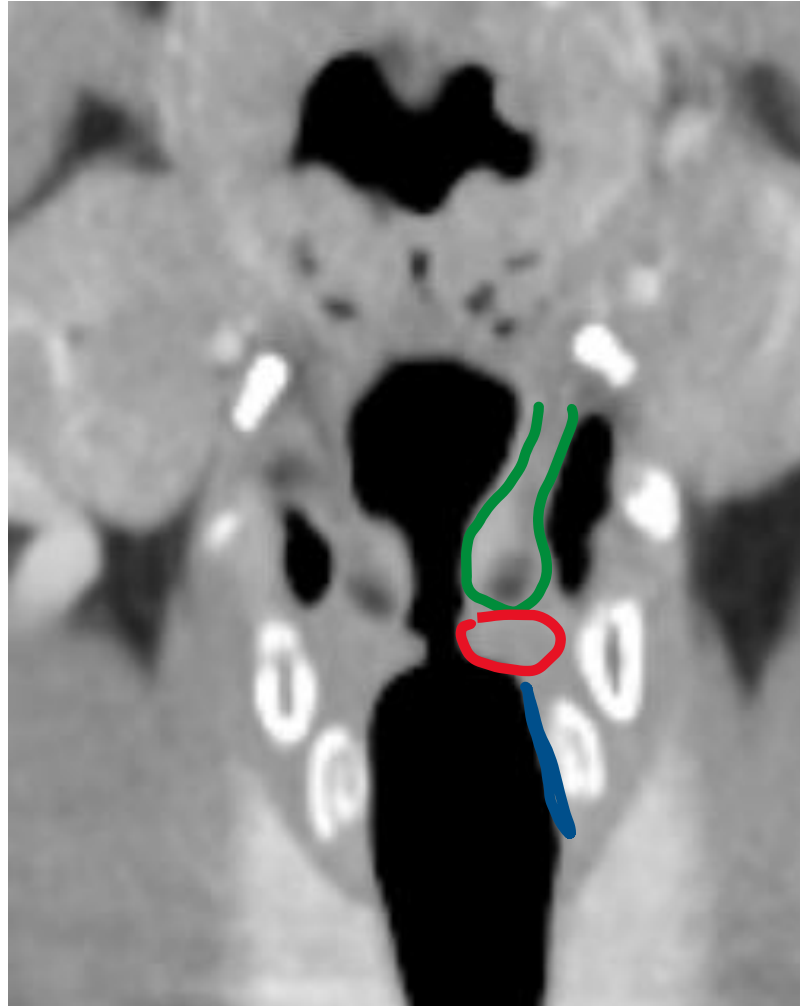
Sagittal CT



Sagittal CT



Coronal CT-Larynx



Supraglottic Larynx

Glottis or vocal cords

Sub-glottis

Epidemiology of head and neck cancer

Worldwide 900,000 cases; 400,000 deaths annually

Males :female 3:1

Site predilections:

- Oral cavity cancers: Indian Subcontinent
- Nasopharyngeal cancer: China and east Asia
- Laryngeal cancer : African American

Mortality is higher in African American men (lower prevalence of HPV)

uptodate.com/contents/epidemiology-and-risk-factors-for-head-and-neck-cancer

Oral Cavity and Pharynx Cancer

Expand All Collapse All

Statistics at a Glance

At a Glance

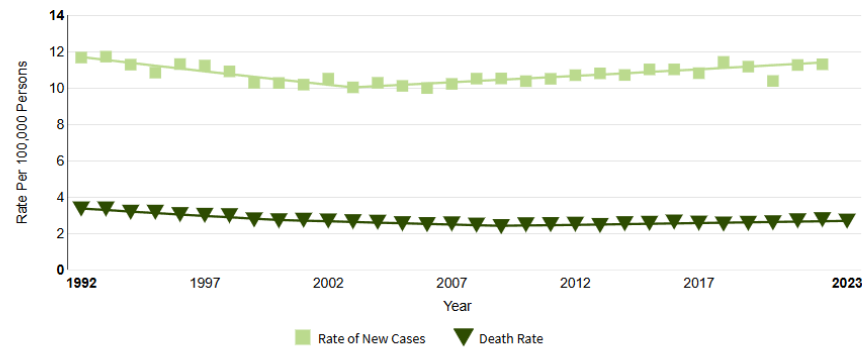
Estimated New Cases in 2025	59,660
% of All New Cancer Cases	2.9%

Estimated Deaths in 2025	12,770
% of All Cancer Deaths	2.1%

5-Year
Relative Survival

69.5%

2015–2021



New cases come from SEER 12. Deaths come from U.S. Mortality.
All Races, Both Sexes. Rates are Age-Adjusted.

Cancer Stat Facts: Laryngeal Cancer

Expand All Collapse All

Reports on Cancer

Annual Report to the Nation

Cancer Stat Facts

Cancer Statistics Review +

Preliminary Cancer Incidence Rates and Trends +

SEER Publications +

Statistics at a Glance

At a Glance

Estimated New Cases in 2025	13,020
% of All New Cancer Cases	0.6%

Estimated Deaths in 2025	3,910
% of All Cancer Deaths	0.6%

5-Year
Relative Survival

62.1%

2015–2021



Risk factors

Tobacco products: 5-25-fold

Alcohol : 5-6-fold

Viruses :Epstein Barr Virus (EBV) :Nasopharyngeal cancer

Human Papilloma 16 (HPV 16) ; Tongue base and tonsil

Immunodeficiency (like HIV) : 2-3-fold

Betel nut chewing; oral cavity cancer

Radiation : thyroid cancer, salivary gland tumors and sarcoma: low risk

Head and neck cancer: a global perspective on epidemiology and prognosis R.Sankanarayanan et al Anticancer Res Nov –Dec 1998

IMAGING TECHNIQUES

CT : Single phase or dual phase contrast injection

Dual phase : 60 ml injected at 2ml/sec, 30 seconds later 40ml at 2ml/sec .
Imaging 10 seconds later

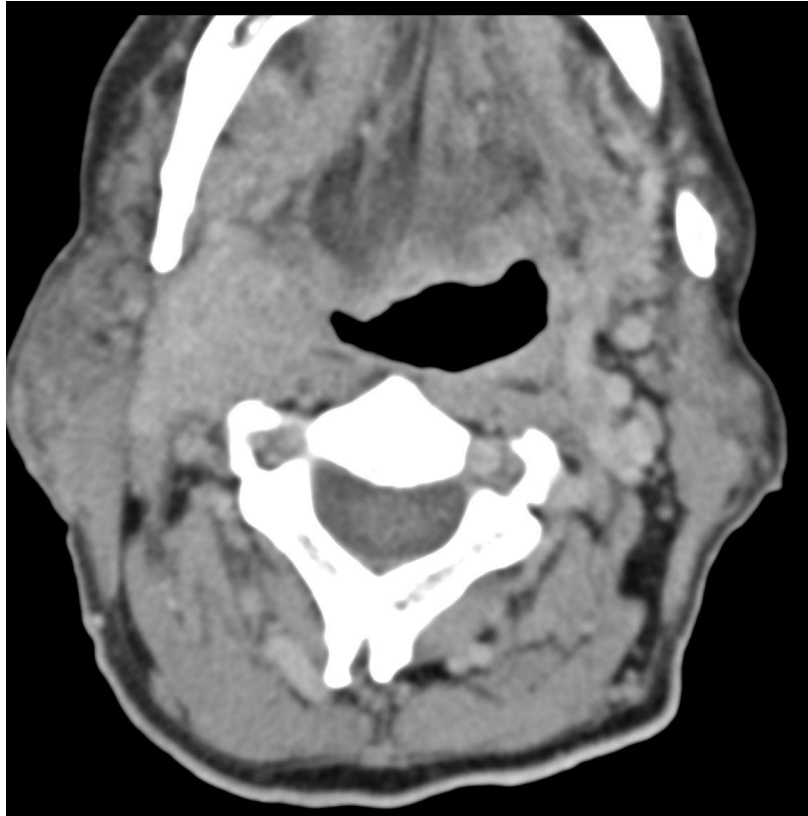
Orbital roof to aortic arch (vocal cord paralysis ;image up to the carina)

2.5 mm axial slice with reconstructions

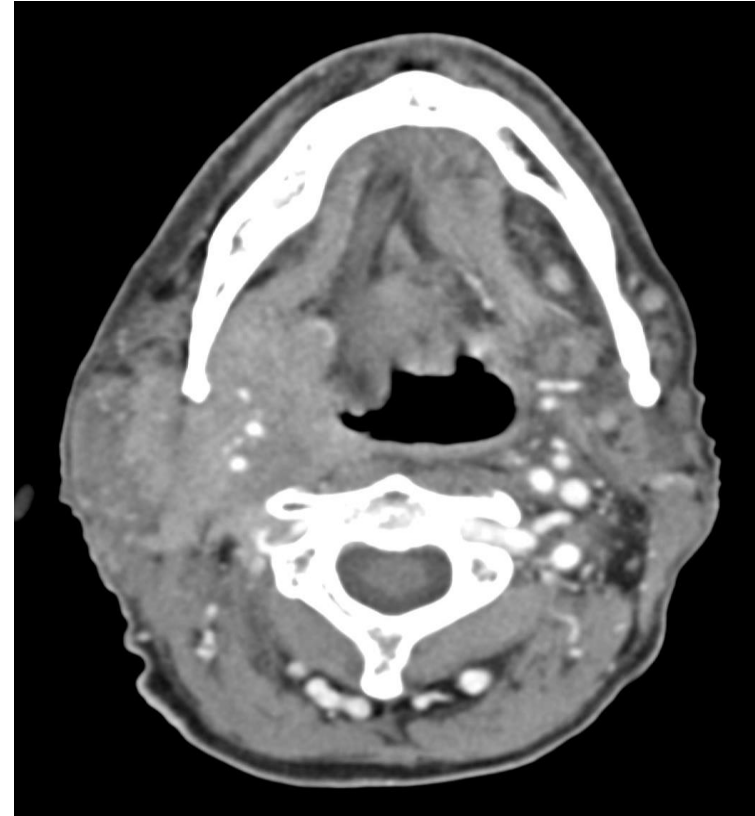
CT of the Neck: Image Analysis and Reporting in the Emergency Setting RadioGraphics 2019; 39:1760–1781

SINGLE vs DUAL TECHNIQUE

13



Single



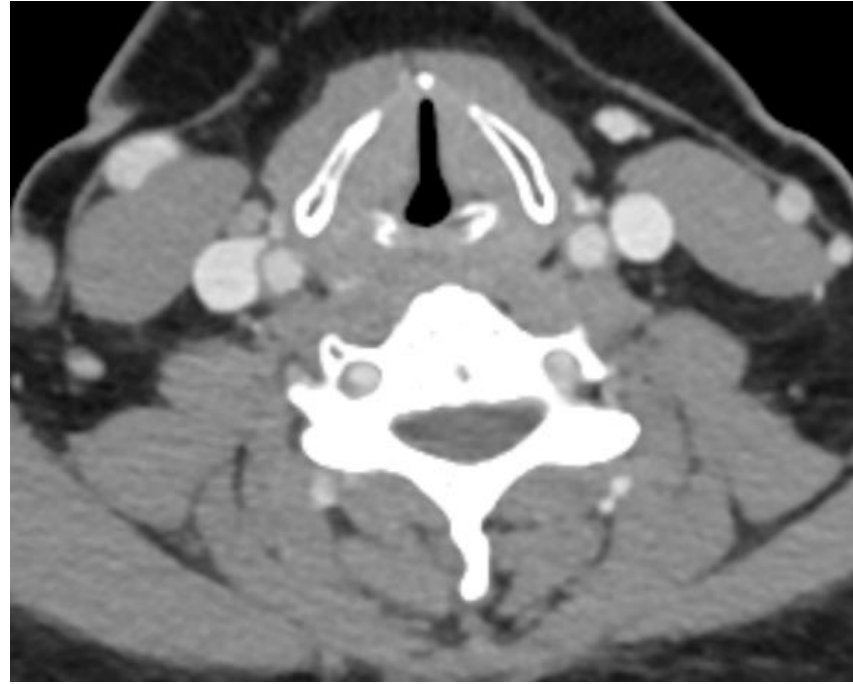
Dual

Imaging Techniques; Shallow respiration

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Suspended respiration



Shallow respiration

Better tumor delineation, skull base, marrow and orbital infiltration and perineural tumor spread.

Primarily used for sinonasal and nasopharyngeal tumor staging

Disadvantages: long scan times, metal artifact.

Techniques: small FOV of 18cm

3-4 mm thick slices

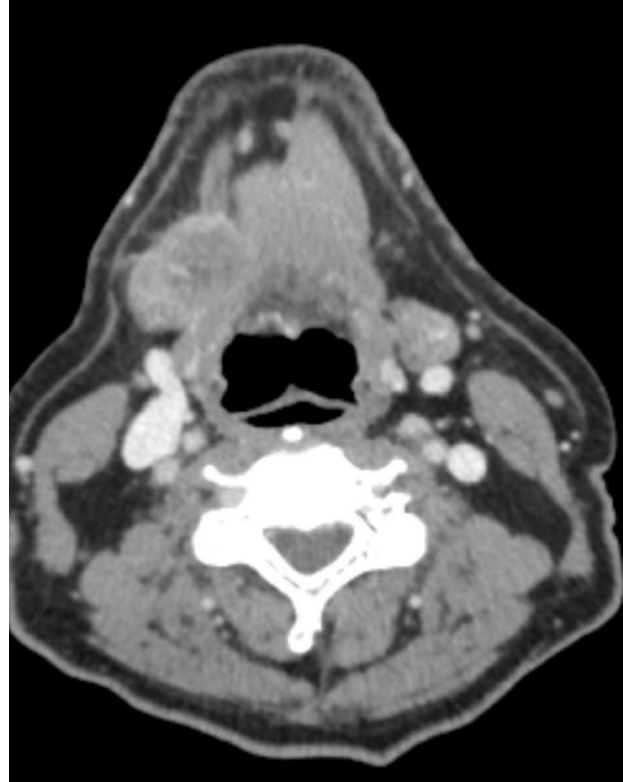
1.5 T magnet preferable due to less susceptibility in post surgical patients

T1 Precontrast **without** FS, T2 with FS, T1 post contrast FS, DWI

Imaging of Head and Neck Cancer With CT, MRI, and US Seminars in Nuclear Medicine, 2021-01-01, Volume 51, Issue 1, Pages 3-12

Case 1: 79-year-old with fullness in mouth

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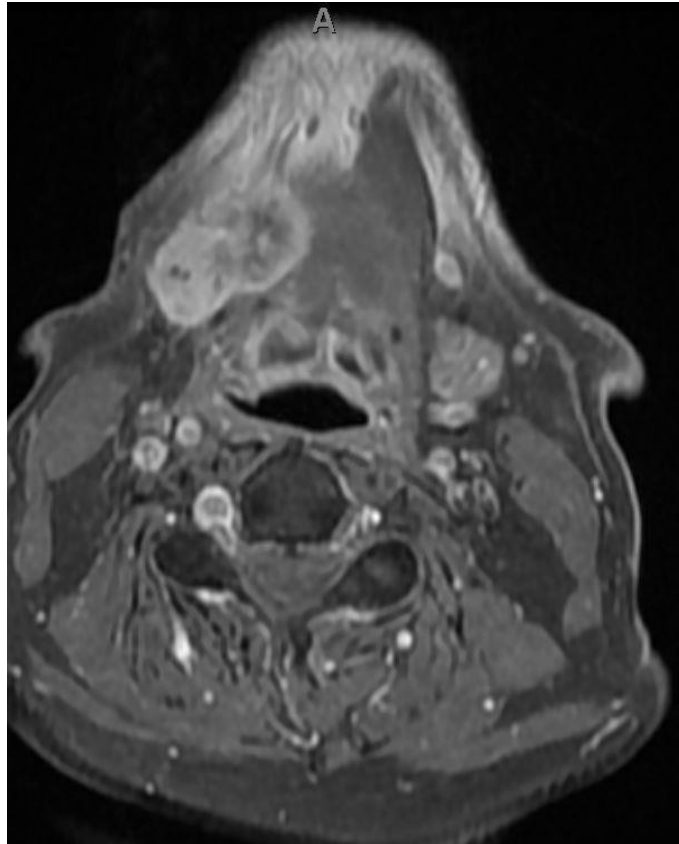


- Mylohyoid digastric sling ;separates Sublingual from submandibular space
- Relatively poor soft tissue contrast as tumor and muscle have similar enhancement

Imaging the Floor of the Mouth and the Sublingual Space RadioGraphics 2011; 31:1215-12

MRI

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Post contrast fat sat

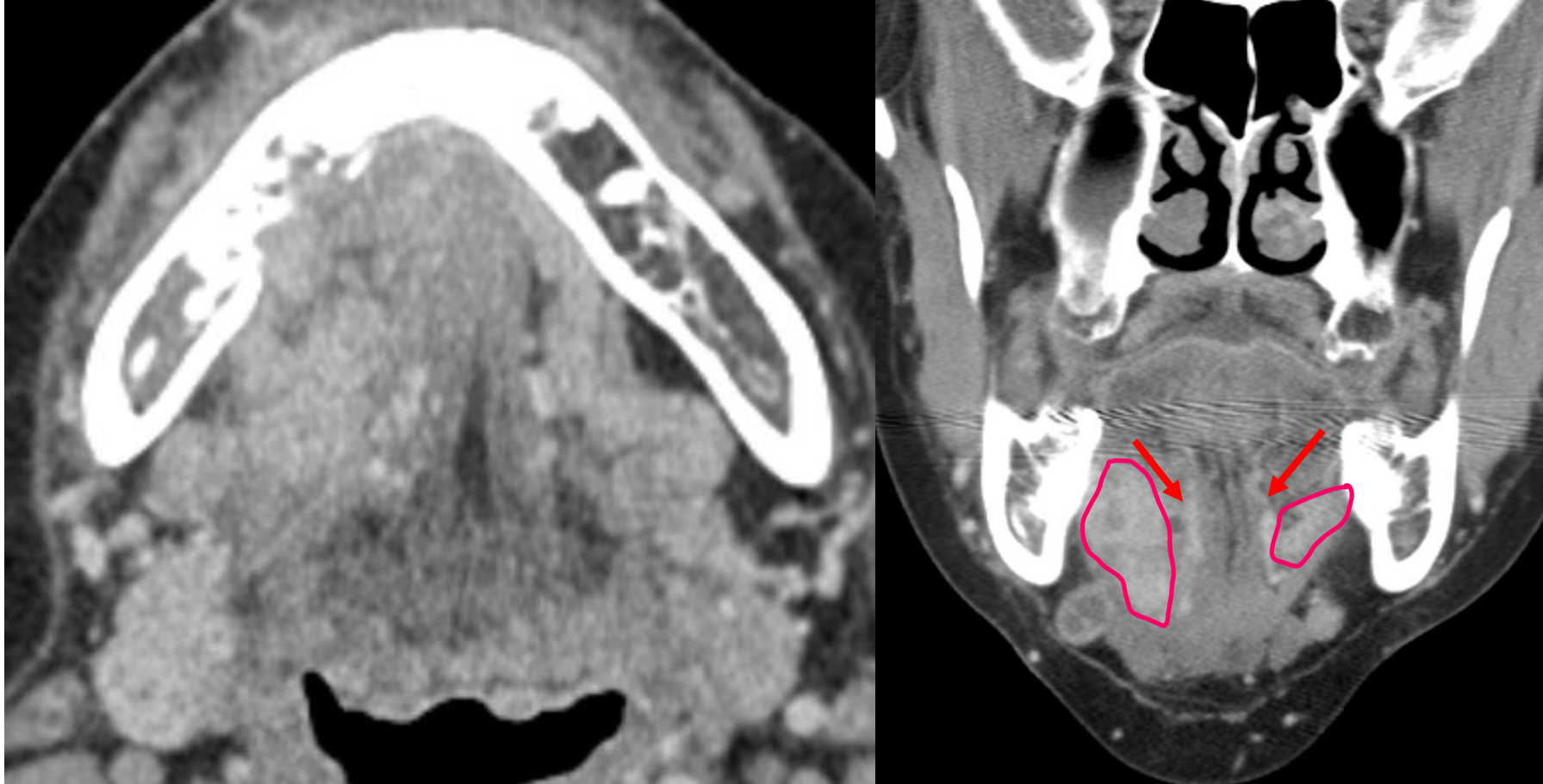


Post contrast nonfat sat

- Diagnosis; Adenoid cystic carcinoma of the Submandibular gland ? invading Sublingual space

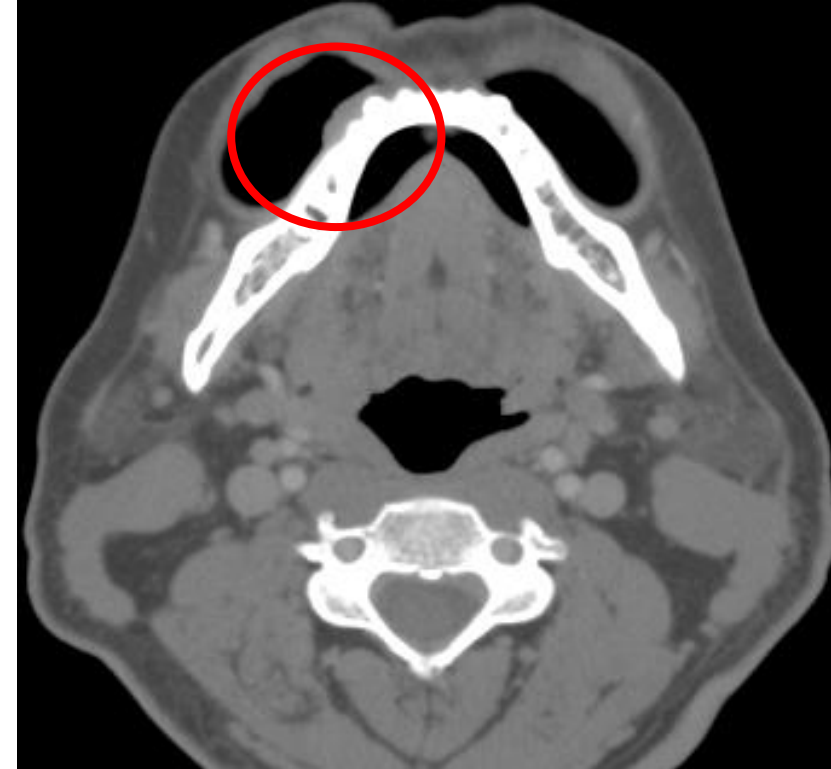
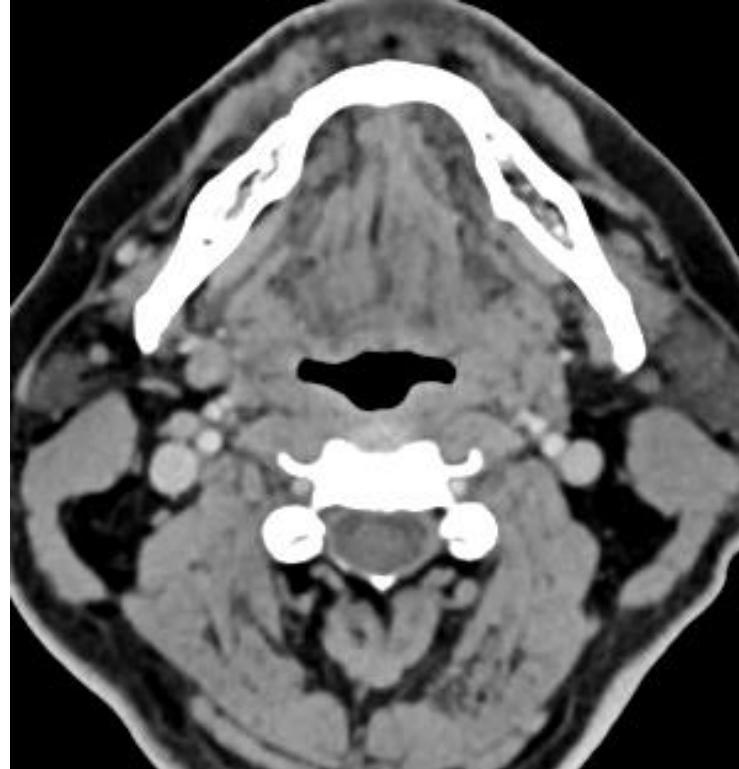
Sublingual space mass

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70 year old patient with a lesion on the gingiva

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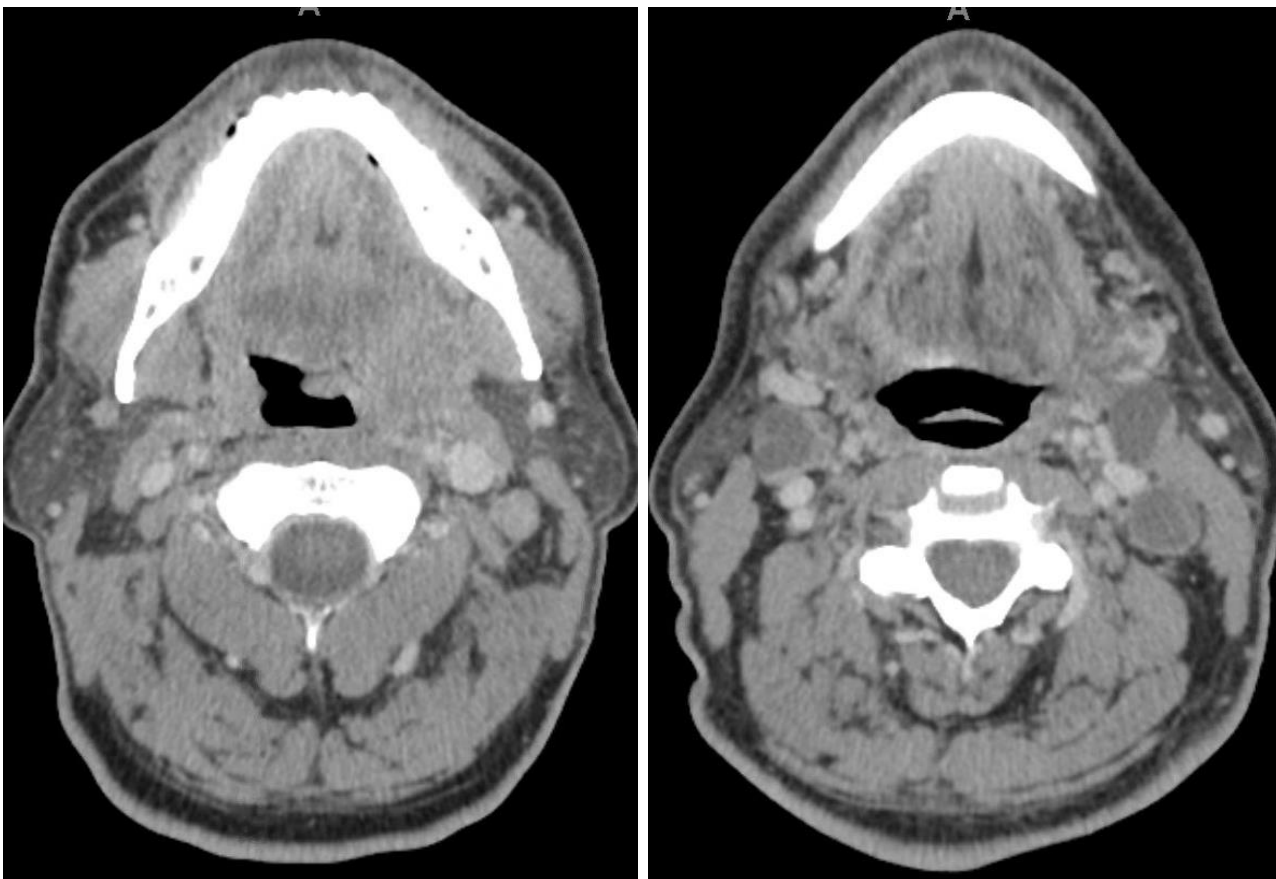


Puffed cheek technique

- *Revisiting the “Puffed Cheek” Technique: Advantages, Fallacies, and Potential Solutions Radiology: Imaging Cancer 2024; 6(3):e230211*

Case 2: 51-year-old male with lump in neck

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Human papilloma virus(HPV) Squamous cell cancer

Tongue base and tonsil

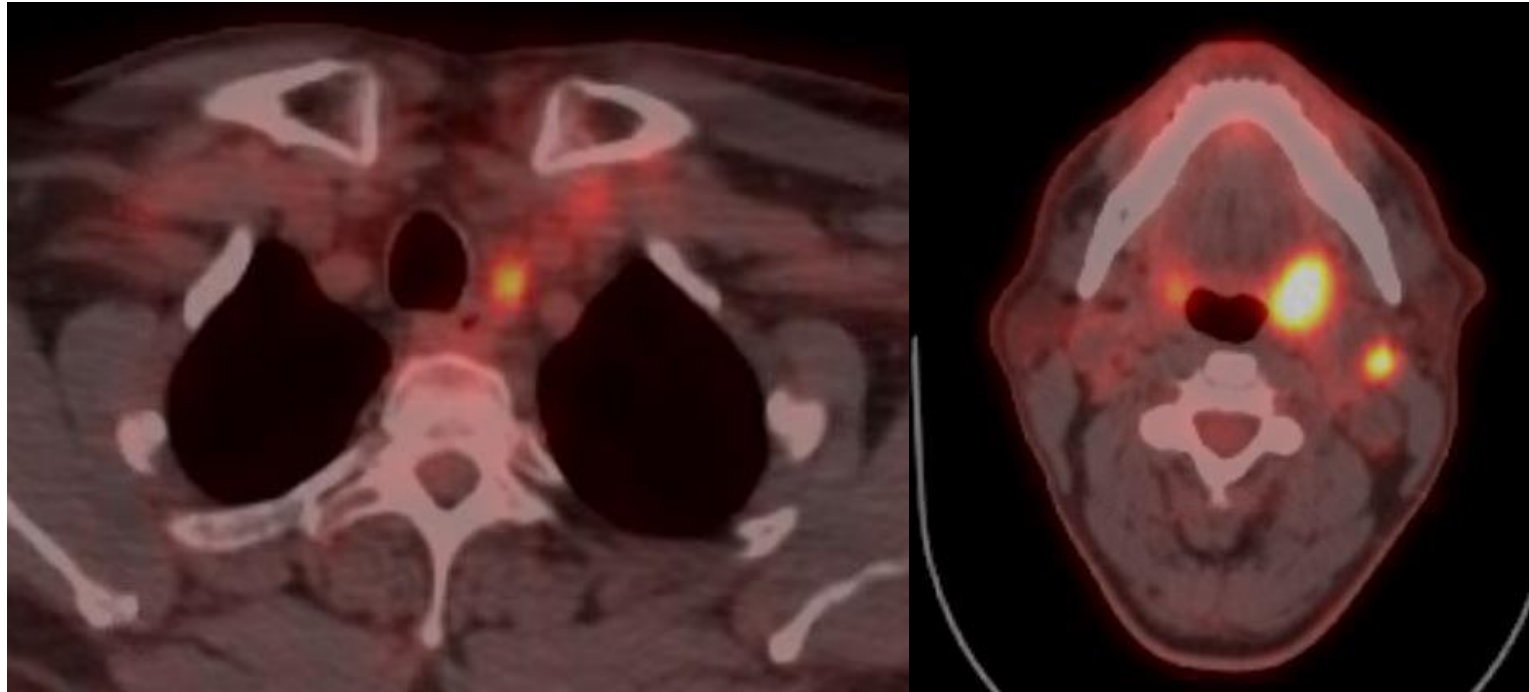
Nonsmokers; Caucasian males, Overall better prognosis

Well defined primary tumor and cystic nodal metastasis

Differences in Imaging Characteristics of HPV-Positive and HPV-Negative Oropharyngeal Cancers: A Blinded Matched-Pair Analysis American Journal of Neuroradiology October 2013, 34 (10) 2005-2009

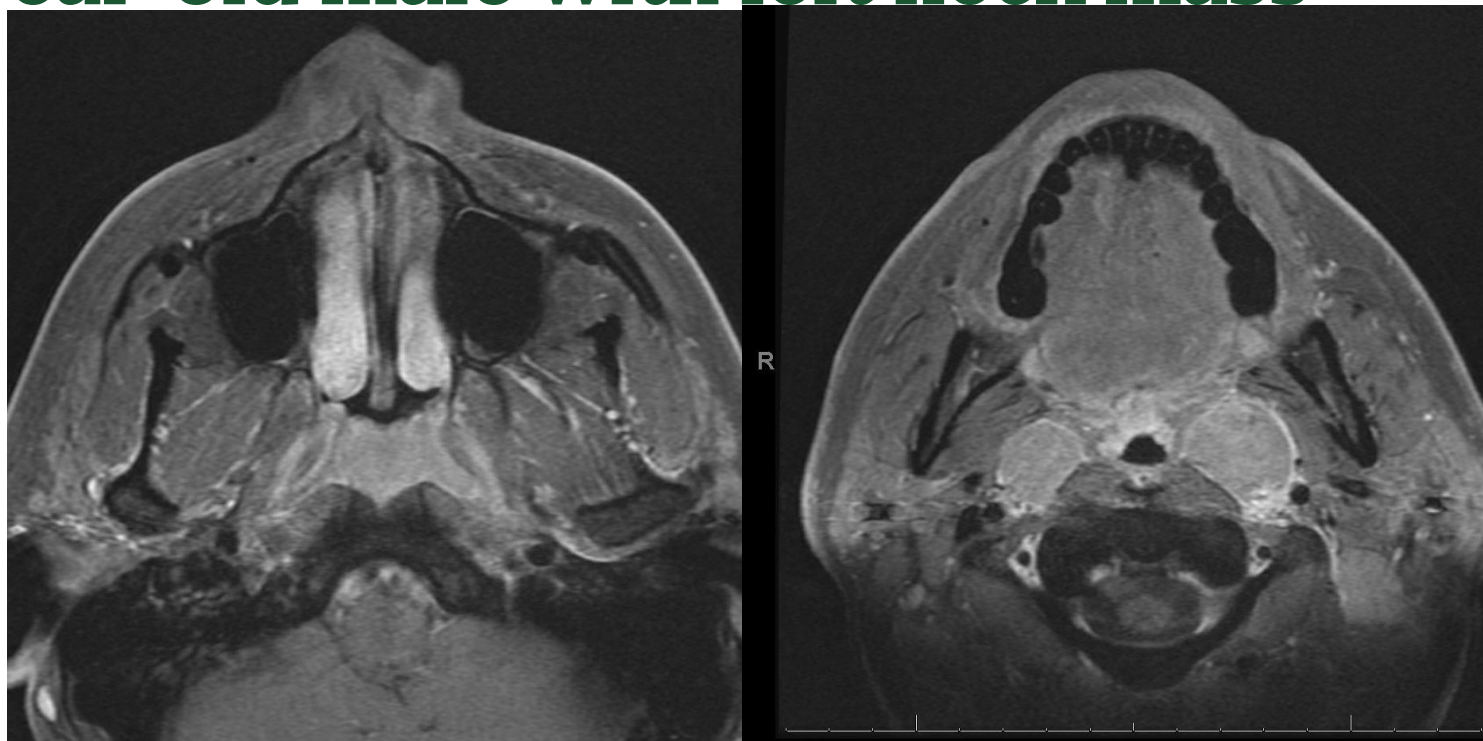
STAGING??

- Stage I Tumor < 2cm, N0
- Stage II Tumor >2cm, N0
- Stage III Tumor >4 cm or ipsilateral lymph node <3cm
- Stage IV Tumor extends outside site of origin (muscle invasion), single ipsilateral node >3cm, Multiple ipsilateral nodes or any contralateral nodes or distant metastasis
- PET CT required for completion staging of stage III or Stage IV on neck CT or MRI



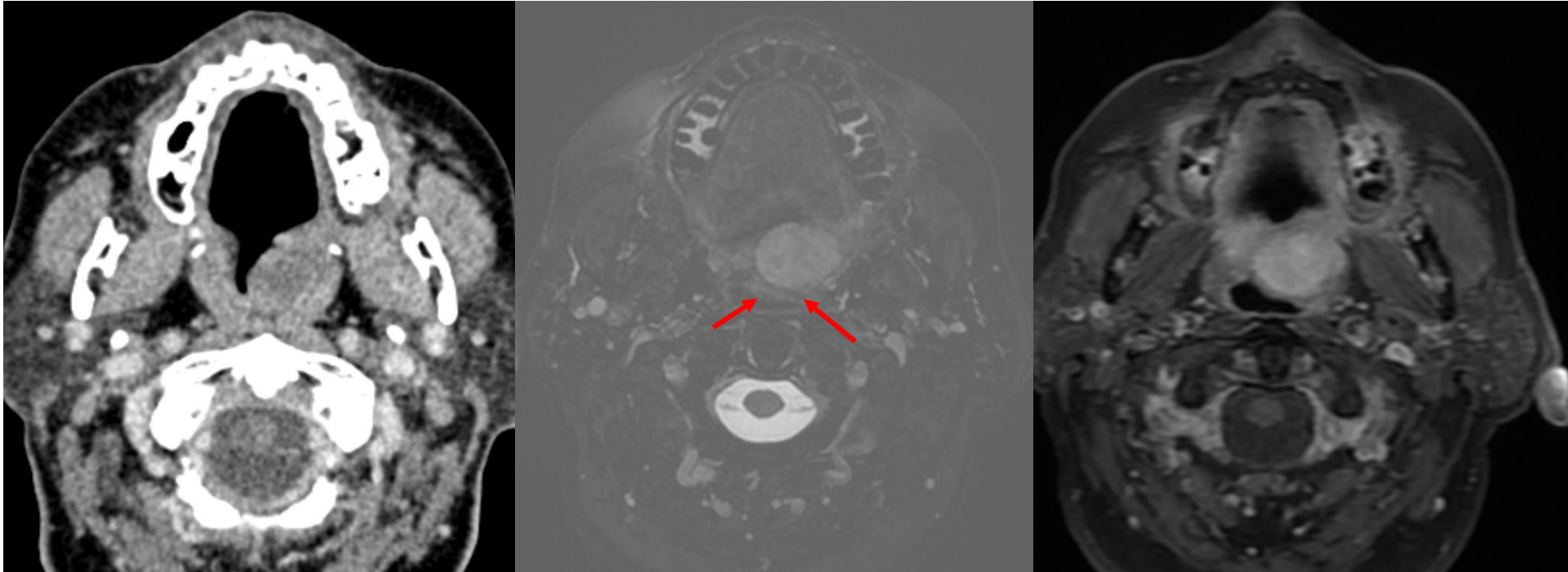
Case3 :36-year-old male with left neck mass

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- Nasopharyngeal carcinoma predominantly on the left: start in Fossa of Rosenmuller
- Bilateral Retropharyngeal nodes :Stage IV; requires PET

Case 4 -70-year-old with progressive growth of a lesion in her mouth



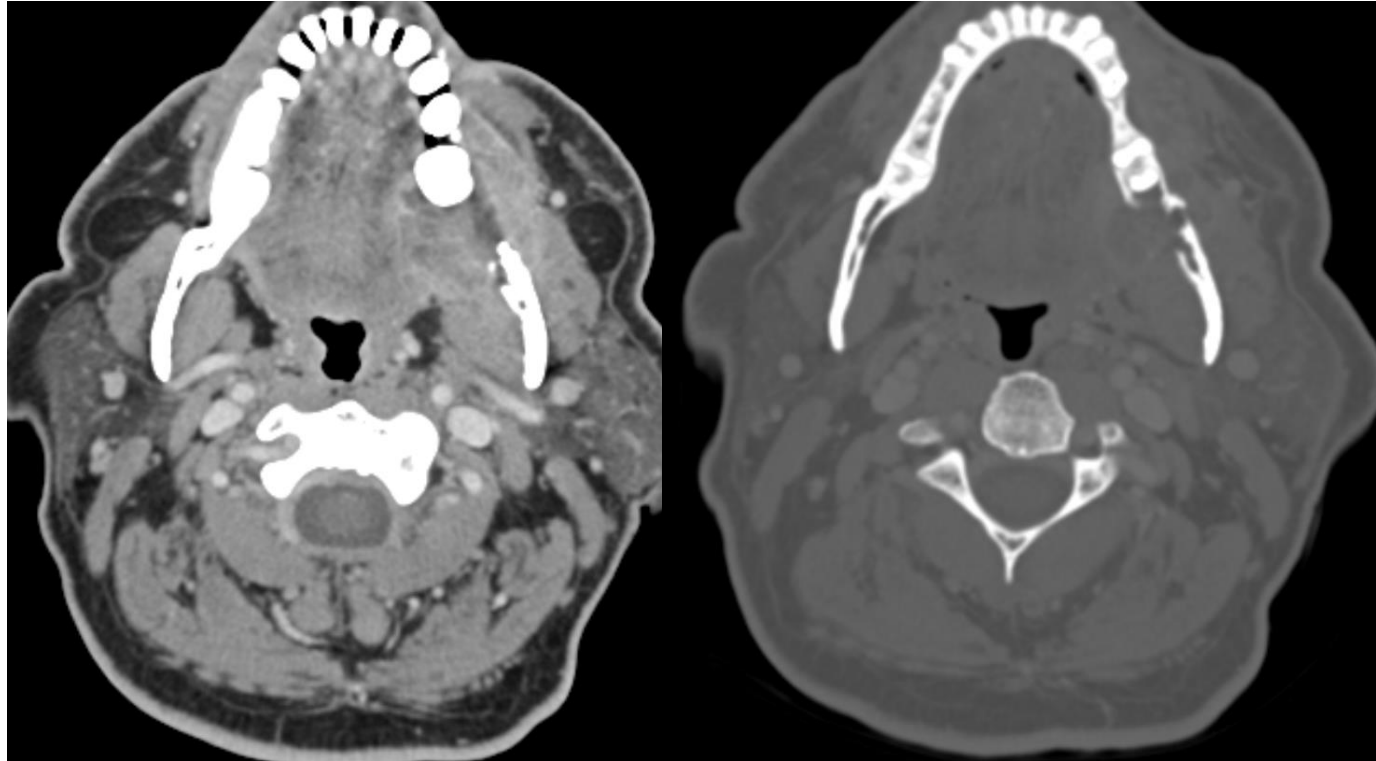
Most common site of minor salivary gland tumor-Soft palate

Submucosal location

Imaging of Malignant Minor Salivary Gland Tumors of the Head and Neck RadioGraphics 2021; 41:175–191

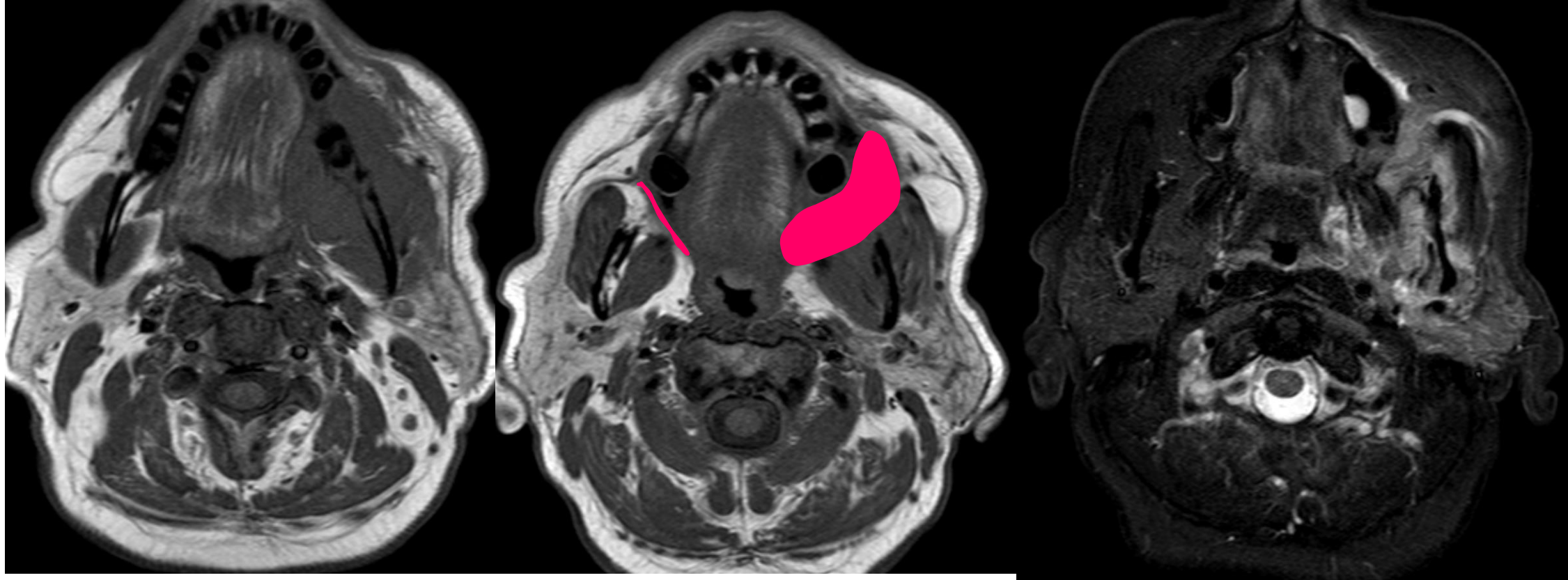
Case 5-60 year old male with pain in left mandible

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60 year old male with pain in left mandible

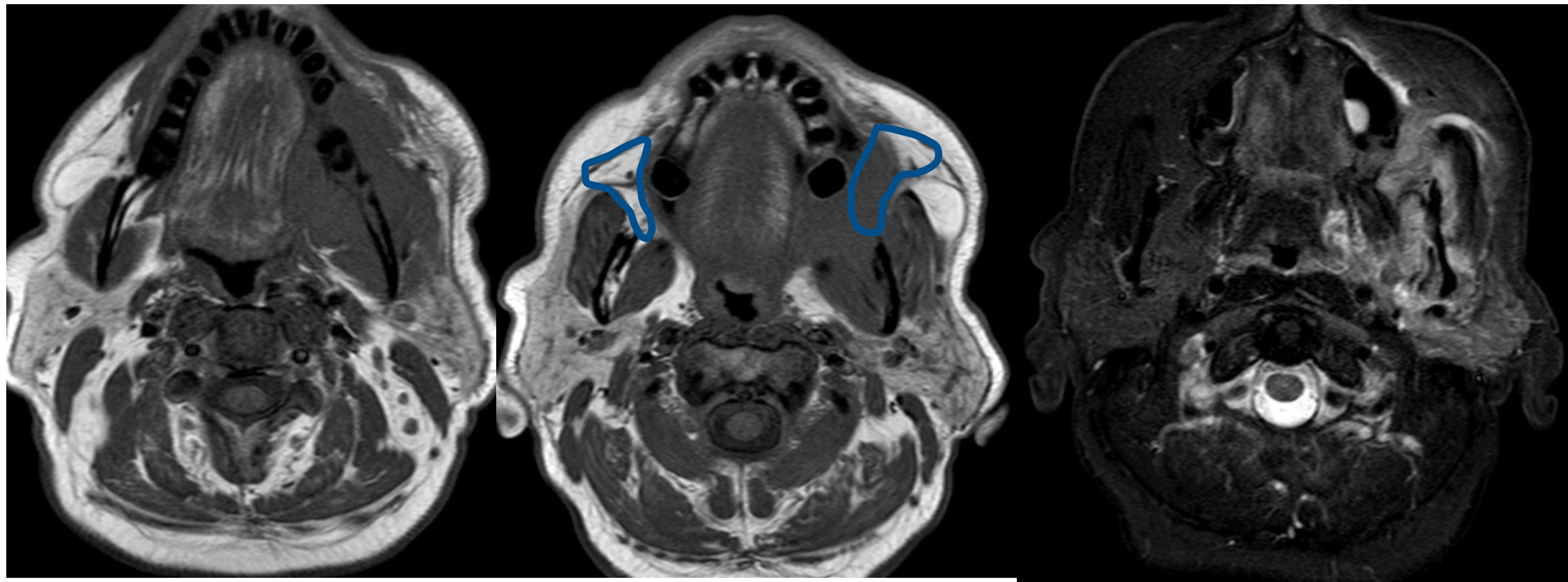
25



Thickened Pterygomandibular raphae seen in Retromolar trigone tumors

60 year old male with pain in left mandible

26

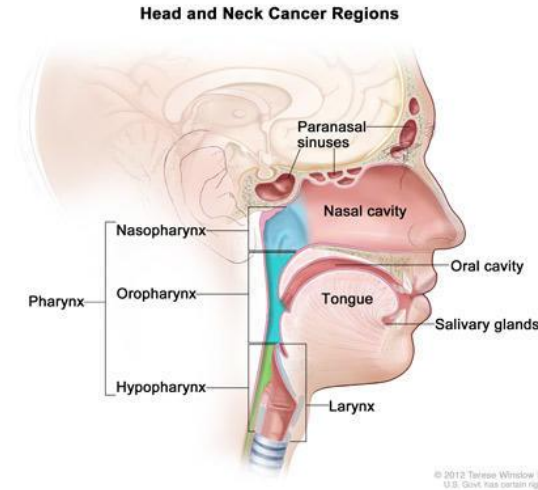


Retromolar trigone tumors can extend to the buccal space

Trends in Head and Neck Cancer: Oral Cavity Carcinoma and What the Radiologist Needs to Know Radiology: Imaging Cancer 2025; 7(6):e250154

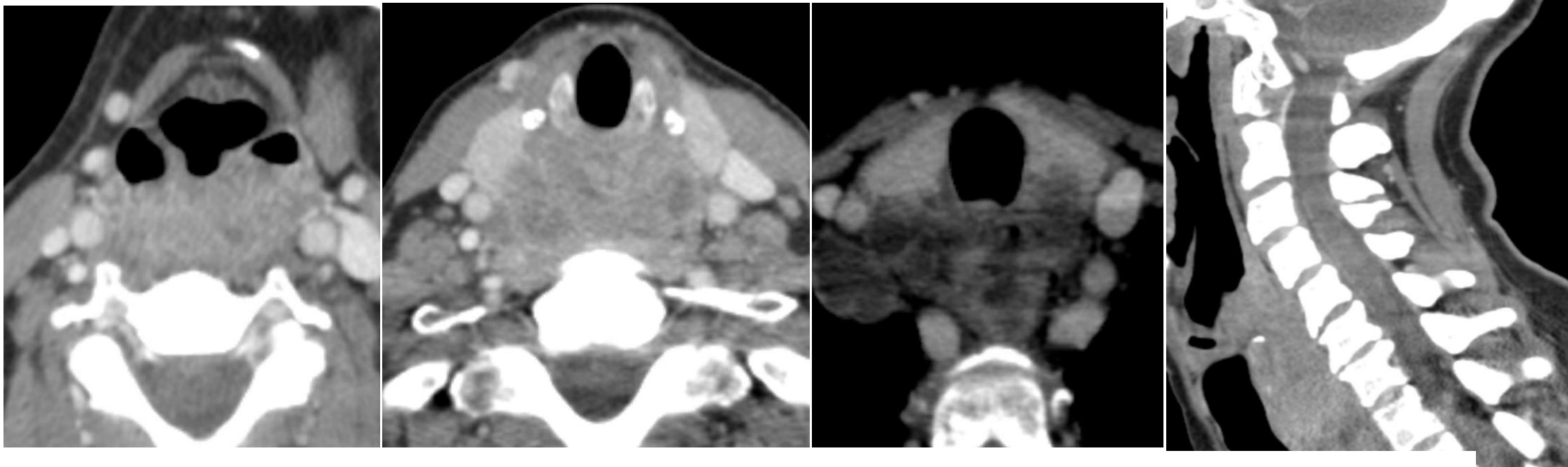
Case 6 : 78-year-old male with ear pain and increasing hoarseness

27

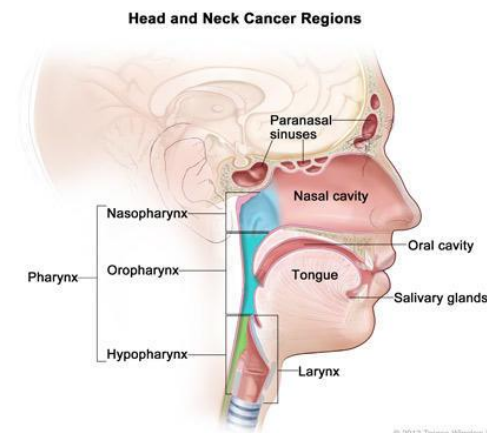


- Supraglottic Laryngeal malignancy
- Extends outside the larynx and can destroy laryngeal cartilages; look for erosion, NOT sclerosis
- MRI more sensitive for cartilage involvement

Case 7: Dysphagia



- Hypopharyngeal squamous cell cancer
- Invading the left thyroid lobe, retropharyngeal space



Hypopharyngeal cancer

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Rare

Common site: Piriform sinus,

Less common: Posterior pharyngeal wall and retro cricoid region(Plummer-Vinson syndrome)

Overall, 5-year survival rate is poor and ranges from 25% to 40%

Multisite involvement in the hypopharynx, extension beyond to involve retropharyngeal and prevertebral space and neck nodes limit survival

Top Magn Reson Imaging & Volume 18, Number 4, August 2007

Case 8 : 37-year-old with neck swelling

30



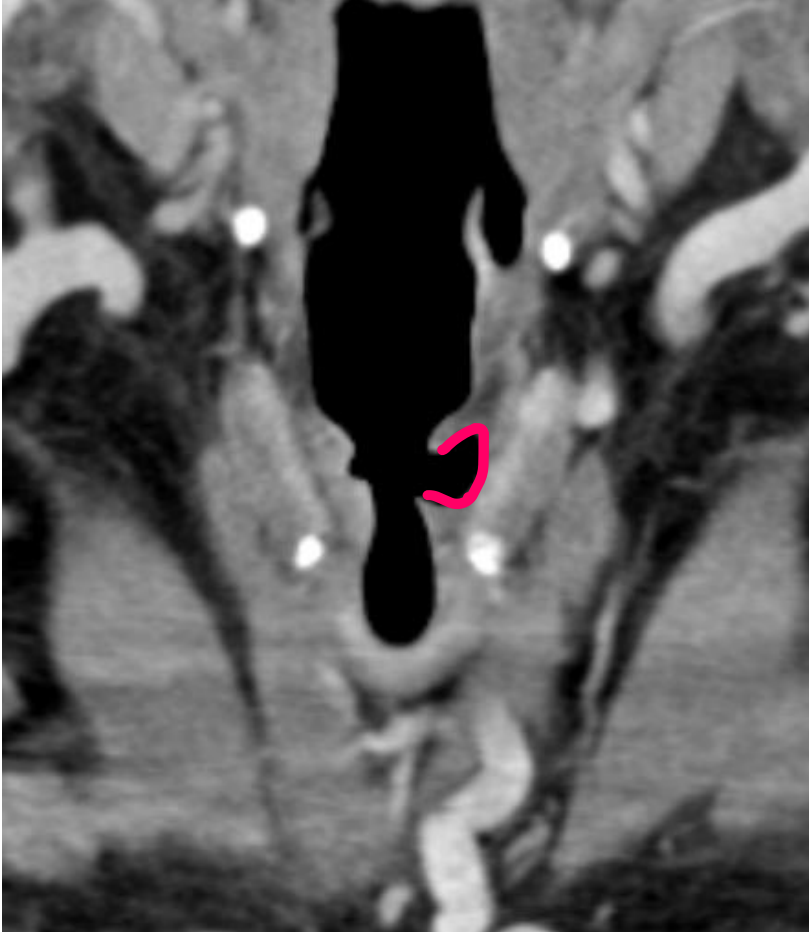
Medialized vocal cord

Sail sign



37-year-old with neck swelling

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Prominent laryngeal ventricle

Vocal cord paralysis: Abnormality along Rec laryngeal nerve

Thyroid/esophageal mass

Supraclavicular, mediastinal or Aortopulmonary nodes

Unilateral Vocal Cord Paralysis: A Review of CT Findings, Mediastinal Causes, and the Course of the Recurrent Laryngeal Nerves RSNA, 2012 • radiographics.rsna.org

Case 9; 61-year-old male left sided otalgia and then neck mass³²

- Is the Tumor confined to lymph node ?

Extracapsular tumor spread (ECS) with involvement of IJV, Sternocleidomastoid muscle.

5-year mortality rate is reduced to 27%

Neuroradiol J. 2017 August 17; 31(2): NP1



CT imaging of ECS or extranodal extension (ENE)

33

- Indistinct nodal margins (most specific)
- Infiltration into adjacent tissues
- Matted nodes
- CT is overall specific but not sensitive to identify ECS

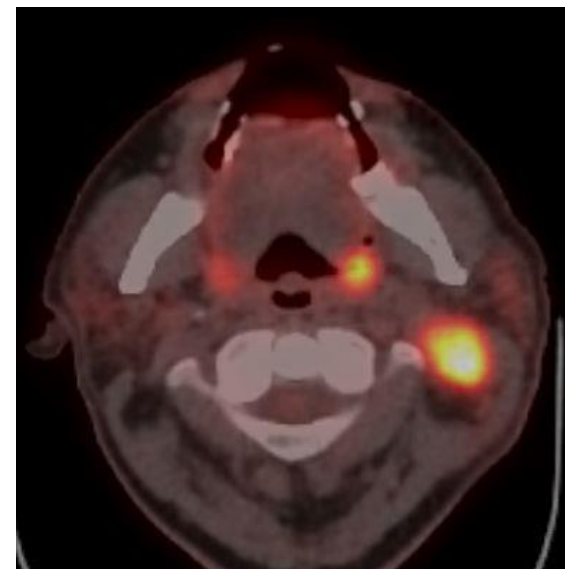


Criteria for the diagnosis of extranodal extension detected on radiological imaging in head and neck cancer: Head and Neck Cancer International Group consensus recommendations www.thelancet.com/oncology Vol 25 July 2024

Imaging in Unknown Primary

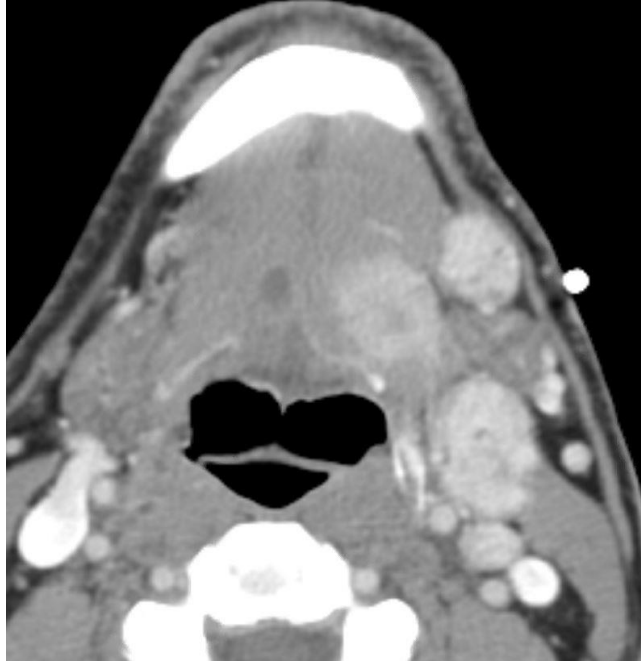
- 5-10 % :primary tumor not found despite endoscopy and CT/MRI
- PET remains the next step ;sensitivity 5-73%
- Helps target biopsy
- Most common primary site is palatine tonsil

Clinical Practice in PET/CT for the Management of Head and Neck Squamous Cell Cancer AJR 2017; 209:289–303



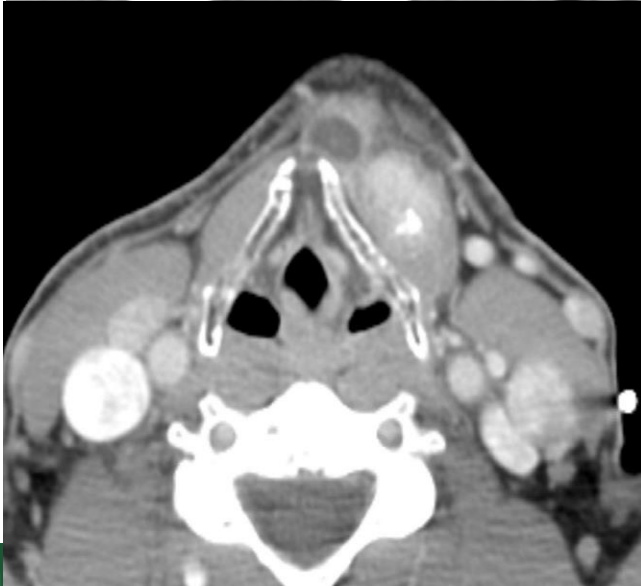
Case 10: Middle aged male with left sided neck mass

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Hyper enhancing nodes:

1. Metastasis from Thyroid, Neuroendocrine, Renal
2. Kaposi's sarcoma
3. Castleman's Disease



Diagnosis :Papillary thyroid cancer from Thyroglossal duct cyst

Approach to intensely enhancing neck nodes Diagn Interv Radiol 2016; 22:168-172

THANK YOU

