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CT Imaging for Soft Tissue Tumors of the Neck

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- An introduction via the case of our patient CB
- The Menu of Tests available to evaluate a neck mass
- An overview of neck anatomy
- The DDx of soft tissue masses in the neck
- Radiographic characteristics of neck masses
- Examples of various neck masses from different patients
- Examination of CB's scan
- A word about CB's findings



- 51yo M h/o HTN, chol p/w R tongue lesion 1/04
- Bx 2/04 c/w metastatic clear cell renal carcinoma
- CT of neck, thorax, abdomen performed for staging
 - 12 x 10 cm R renal mass with R renal vein clot
 - 2 nodules in the L lingula
 - Enlarged lymph nodes: cervical, pretracheal, hilar, pericaval, periaortic, retrocaval, retroperiotneal
 - Assymetry of the oropharynx and hypopharynx w/o definable mass
- Normal liver, spleen, adrenals, pancreas
- No bony lytic or sclerotic lesions
- Brain MRI negative for any intracranial metastases



- R radical nephrectomy and lymphadenectomy 2/04
- pathology c/w clear cell carcinoma of the kidney
- recovered well from surgery
- presents to BIDMC 5/04 to explore treatment options
- Denies recent F/C/NS, N/V/D, CP, SOB, flank pain, hematuria, dysuria, edema, neurologic sx. Does report 8 lb weight loss over 1 month.



- no palpable LAD
- Palpable mass in the R anterior neck
- CN II-XII intact



CT scan performed to evaluate extent of current disease for therapy guidance



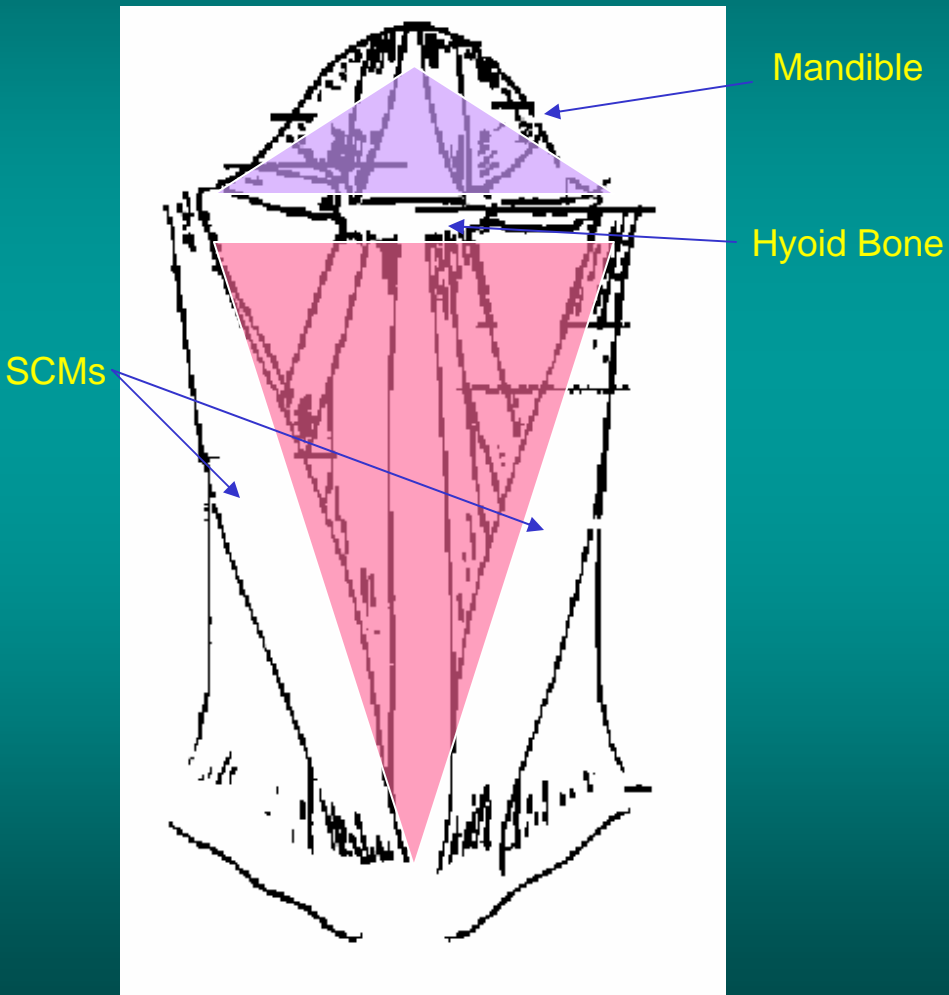
The Menu of Tests for Neck Imaging

Modality	Utility
CT	Most effective for tissue discrimination, spatial resolution, staging, mass effect, treatment planning, monitoring response
Ultrasound	Characterize cystic or vascular masses
Angiography	Pre-op embolization
PET/radio-nuclide scans	Image neoplasms, thyroid nodules
MRI	Difficult discrimination between neoplasm and normal tissue
CXR	Not used for diagnosis



Clinicians use the following triangles to navigate neck anatomy:

Anterior Triangle

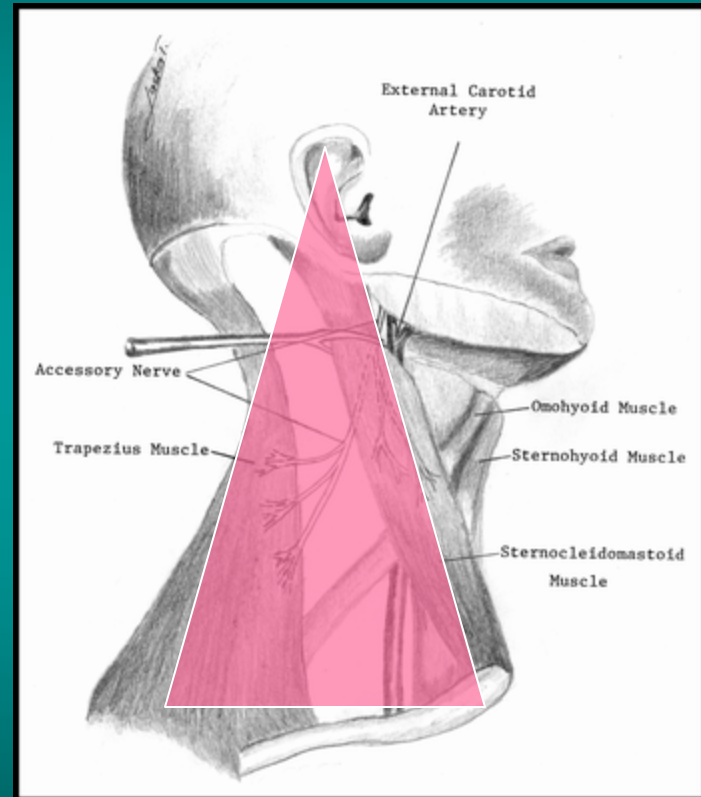


- The neck is a cylinder extending from the mandible to the thoracic inlet and from the base of the skull to the scapulae
- The anterior triangle of the neck is bordered by the SCMs and the mandible
- The anterior triangle is divided into the suprahyoid and infrahyoid regions by the hyoid bone
- The infrahyoid region is divided into the carotid and muscular triangles by the superior belly of the omohyoid muscle
- The carotid triangle contains the carotid sheath



Posterior Triangle

- The posterior triangle is bordered by the SCMs, trapezius and clavicle
- The inferior belly of the omohyoid muscle divides the posterior triangle into the superior and inferior regions
- The inferior region of the posterior triangle contains the subclavian artery and the brachial plexus

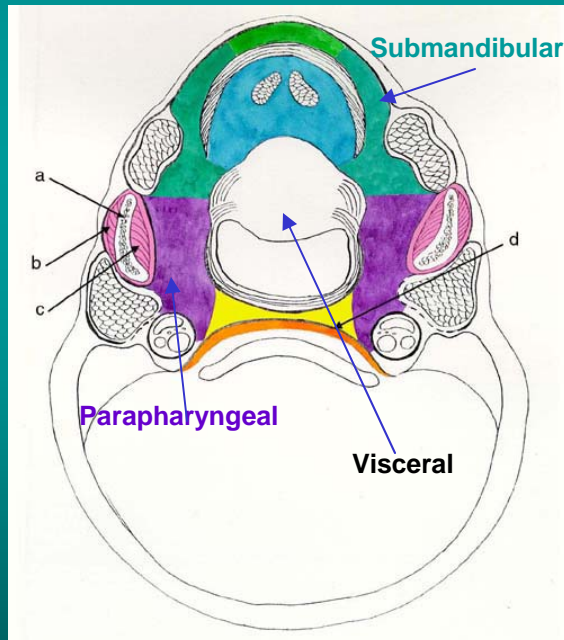


www.ptjournal.org/.../v81n3p936-figs.cfm



Radiologists use “spaces”, not triangles, to describe the neck

- The spaces of the neck are defined by the cervical fascia
- The hyoid bone again divides the neck into two regions



Suprahyoid spaces

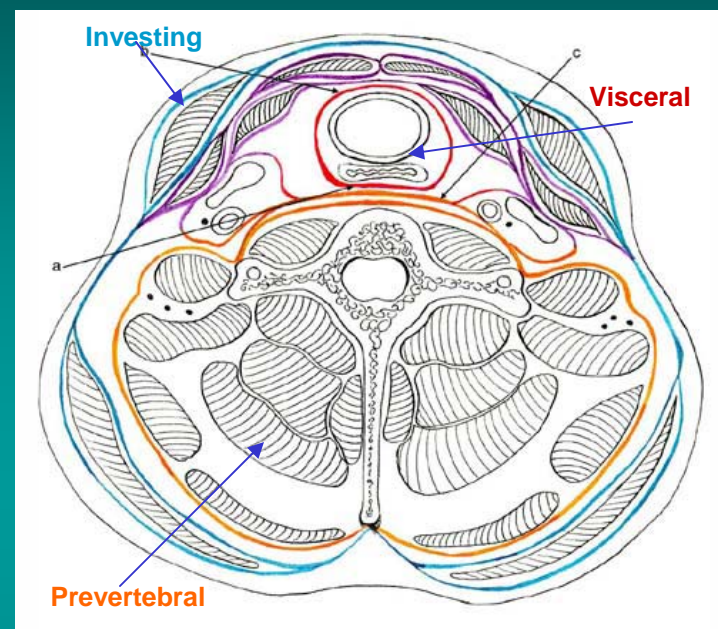
- **Submandibular** – below the mandible and floor of the mouth
- **Visceral** – containing the pharynx, larynx, trachea, glands
- **Parapharyngeal** – surrounding the pharynx



Radiologists use “spaces”, not triangles, to describe the neck

Infrahyoid Spaces

- Investing – superficial, containing musculature
- Visceral – containing organs, larynx, pharynx, trachea, cartilages, glands
- Prevertebral – spinal column and surrounding musculature





Soft tissue masses like CB's can be of many etiologies:

- Superficial/Subcutaneous: sebaceous cysts, cellulitis
- Salivary Gland: benign and malignant enlargement
- Thyroid and Parathyroid: benign and malignant enlargement
- Aerodigestive Tract: SCC, cysts
- Vascular: malformations
- Neurogenic: glomus tumors

- **Soft Tissue Lesions** **DDx**
 - Abscess
 - Lymphadenopathy (benign, metastatic)
 - Lymphoma
 - Salivary Gland Enlargement
 - Thyroid: adenoma, goiter, cyst, carcinoma
 - Branchial cleft cyst
 - Lipoma
 - Other (e.g., vascular, neurogenic, sarcoma, thyroglossal duct cyst)



The following should be evaluated when imaging soft tissue neck masses:

- Fat density
- Fluid-fluid levels
- Fascial planes
- Size
- Deep vs. superficial
- Intramuscular
- Necrosis
- Hemorrhage
- Margins



- The following slides show examples of various types of neck masses
- Each mass should be evaluated according to the radiographic characteristics listed on the previous slide
- We will end with a look back at our patient CB's CT of the neck to see if it shares any of the characteristics of the other examples of neck masses



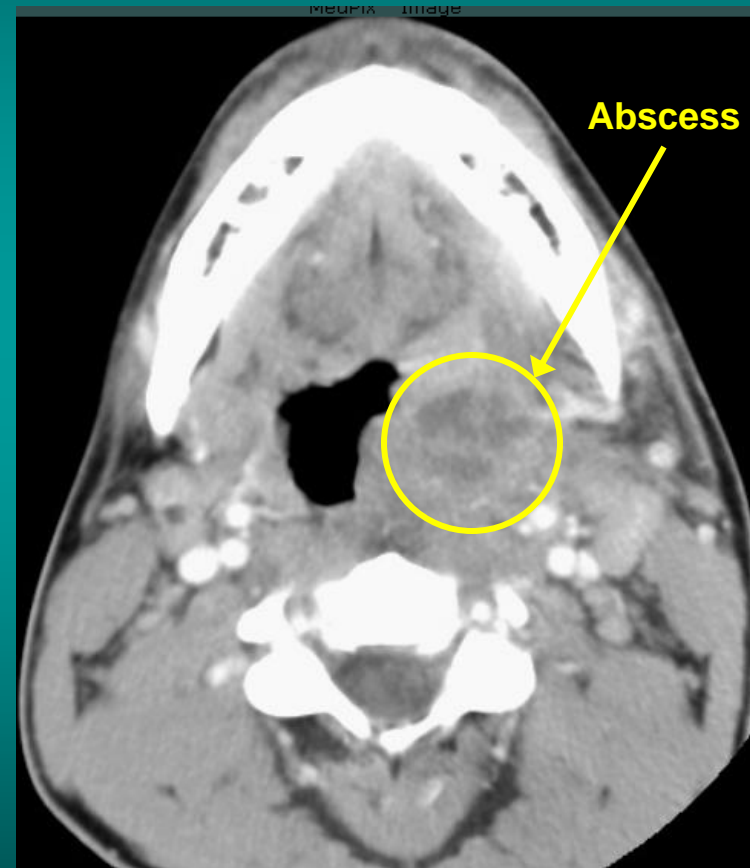
- This mass is in the anterior triangle and the parapharyngeal space
- It has no fat density, fluid-fluid levels, it is within a Fascial plane, of large Size, Deep, not intramuscular, does show evidence of Necrosis, no Hemorrhage
- Difficult to see its margins because it is of similar density to the surrounding muscle

Normal CT



PACS, BIDMC

Retropharyngeal Abscess

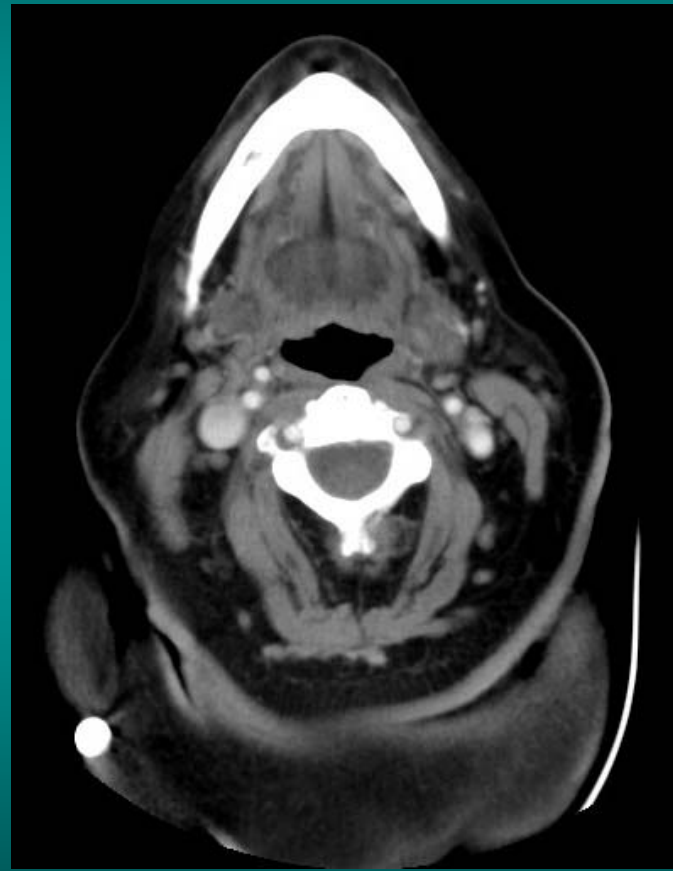


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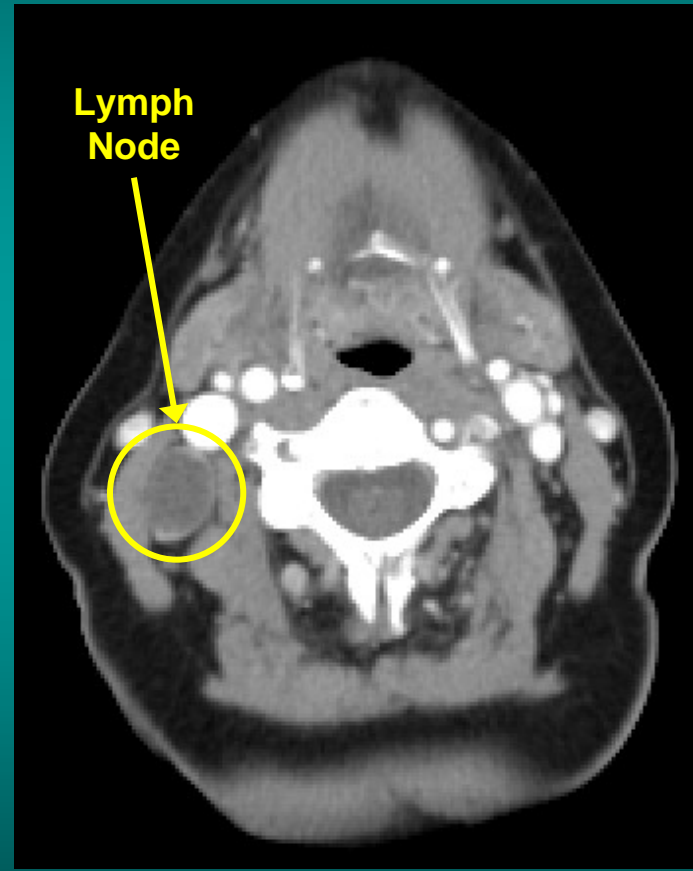
- This mass is in the posterior triangle and the prevertebral space
- It has no fat density, fluid-fluid levels, it is within a fascial plane, large size, deep, not intramuscular, does show evidence of Necrosis with ? Extension into the temporalis, no Hemorrhage, Margins here appear visible

Normal CT



PACS, BIDMC

Necrotic Lymphadenitis



Courtesy Dr. Atif Zaheer



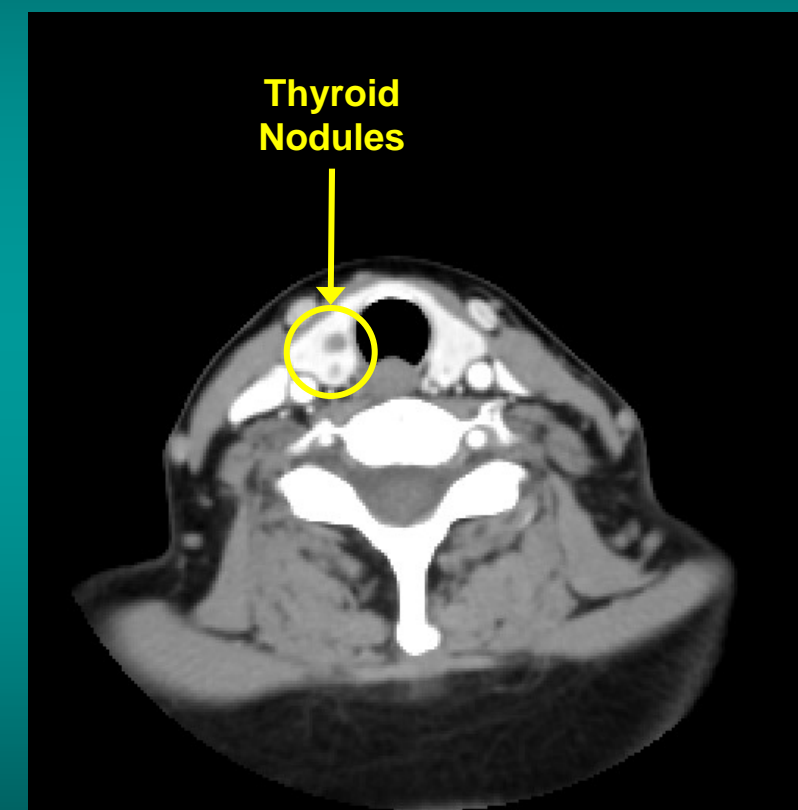
- This mass is in the anterior triangle and the visceral space
- It has no fat density, no fluid-fluid levels, it is within a fascial plane and limited to thyroid, enlarged Size, superficial, not Intramuscular, no Necrosis or Hemorrhage, good Margins. ? nodes.
- well-enhancing due to vascular nature of gland, even w/o contrast due to Iodine content!

Normal CT



PACS, BIDMC

Multi-Nodular Goiter



PACS, BIDMC



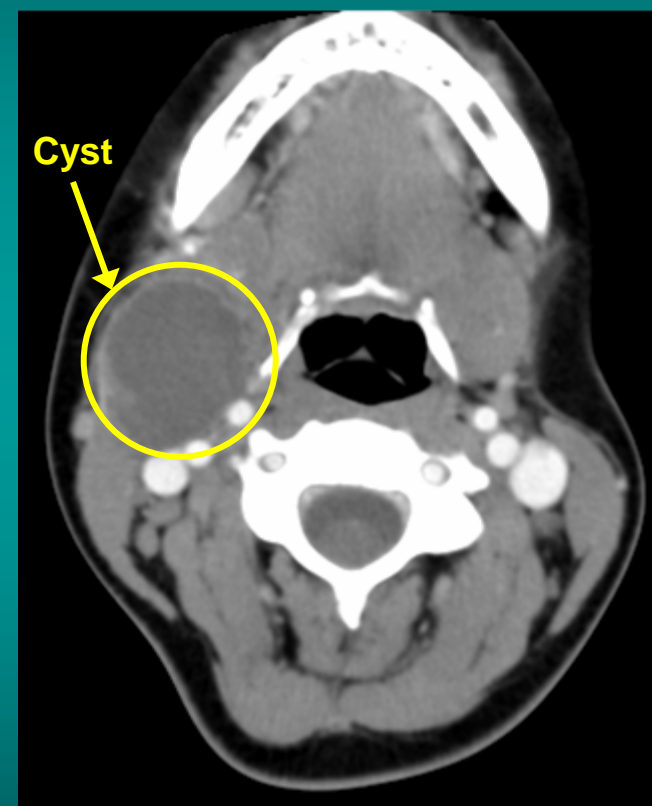
- This lesion is in the anterior triangle and the investing vs parapharyngeal space
- It is well circumscribed, does not appear to have fat density, no fluid-fluid levels, is within a fascial plane, is superficial, large, and no evidence of necrosis or hemorrhage. HU = fluid.

Normal CT



PACS, BIDMC

Branchial Cleft Cyst



Courtesy Dr. Atif Zaheer



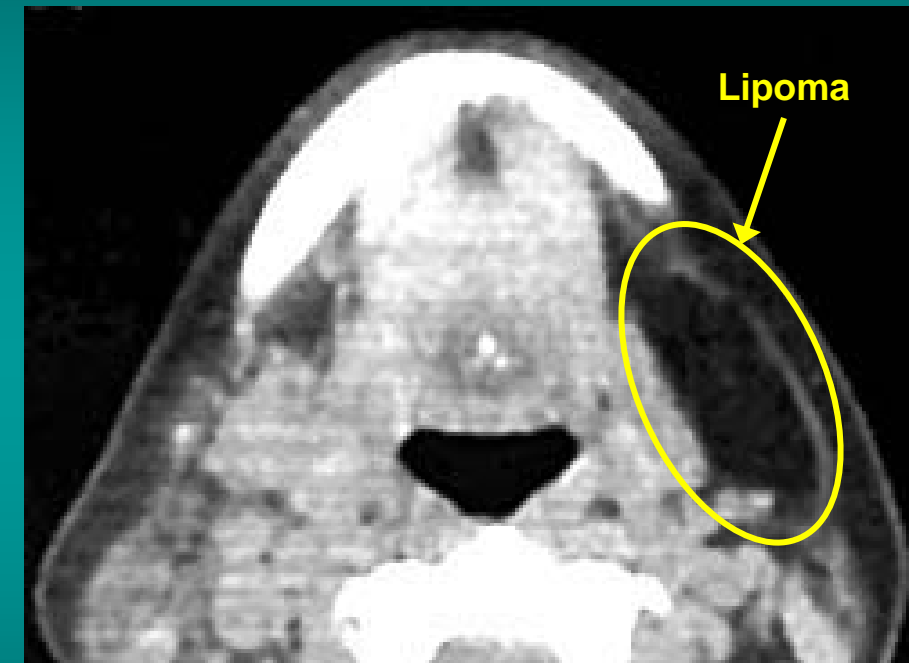
- This lesion is in the Anterior triangle, investing space
- Circumscribed, smooth, uniform attenuation. -65 to -125 HU, thin fibrous septa, does not enhance w/ IV contrast

Normal CT



PACS, BIDMC

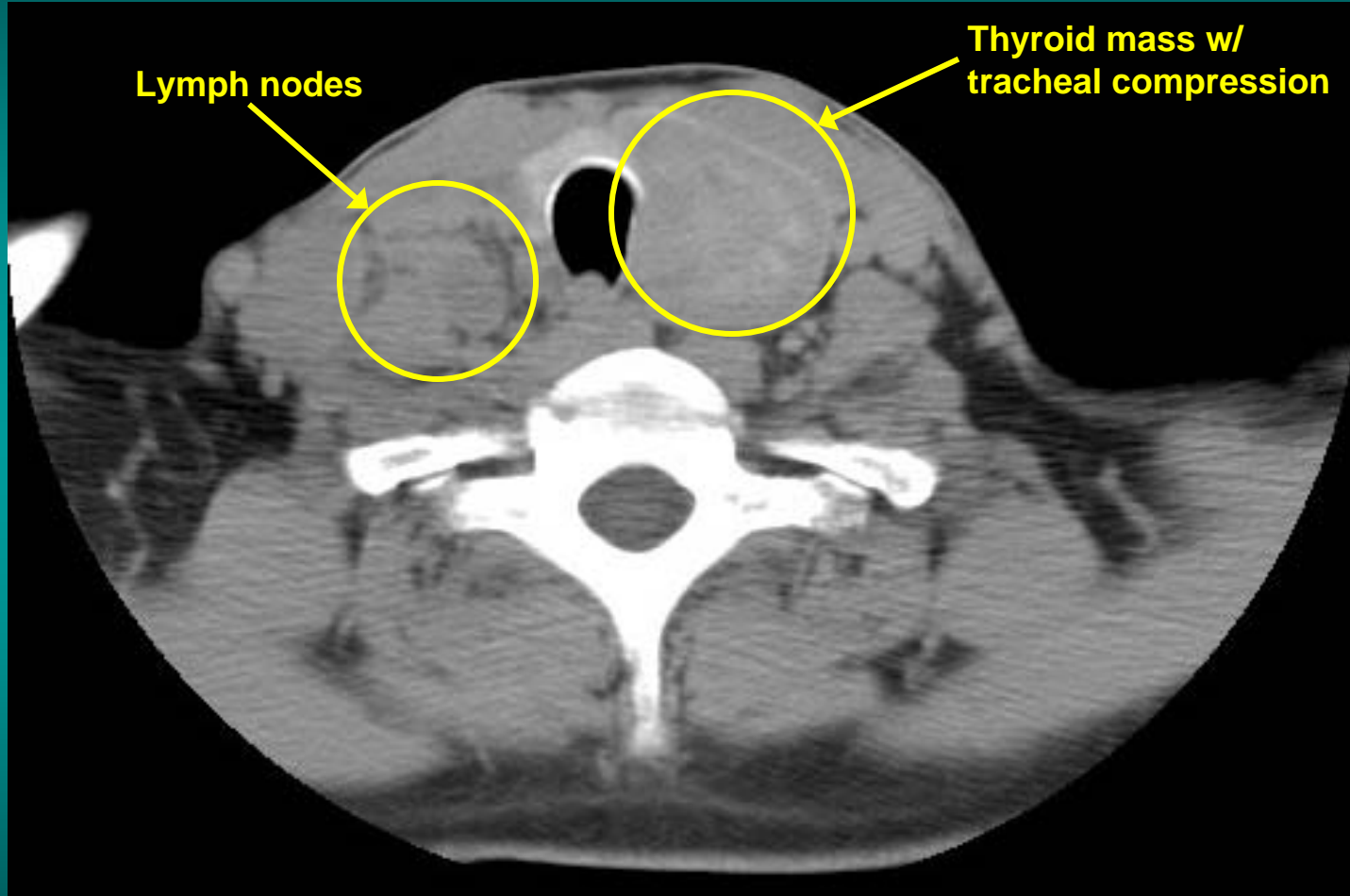
Submandibular Lipoma



www.aichi-gauin.ac.jp/.../NB122.htm



CB scan showed left thyroid enlargement and right-sided lymphadenopathy



- Anterior triangle, visceral space. Nodes are anterior and parapharyngeal.
- left lobe enlargement to 48mm, appears hypodense for a thyroid though pt has not yet gotten contrast.
- Mass is heterogenous with cyst formation on both sides, even though R is not as large as the left
- R sided LAD (level 5), some with central hypodensity that may indicate necrosis, size and multiplicity of nodes (also level 4 and 3) suggest malignancy
- Displacement of trachea to L

Courtesy Dr. David Hackney



CT findings could be consistent with the following:

- Goiter with nodal mets
- Primary thyroid malignancy w/ nodal mets
- **Metastatic disease involving both thyroid and nodes**



- Metastasis to thyroid gland is a very rare cause of thyroid enlargement
- Vascular supply may result in entrapment of tumor emboli
- Usually nodular, either single or multiple
- Can mimic primary thyroid gland neoplasms or multinodular goiter
- RCC is one of the most common types of cancer to metastasize to the thyroid
 - Others include melanoma, breast, lung, colon
 - SCC local invasion
- When thyroid mets are the first clinical presentation, the primary is most often RCC



- CT scan is the modality of choice for tissue differentiation, staging and monitoring treatment of neck pathology
- Neck anatomy is divided into triangles or spaces
- Neck masses may arise from many tissues of the neck
- Soft tissue neck masses have few specific radiographic characteristics but many hints can point the radiologist toward a benign or malignant process
- CT may not be able to delineate the origin of a neck mass!



- Branstetter, BF and Weissman JL. Normal Anatomy of the Neck with CT and MR Imaging Correlation. Radiologic Clinics of North America; Sept 2000 38:925-940.
- Eskey, CJ, Robson, CD, Weber AL. Imaging of Benign and Malignant Soft Tissue Tumors of the Neck. Radiologic Clinics of North America; Sept 200, 38:1091-1104.
- Gottlieb MD, Roland JT. Paradoxical spread of renal cell carcinoma to the head and neck. Laryngoscopy; Sept 1998: 1301-5.
- Hefess, CS, Wenig, BM, Thompson LD. Metastatic Renal Cell Carcinoma to the Thyroid Gland. Cancer; November 1 2002: 1869-1878
- Kazuhiro A, Hasegawa T, Onodera S, Oishi Y, Suzuki M. Renal Metastasis of Thyroid Carcinoma. International Journal of Urology; 2002 (9): 656-658.
- Larson SM, Robbins R. Positron emission tomography in thyroid cancer management. Seminars in Roentgenology; Apr 2002: 169-74.
- Lev S, Lev MH. Imaging of Cystic Lesions. Rad Clin N Am; Sept 2000; 38:1013-1029.
- Pickhardt, PJ, Pickard RH. Sonography of delayed thyroid metastasis from renal cell carcinoma with jugular vein extension. American Journal of Roentgenology; Jul 2003: 272-4.
- Sakai, O, et al. Lymph Node Pathology: Benign Proliferative, Lymphoma and Metastatic Disease. Rad Clin N Am; Sept 2000; 38: 979-999.
- Som, PM, et al. Head and Neck Imaging. Mosby; 1991: 498-669.
- Weber, AL, Randolph G, Aksoy FG. The Thyroid and Parathyroid Glands: CT and MR Imaging and Correlation with Pathology and Clinical Findings. Radiologic Clinics of North America; Sept 2000, 38:1105-1130.
- Weber, AL, Siciliano, A. CT and MR Imaging of Neck Infections with Clinical Correlations. Rad Clin of N Am; Sept 2000; 38:941-969.



- My May 2004 Core Radiology Classmates
- Pamela Lepkowski
- Gillian Lieberman, MD
- Dr. David Hackney
- Dr. Michael Schuster
- Dr. Atif Zaheer
- Larry Barbaras our Webmaster
- Michael Levinson