

Staging Laryngeal & Hypopharyngeal Carcinoma

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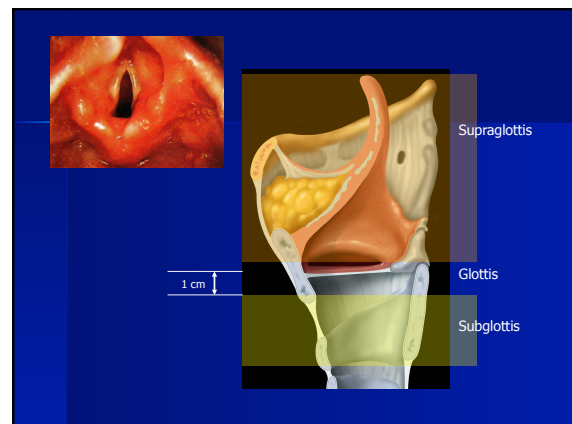
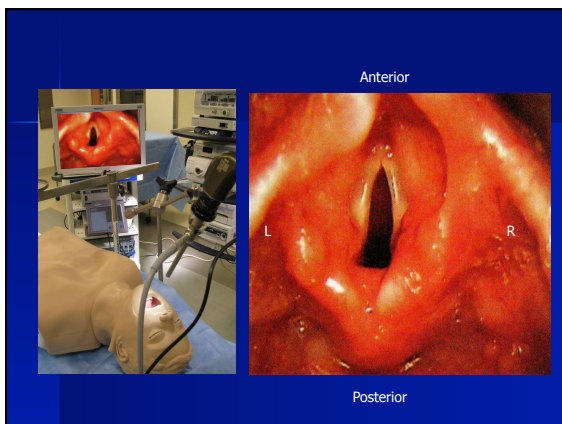


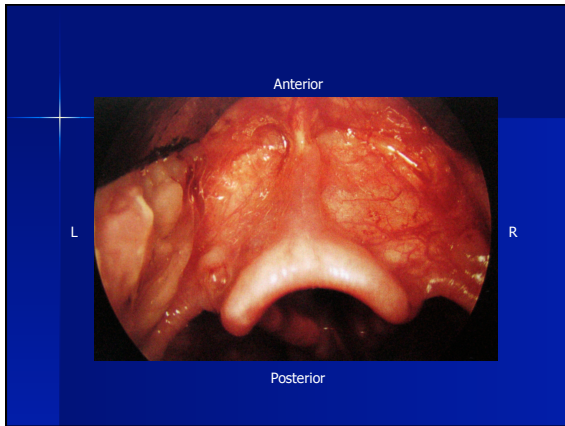
Outline

- Normal anatomy and radiologic correlates for each anatomic site
- Principles of imaging: CT vs MRI
- Understanding patterns of spread of tumors of the larynx and hypopharynx for accurate staging

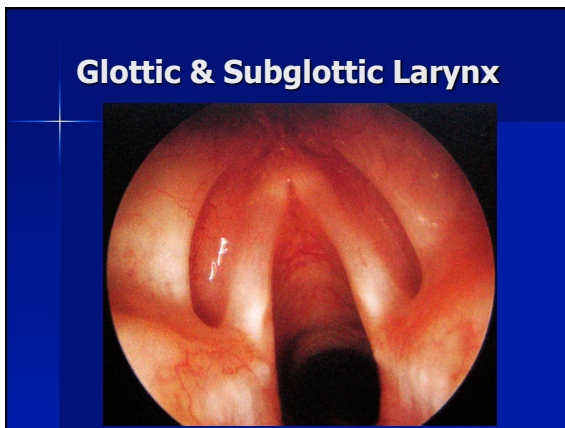
Normal Anatomy

Mucosal Anatomy





Supraglottic Larynx



Hypopharynx

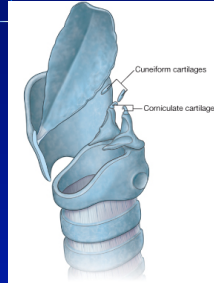
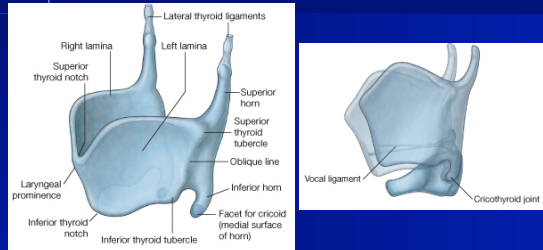
- Pyriform sinus
- Postcricoid region
- Posterior pharyngeal wall (PPW)

Laryngeal Framework

Cricoid is the foundation

- only complete ring
- maintains patent airway
- provides articulation for thyroid and arytenoid cartilages

Thyroid Cartilage



- Epiglottis
 - Protects airway
 - Thyroepiglottic lig.
- Arytenoid cartilages
 - Articulate with cricoid
 - Spans supraglottis and glottis
 - Vocal process attaches to vocal lig.

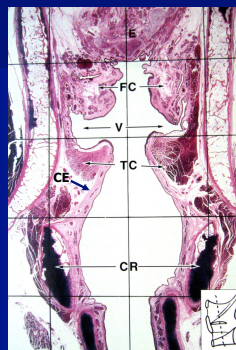
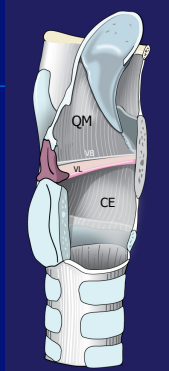
Membranes & Spaces

Quadrangular membrane



- Lateral margin of epiglottis and AEF to upper arytenoid & corniculate cartilages
- Ventricular lig is lower margin
- Upper margin supports AEF
- Medial boundary of paraglottic space

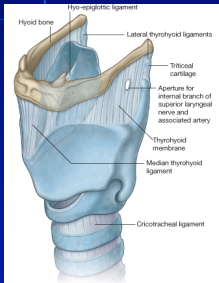
Conus elasticus



Laryngeal Spaces

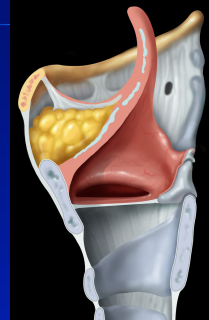
- Laryngeal "spaces" formed by membranes and enclosed by cartilages
- Two important Spaces:
 - Pre-epiglottic Space
 - Paraglottic Space

Pre-epiglottic Space



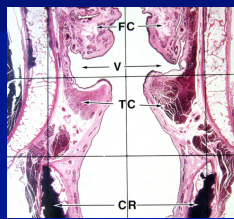
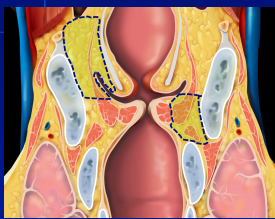
- C-shaped space enclosed between hyoid bone anteriorly & epiglottic cartilage posteriorly
- Thyrohyoid membrane wraps around to form lateral boundary of PES

Pre-epiglottic Space



- Roof is vallecular mucosa & underlying hyo-epiglottic lig divides PES into halves
- Inferiorly, bounded by petiole of epiglottis which attaches to thyroid cartilage via thyroepiglottic lig
- Normally contains fat

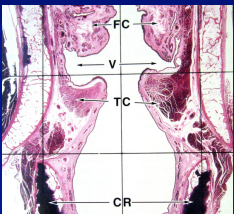
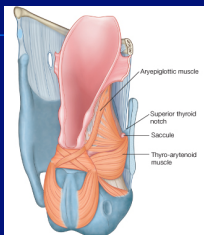
Paraglottic Space



- Lies between mucosa and cartilages of larynx
- Supraglottic PGS contains fat
- Glottic PGS contains thyroarytenoid muscle
- PGS contiguous with PES and posterior arytenoid fat pad

Muscles

Thyroarytenoid muscle



- Obliquely oriented from vocal process of arytenoid to anterior commissure in anterior midline
- Medial most fibers termed "vocalis" muscle

Imaging Modalities

CT vs MRI

- CT quicker acquisition time – less susceptible to swallowing artifact compared to MRI
- MR images ossified cartilage better than CT

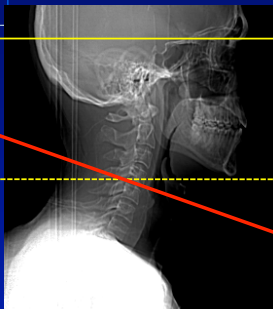
CT vs MRI



- Angle parallel to C4-5 and C5-6 disc spaces – corresponds to axis of true and false vocal folds



CT vs MRI



- Angle parallel to C4-5 and C5-6 disc spaces – corresponds to axis of true and false vocal folds



Pathways of Tumor Spread

General Principles

- Epithelial tumors – SCC
- Submucosal tumors – minor salivary gland origin
- Sarcomas from muscle and cartilage framework
- Metastatic tumors can occur

Supraglottic Larynx

Supraglottic Larynx SCCa T Staging

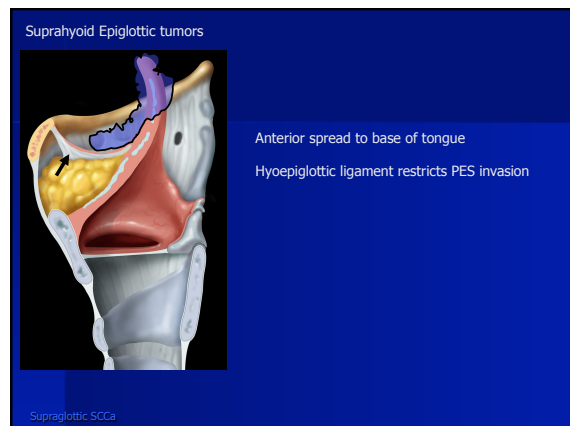
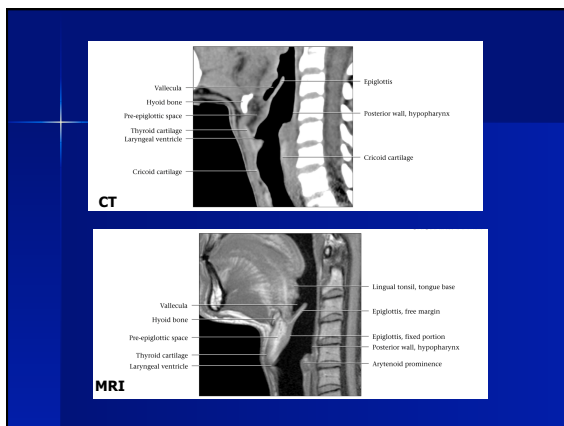
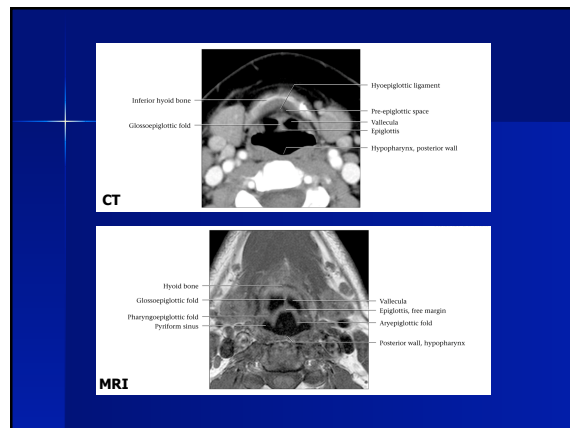
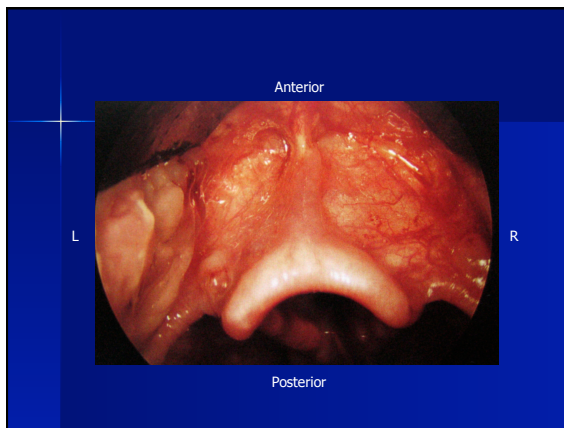
T1	Tumor limited to one subsite of supraglottis with normal vocal cord mobility
T2	Tumor invades mucosa of more than adjacent subsite of supraglottis or glottis or region outside the supraglottis (e.g. mucosa of base of tongue, vallecula, medial wall of pyriform sinus) without fixation of the larynx
T3	Tumor limited to larynx with vocal cord fixation and/or invades any of the following: postcricoid area, pre-epiglottic space, paraglottic space, and/or inner cortex of thyroid cartilage
T4a	Moderately advanced local disease Tumor invades through the thyroid cartilage and/or invades tissues beyond the larynx (e.g. trachea, soft tissues of neck including deep extrinsic muscle of the tongue, strap muscles, thyroid, or esophagus)
T4b	Very advanced local disease Tumor invades vertebral space, encases carotid artery, or invades mediastinal structures

Supraglottic SCCa

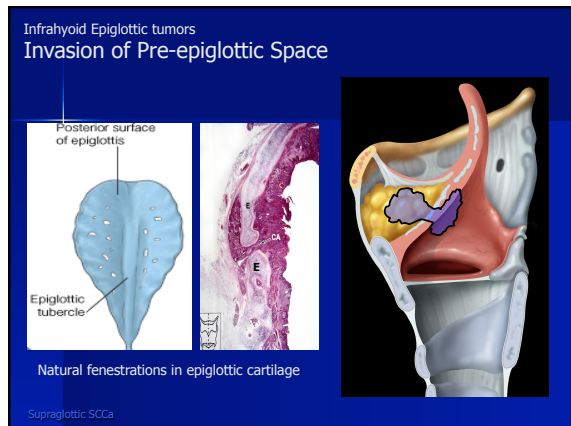
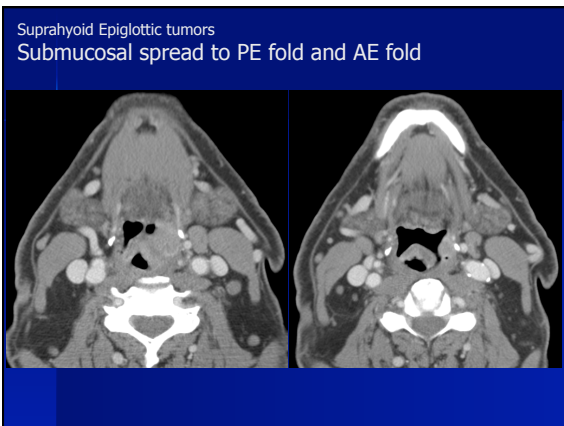
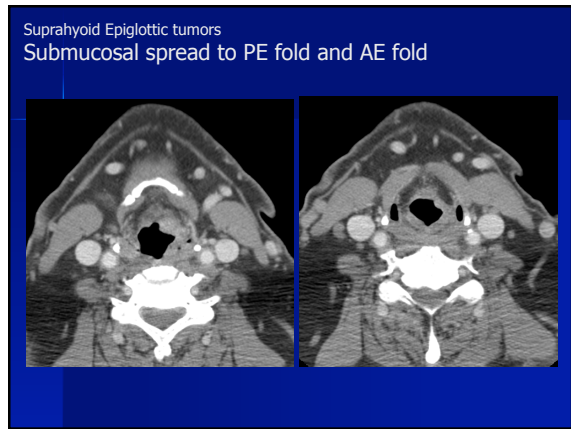
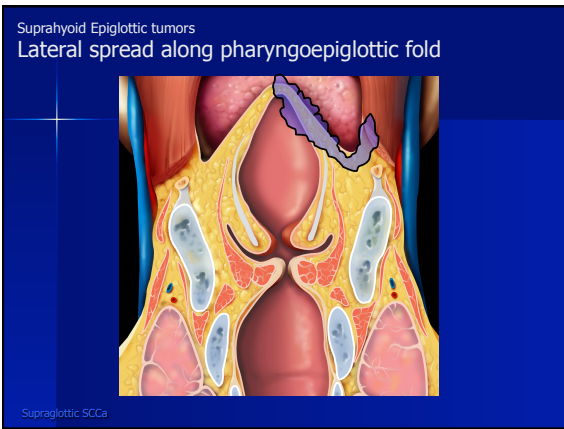
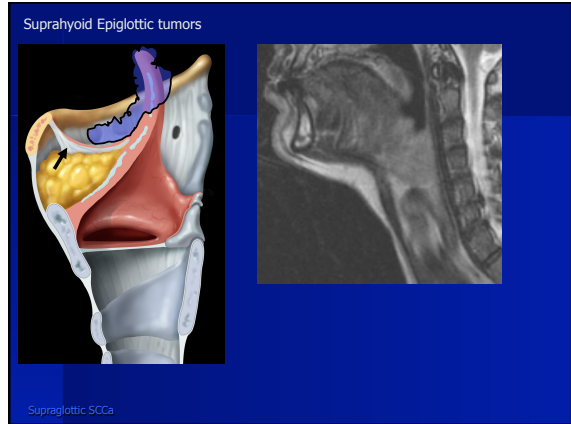
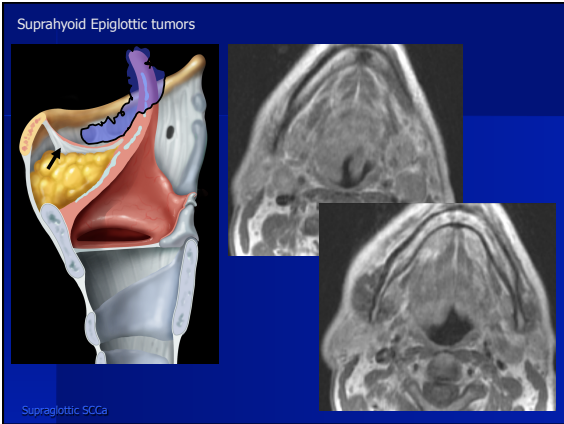
Supraglottic Larynx SCCa Spread patterns

- Epiglottic tumors
Suprahyoid (free) vs Infrahyoid (fixed) portion
- Aryepiglottic fold tumors
- False cord/ventricle tumors


Supraglottic SCCa



Supraglottic SCCa



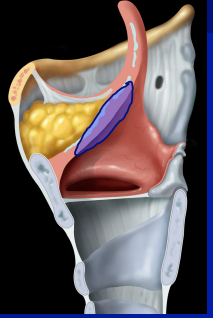
Infrahyoid Epiglottic tumors
Invasion of Pre-epiglottic Space



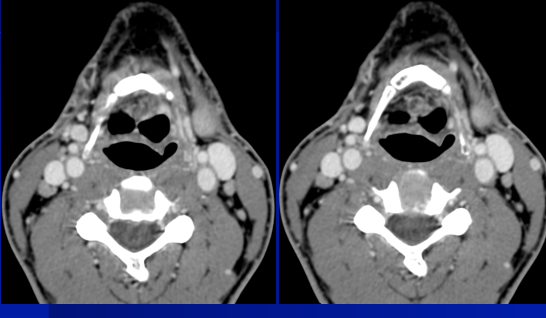
Submucosal infrahyoid epiglottic tumor
AEF clear

No extension into vallecula or PE fold

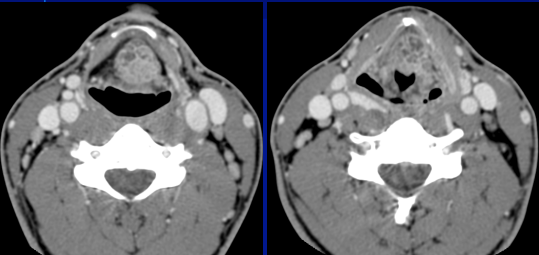
Bilaterally mobile true vocal cords



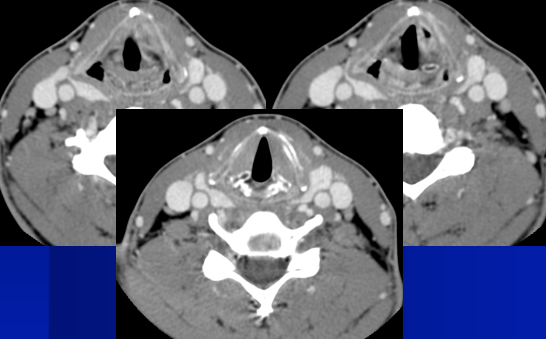
Infrahyoid Epiglottic tumors
Invasion of Pre-epiglottic Space



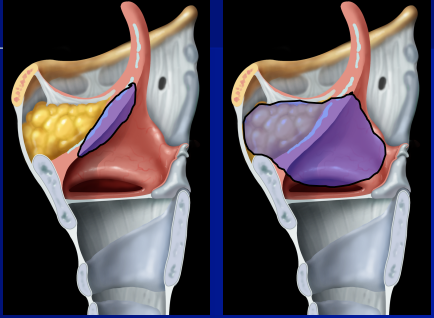
Infrahyoid Epiglottic tumors
Invasion of Pre-epiglottic Space



Infrahyoid Epiglottic tumors
Invasion of Pre-epiglottic Space



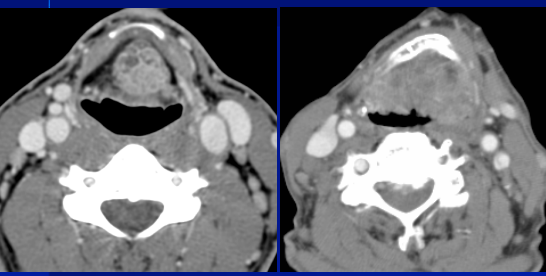
Infrahyoid Epiglottic tumors
Invasion of Pre-epiglottic Space



Clinical Extent

Imaging Extent

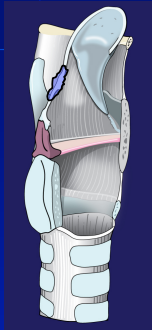
Infrahyoid Epiglottic tumors
Pushing vs Infiltrating Borders of the tumor



Minor Salivary Gland Ca

SCC

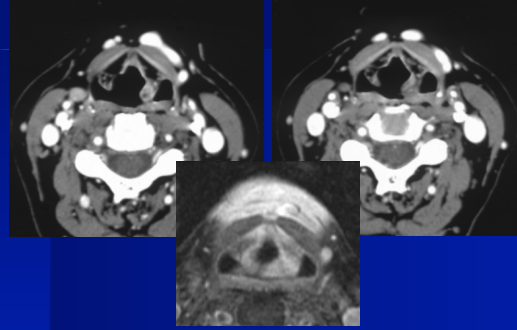
Aryepiglottic fold tumors
Patterns of Spread



Supraglottic SCCa

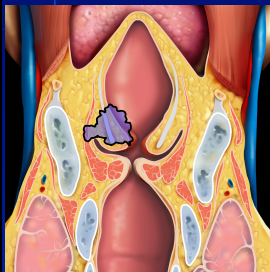
- Early tumors can remain confined to the AEF
- Lateral spread along medial wall of pyriform sinus can cause confusion regarding site of origin: SGL vs HP
“Marginal Tumors”

Aryepiglottic fold tumors
Patterns of Spread

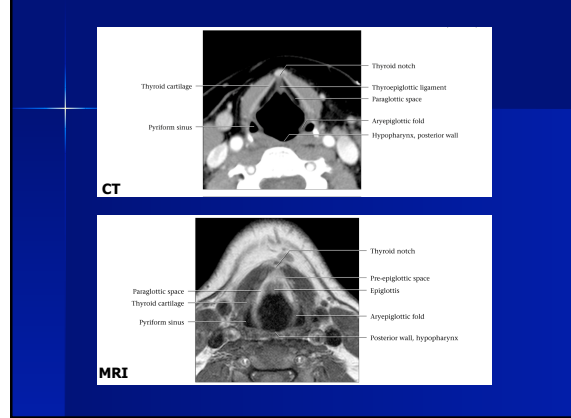
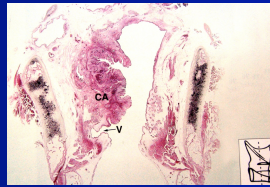


Supraglottic SCCa

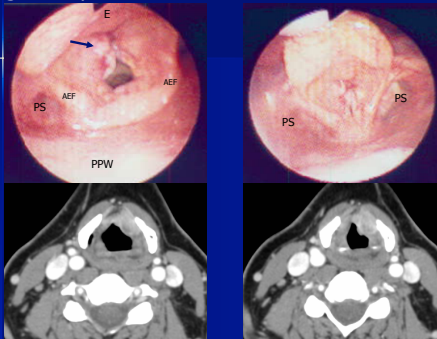
False vocal fold/ventricle tumors
Paraglottic space involvement



Supraglottic SCCa

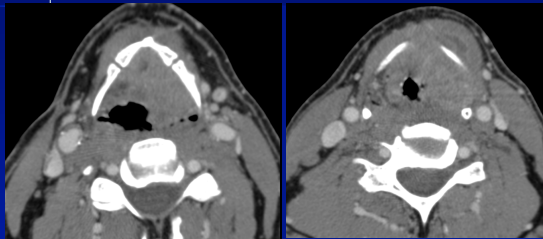


False vocal fold/ventricle tumors
Paraglottic space involvement



Supraglottic SCCa

Supraglottic tumors
Cartilage destruction and extralaryngeal spread is rare



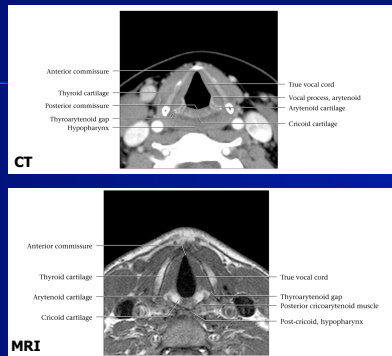
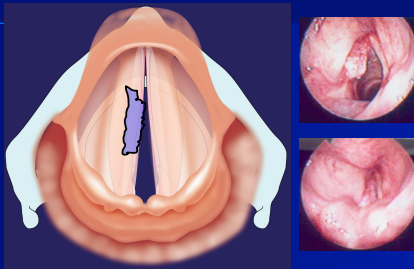
Supraglottic SCCa

Glottic & Subglottic Larynx

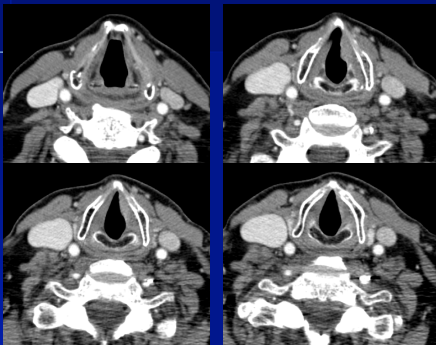
Glottic tumors T Staging

T1	Tumor limited to the vocal cord(s) (may involve anterior or posterior commissure) with normal mobility
T1a	Tumor limited to one vocal cord
T1b	Tumor involves both vocal cords
T2	Tumor extends to supraglottis and/or subglottis, and/or with impaired vocal cord mobility
T3	Tumor limited to larynx with vocal cord fixation and/or invasion of paraglottic space, and/or inner cortex of the thyroid cartilage
T4a	Moderately advanced local disease Tumor invades through the outer cortex of the thyroid cartilage and/or invades tissues beyond the larynx (e.g., trachea, soft tissues of neck including deep extrinsic muscle of the tongue, strap muscles, thyroid or esophagus)
T4b	Very advanced local disease Tumor invades prevertebral space, encases carotid artery or invades mediastinal structures

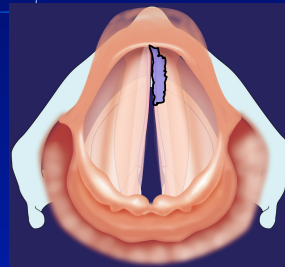
Glottic tumors Early glottic tumor confined to TVC



Glottic tumors Early glottic tumor confined to TVC

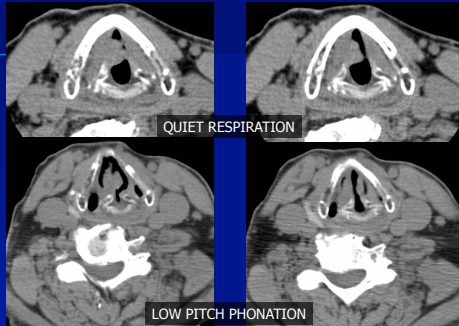


Horizontal (AP) spread Anterior Commissure



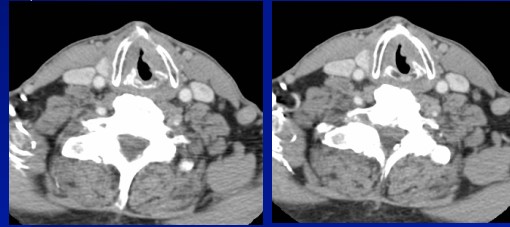
- Cartilage invasion unlikely in T1 lesions (cords mobile) – minor cartilage demineralization likely normal anatomic variation

Horizontal (AP) spread
Anterior Commissure



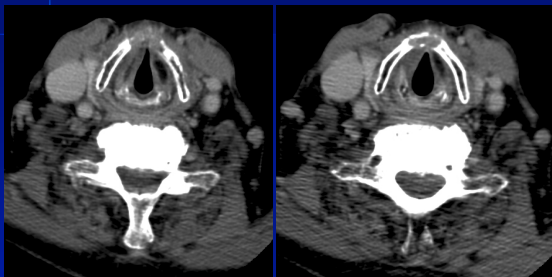
Glottic SCCa

Horizontal (AP) spread
Anterior Commissure



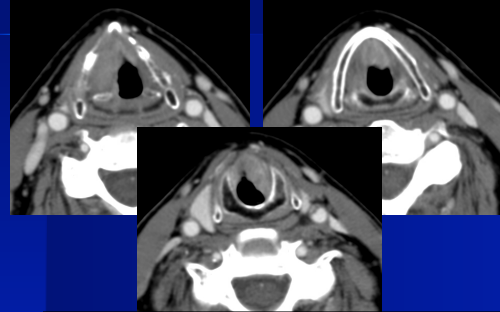
Glottic SCCa

Horizontal (AP) spread
AC lesion with cartilage invasion

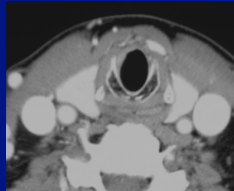
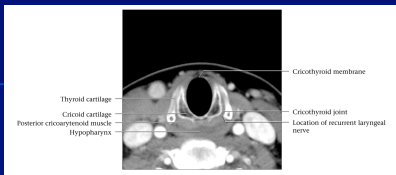


Glottic SCCa

Advanced Glottic Cancer
Horizontal, Lateral and Vertical Spread



Subglottic extension can occur on side contralateral to bulk of tumor

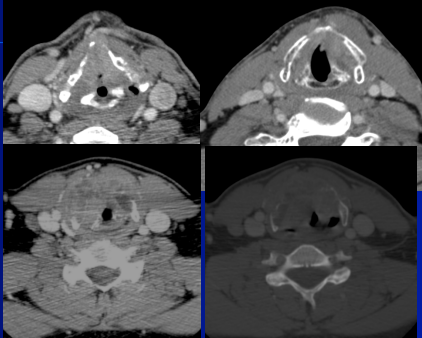


Lateral Spread
Cartilage Invasion

- Early invasion difficult to call – sclerosis can be perichondritis vs invasion

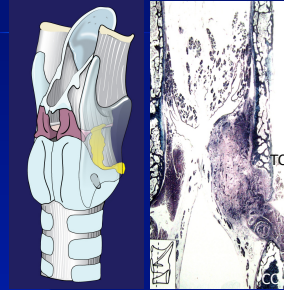
Glottic SCCa

Lateral Spread
Cartilage Invasion & Extralaryngeal Spread



Glottic SCCa

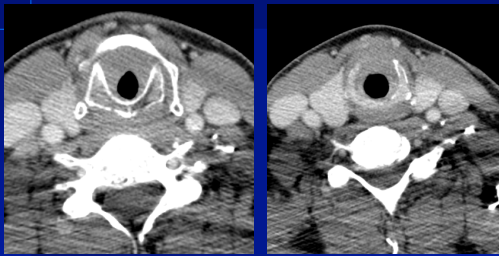
Lateral Spread
Other Routes of Extralaryngeal Spread



- Conus elasticus funnels tumor in PGS laterally towards the CT membrane
- CT membrane is a natural barrier to extralaryngeal spread
- Tumor can breach CT membrane and exit larynx

Glottic SCCa

Lateral Spread
Extralaryngeal Spread thru CT membrane



Glottic SCCa

Hypopharynx

Hypopharynx SCC

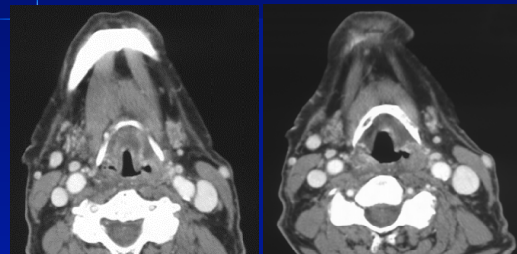
T Staging

T1	Tumor limited to one subsite of hypopharynx and/or 2 cm or less in greatest dimension
T2	Tumor invades more than one subsite of hypopharynx or an adjacent site , or measures more than 2 cm but not more than 4 cm in greatest dimension without fixation of hemilarynx
T3	Tumor more than 4 cm in greatest dimension or with fixation of hemilarynx or extension to esophagus
T4a	Moderately advanced local disease Tumor invades thyroid/cricoid cartilage, hyoid bone, thyroid gland, or central compartment soft tissue*
T4b	Very advanced local disease Tumor invades prevertebral fascia, encases carotid artery, or involves mediastinal structures

* Central compartment soft tissue includes prelaryngeal strap muscles and subcutaneous fat.

Pyiform SCCa

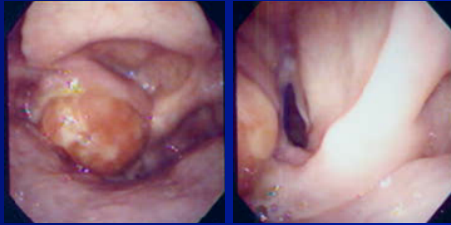
Early Tumor



HP SCCa

Pyriform SCCa

Early Tumor

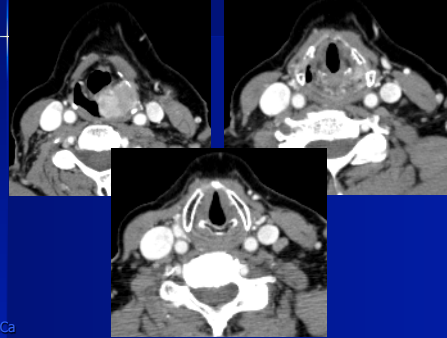


Mobile Vocal Cords

HP SCCa

Pyriform SCCa

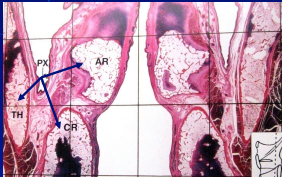
Early Tumor



HP SCCa

Pyriform SCCa

Extralaryngeal caudal spread at apex of PS

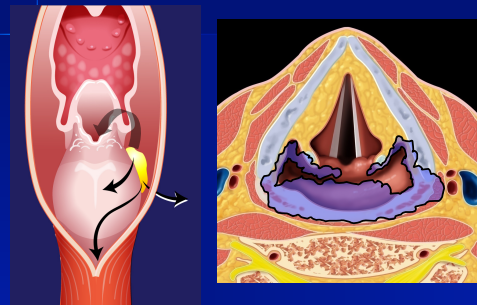


- involvement of cricothyroid joint
- upper TE groove
- involvement of RLN
- involvement of thyroid gland (superior pole)
- invasion of inferior pharyngeal constrictor and esophageal musculature – better appreciated on T2W MRI

HP SCCa

Pyriform SCCa

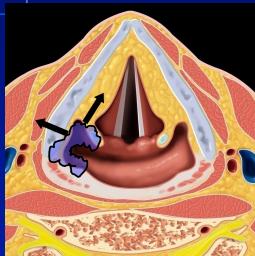
Mucosal Spread



HP SCCa

Pyriform SCCa

Deep Spread

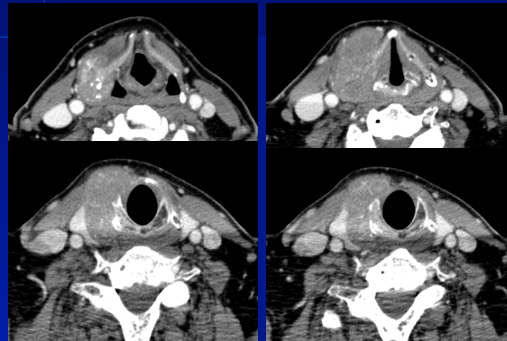


- Paraglottic space invasion
 - cephalad spread to PES
 - caudad spread deep to conus elasticus into subglottis
 - extralaryngeal spread thru cricothyroid membrane
- Lateral Spread

HP SCCa

Pyriform SCCa

Lateral spread



Pyrimform SCCa

Paraglottic Space Invasion

HP SCCa

Pyrimform SCCa

Paraglottic Space Invasion

HP SCCa

Pyrimform SCCa

Circumferential Spread

Prevertebral fascia/musculature

HP SCCa

Pyrimform SCCa

Circumferential Spread

HP SCCa

Summary

Supraglottic tumors

- Hyoepiglottic ligament is barrier to PES involvement from suprahoid tumors
- PES involvement commoner with infrahyoid tumors
- PES contiguous with PGS and arytenoid fat pad
- Vocal cord paralysis due to paraglottic space invasion or arytenoid fixation

Summary

Glottic tumors

- Horizontal spread (AC) with early tumors
- Vertical (subglottic/supraglottic) spread and lateral (PGS) spread with more advanced tumors
- Early cartilage invasion difficult to call
- Cartilage invasion occurs more commonly in glottic vs supraglottic ca especially with anteriorly located bulky glottic tumors

Summary

Pyiform Sinus tumors

- Vocal cord paralysis
direct spread into paraglottic space or
direct involvement of cricoarytenoid joint
- Check prevertebral fascia/musculature if PPW
involved
- Distal submucosal spread into cervical
esophagus can occur with skip areas

Conclusion

Understanding
laryngopharyngeal anatomy
is key to understanding
tumor spread patterns and
accurate staging