



Thyroid Ultrasound

Lecture 18



Objectives

- Identify the anatomy, location of the thyroid gland & parathyroid gland.
- Understand the radiological sign and radiological investigations of thyroid Ophthalmopathy.
- Recognize renal osteodystrophy involving different skeletal images as well as radioiodine study.
- To know the thyroid nodules and how we can differentiate benign from malignant nodule.
- To explain the usage of scintigraphy for thyrotoxicosis.

Color index:

Black: Main text

Red: Important

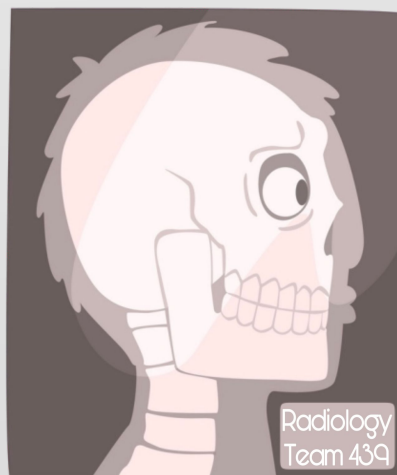
Yellow: Golden notes

Green : Drs notes 439

Dark green : Drs notes

438

Gray: Extra



Thyroid Anatomy

- Superficial, butterfly-shaped gland that is variable in size and weighs approx. 25-35 grams.
- Two lobes in the anterior neck on either side of the trachea inferior to the thyroid cartilage. Each lobe measures approximately 4-6 cm in length.
- Joined by isthmus.
- Variants (Size and shape, pyramidal lobe, ectopic)
- Average width: 12-15 mm (each lobe)
- Average height: 40-60 mm long

Arterial supply

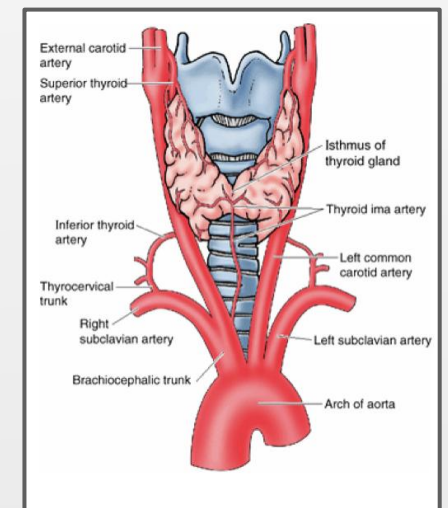
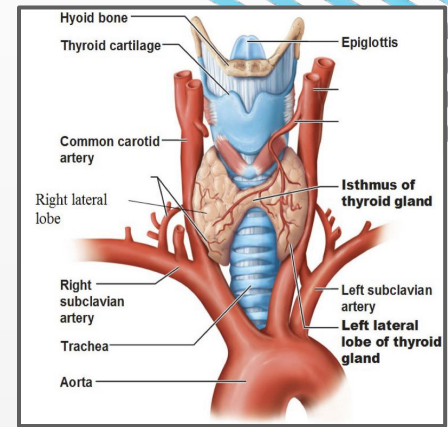
The Superior Thyroid Artery > arises from the External carotid artery.

The Inferior Thyroid Artery > arises from the thyrocervical trunk.

Venous supply

The Superior and Middle Thyroid Vein > drain into the Internal jugular vein

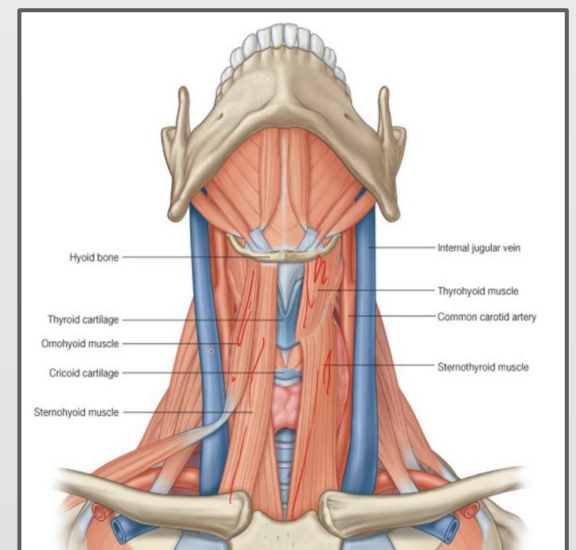
The Inferior Thyroid Vein > drain into the the brachiocephalic vein.



Thyroid location

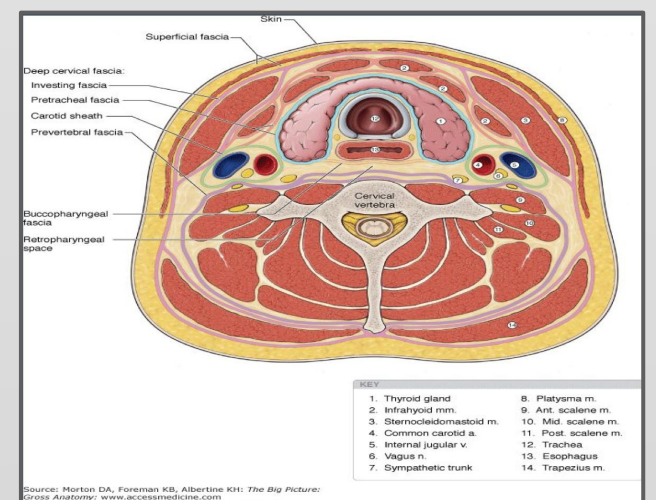
- The thyroid extends from **C5 to T1** and **lies anterior to the thyroid and cricoid cartilages** of the larynx and the first three tracheal rings.
- Bilateral lobes bordered laterally by the CCA and IJV.
- Isthmus unites the lobes at the level of 2nd, 3rd and 4th tracheal rings.
- Lies between the ant strap muscles (sternocleidomastoid, sternothyroid and sternohyoid) and posterior longus colli muscle.

so in case of taking a biopsy you should introduce the needle in an oblique position. if you go medially you will injure the=RLN, laterally=carotid space ect.



Relations

- Anteriorly: strap muscles.
- Posteriorly: thyroid cartilage, cricoid cartilage, trachea.
- **Posteromedially:** trachea, esophagus, tracheoesophageal groove (containing lymph nodes, **recurrent laryngeal nerve**, parathyroid glands).
- **Posterolaterally:** carotid space (carotid artery, internal jugular vein, **vagus nerve**).



Source: Morton DA, Foreman KB, Albertine KH: *The Big Picture: Gross Anatomy*. www.accessmedicine.com
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Thyroid US

» Thyroid US: Why

- Diagnostic purposes
- FNA for suspicious thyroid nodules
- Therapeutic purposes using US as guidance for RFA of benign thyroid gland nodules, etc.



US Scanner
mean frequency of 10 to 14mhz
Transducer : linear

» Thyroid US: Indications

Evaluation of :

- Location and characteristics of palpable neck masses, including an enlarged thyroid.
Presence, size and location of thyroid gland
- Lab abnormalities
- Abnormalities detected by other lab exams
- Follow-up imaging of previously detected thyroid nodules, when indicated.
- Patients at high risk of occult thyroid malignancy

Including but not limited to :

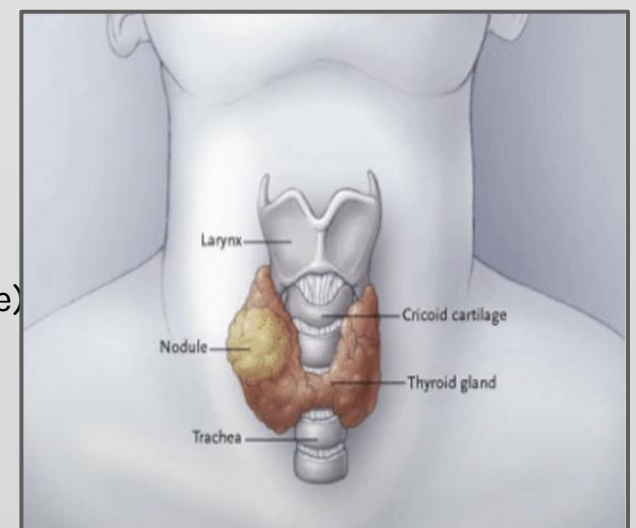
- Evaluation for regional nodal metastases in pts with proven or suspected thyroid carcinoma before thyroidectomy.
- Thyroid gland for suspicious nodules before neck surgery for non thyroid disease
- Evaluation for recurrent diseases or regional nodal metastases after total or partial thyroidectomy for thyroid carcinoma
- Thyroid gland for suspicious nodules before radioiodine ablation of the gland.

» Thyroid US: Examination

- The right and left lobes should be imaged in longitudinal and transverse planes
- The size of each thyroid lobe should be recorded in 3d (AP, Tran, Long)
- Recorded images should include
 1. Trans images of sup, mid and inf portions of right and left thyroid lobes.
 2. Longitudinal images of the medial and lat portion of both lobes
 3. And at least a trans image of isthmus
- The thickness of isthmus on the trans view should be recorded.
- A Color Doppler can be used to supplement the greyscale evaluation of diffuse or focal abnormalities of the thyroid.

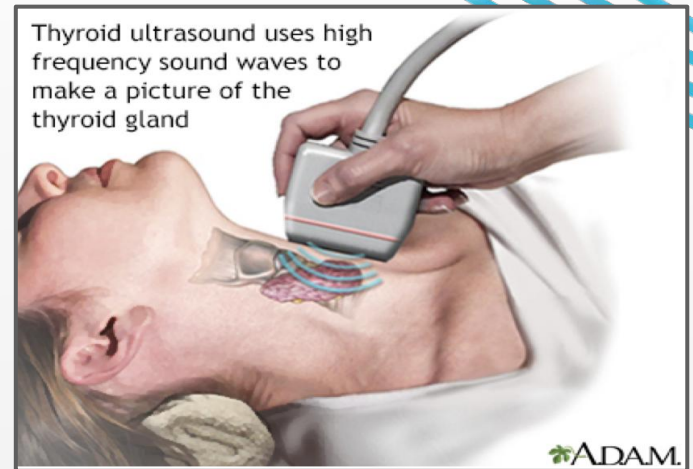
» Thyroid US: Scanning Fields

- Central Neck
- Often necessary to extend imaging to include:
 1. The soft tissue above the isthmus (evaluate possible pyramidal lobe)
 2. Congenital abnormalities



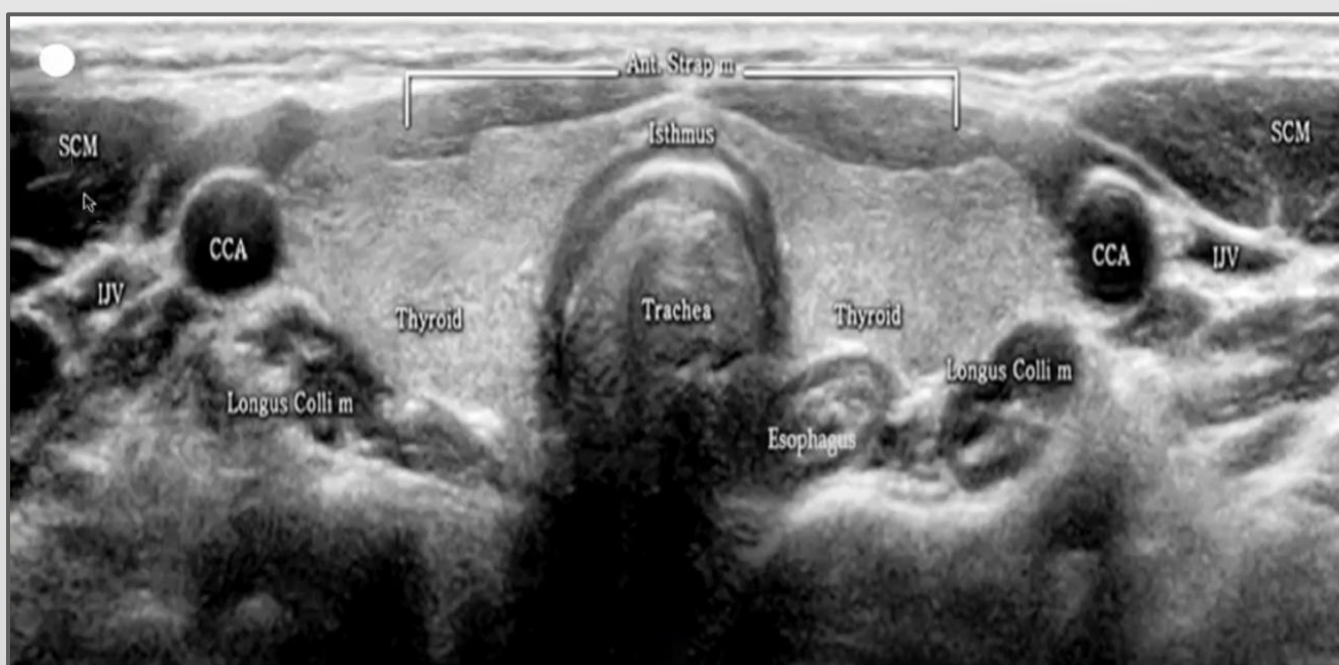
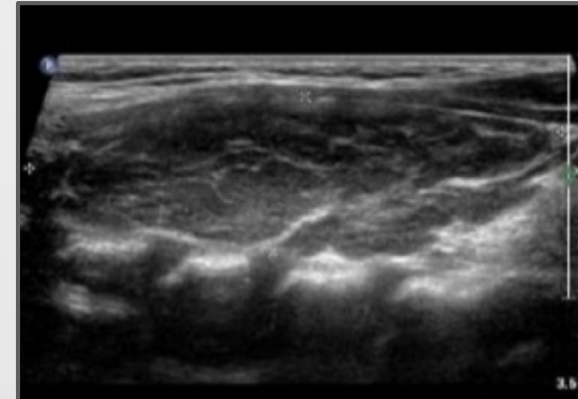
» Thyroid US: Advantages

- Painless, quick (real-time), no contrast material, no radiation.
- Chances of missing something during palpation.
- Can be used in pregnancy
- Can detect thyroid nodules as small as 2-3mm and provide guidance for FNA biopsy

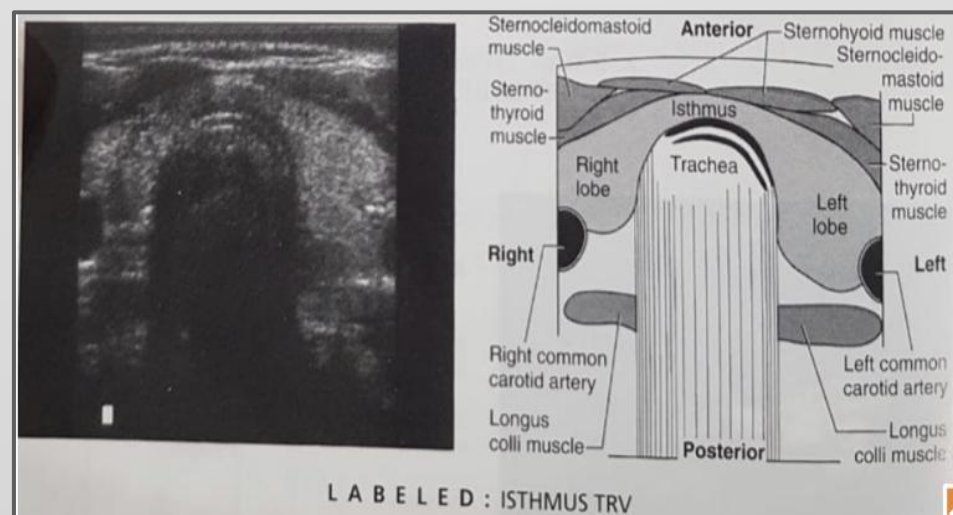
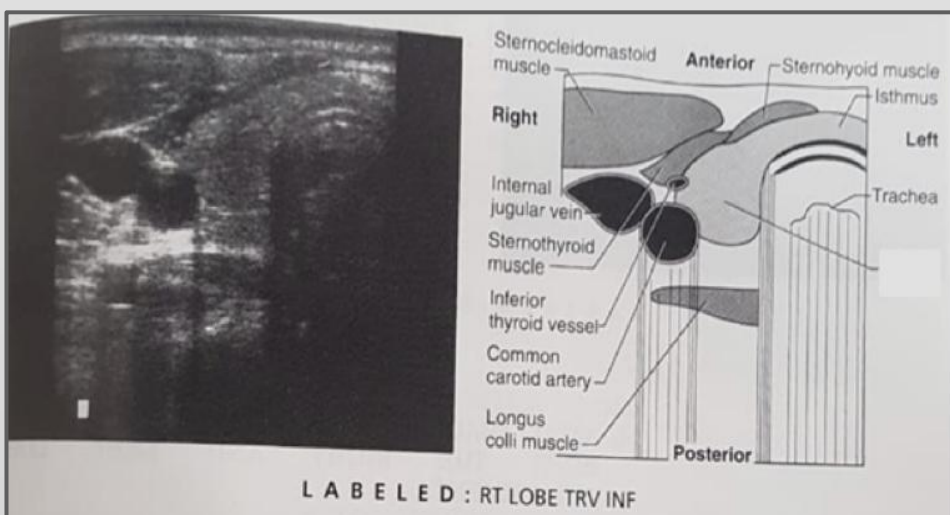
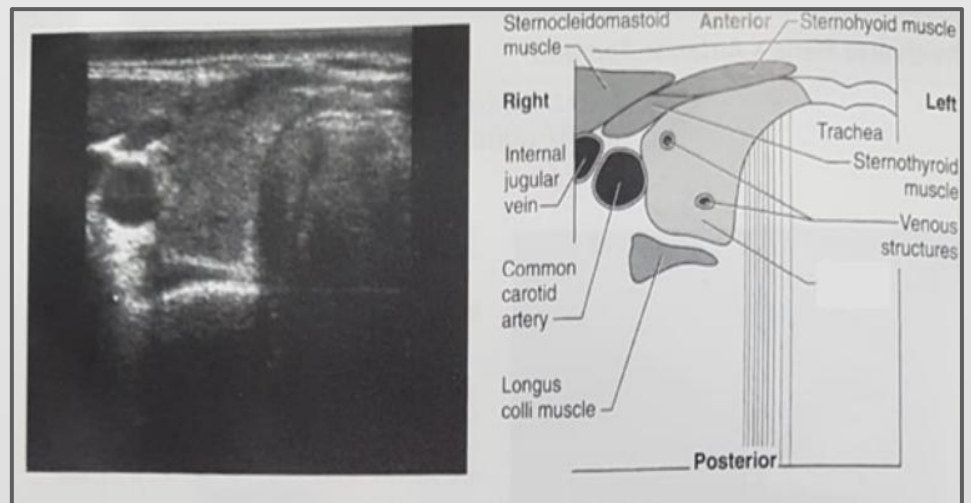
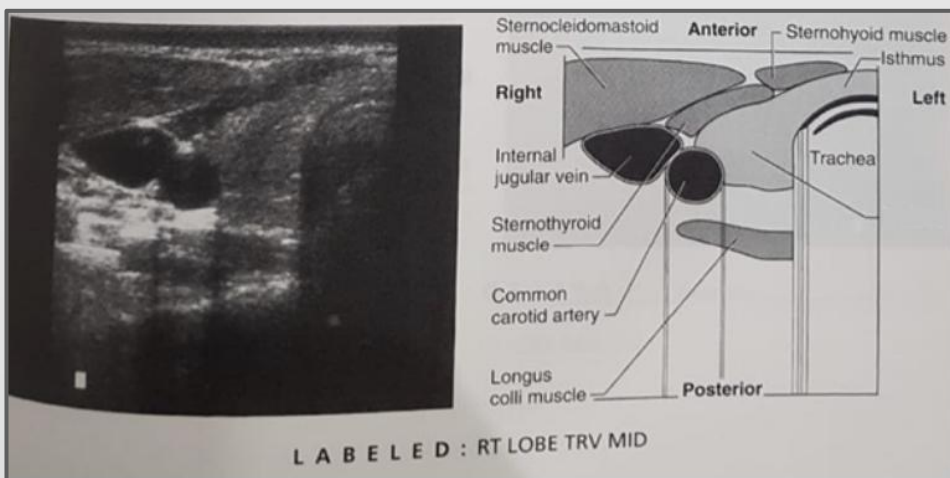
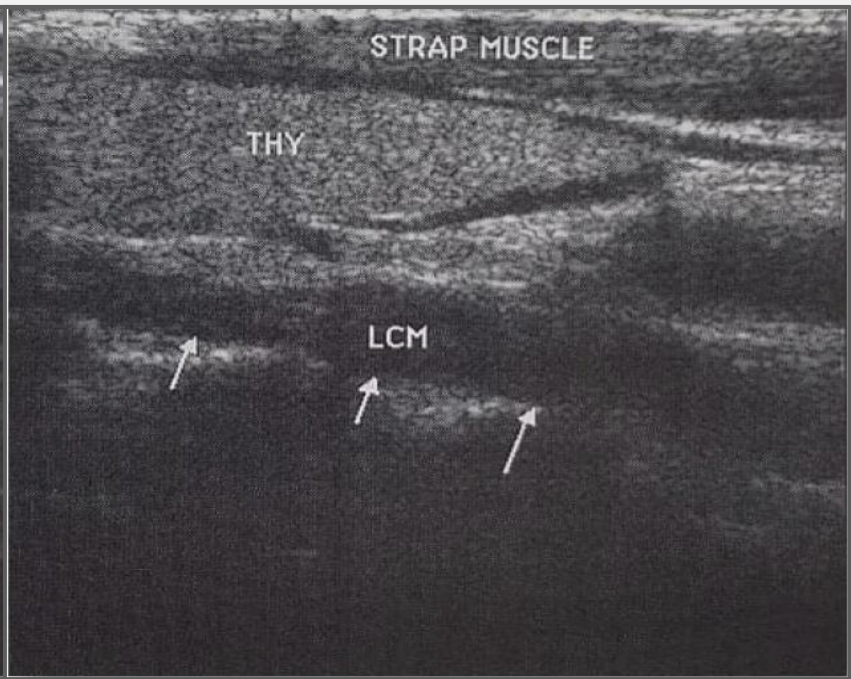
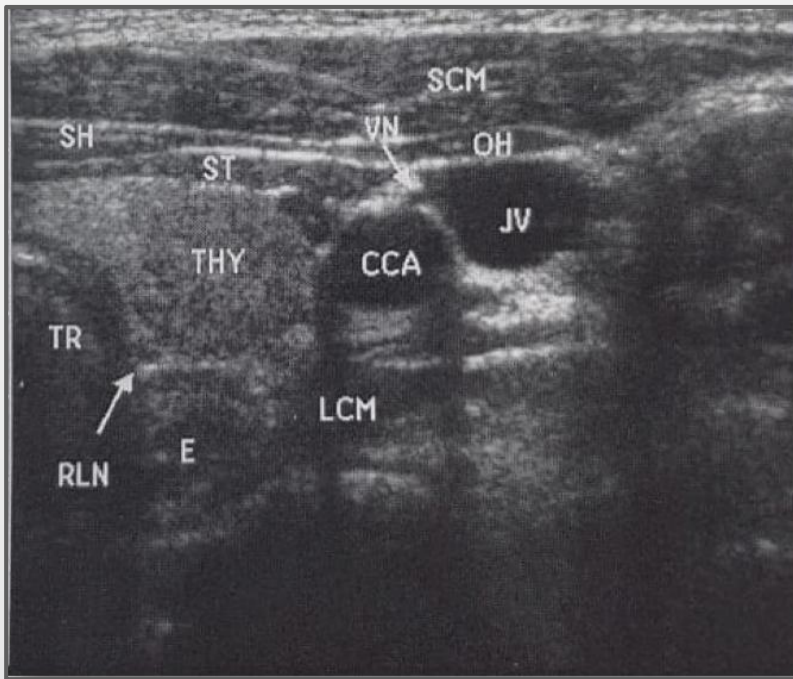
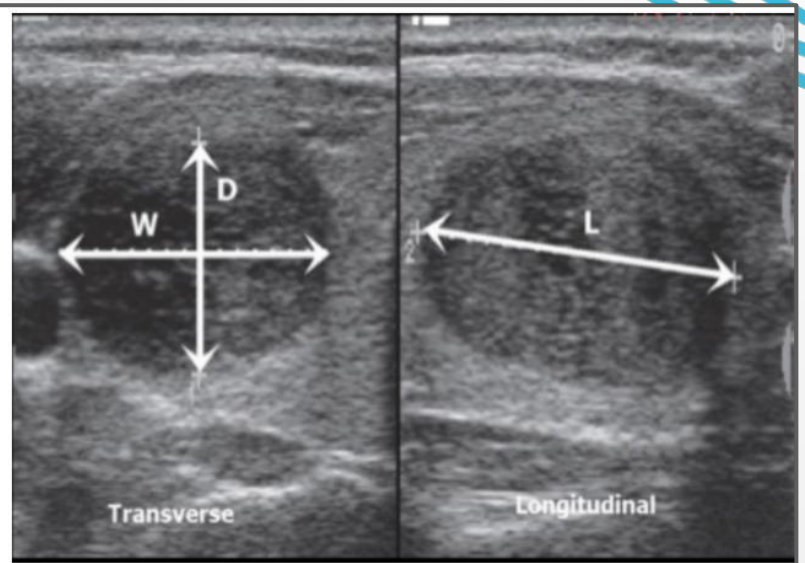
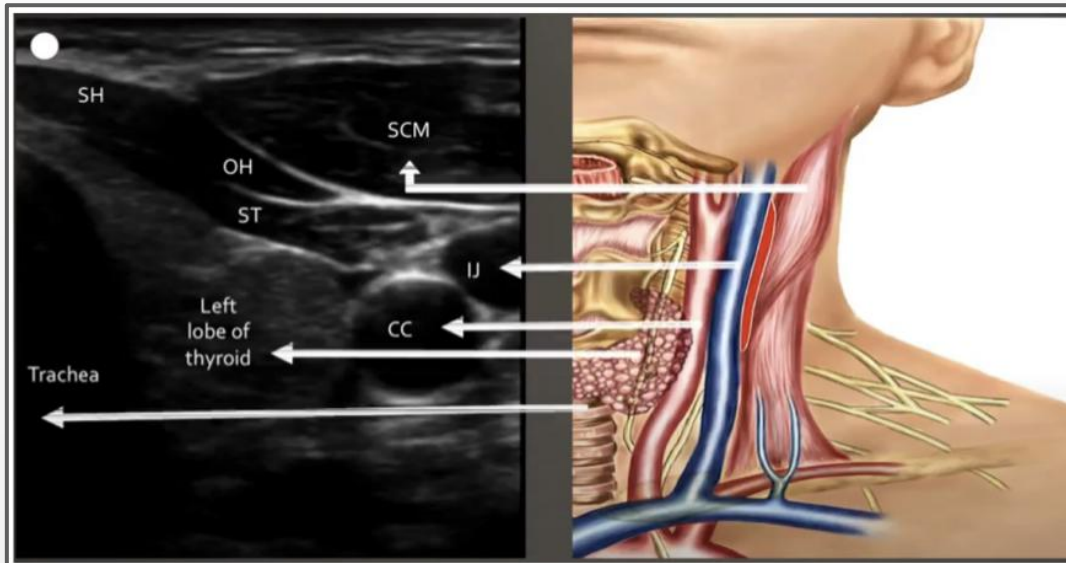


» Normal Thyroid US

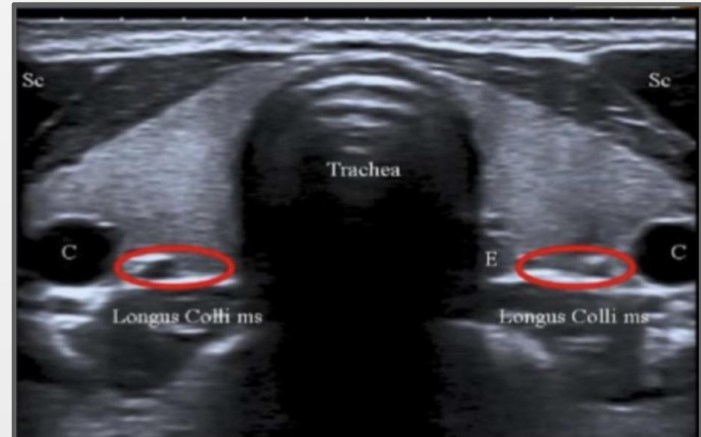
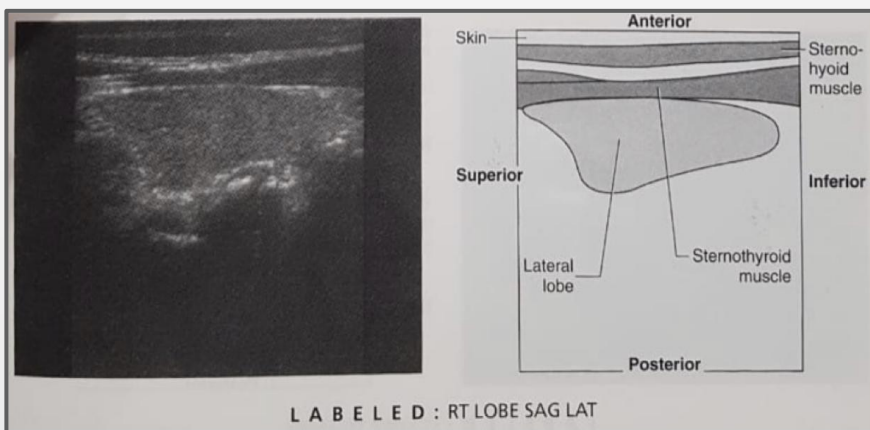
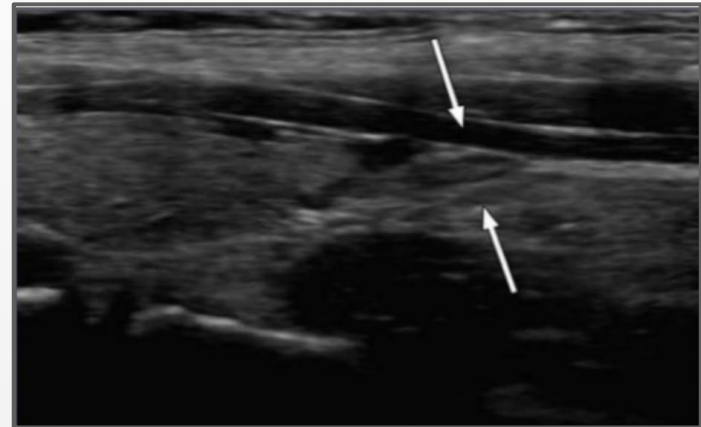
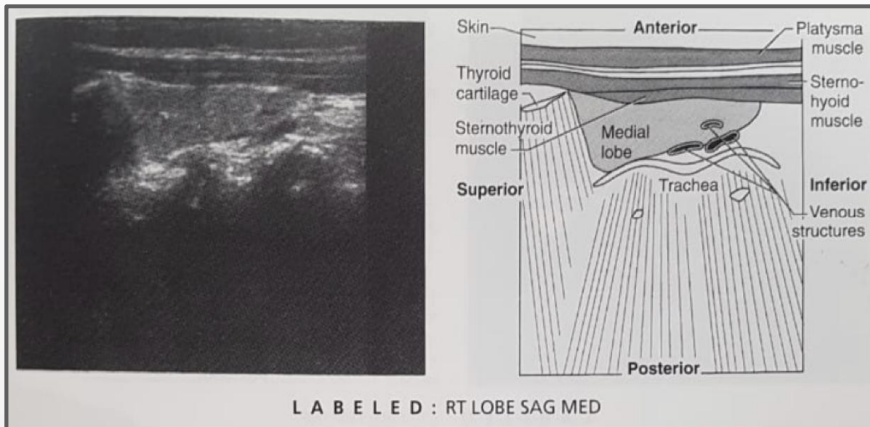
- Normal thyroid gland appears homogeneous and moderately echogenic.
- Similar appearance to normal liver and testes parenchyma.
- It is hyperechoic relative to adjacent musculature.
- Parathyroid appear flat, hypoechoic structures lying between the thyroid gland anteriorly and longus colli muscle posteriorly.



Normal Thyroid US



Normal Thyroid US



» Thyroid Abnormalities

Should be imaged in a way that allows for reporting and documentation of :

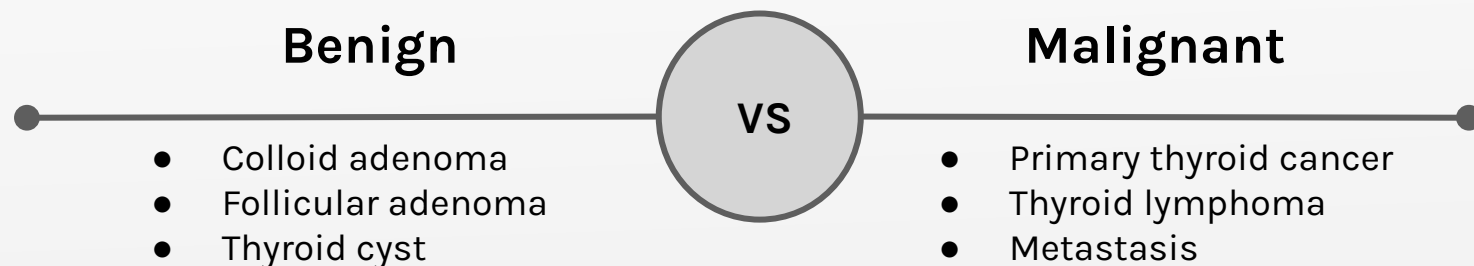
- The location, size, number and character of significant abnormalities, including measurements of nodules and focal abnormalities in 3 dimensions
- The localized or diffused nature of any thyroid abnormality
- The sonographic features of any thyroid abnormality with respect to :
 1. Echogenicity
 2. Composition (degree of cystic change)
 3. Margins (smooth or irregular)
 4. Presence and type of calcification (if present) and
 5. Other relevant sonographic patterns, peripheral vascularity and color Doppler.
- The presence and size of any abnormal lymph node in the lateral compartment of the neck.

» Thyroid Diseases

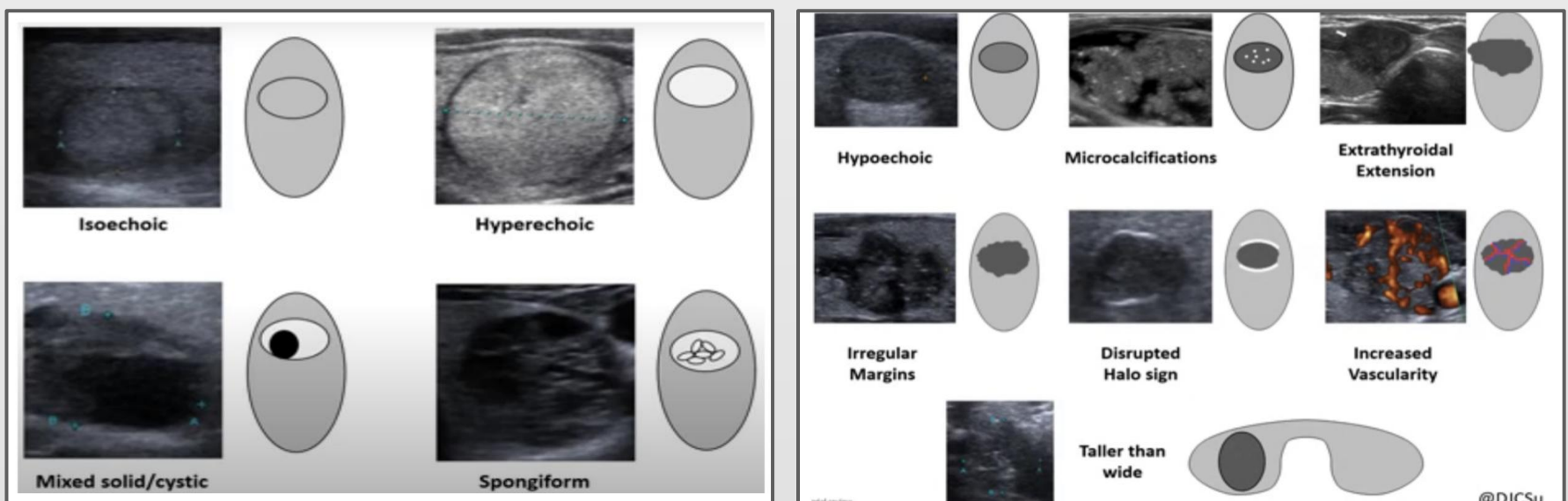
1. Grave's disease
2. Hashimoto thyroiditis
3. Multinodular goiter
4. Ectopic thyroid

Thyroid Nodules

- Thyroid nodules are any lesion delineated on imaging studies. They can be benign or malignant.
- Thyroid nodules are common incidental findings, more in female with a ratio of 4:1.



Benign characteristics	Suspicious characteristics
<ul style="list-style-type: none"> • Smooth or regular margins • Positive halo sign • Peripheral vascularity • Anechoic, isoechoic or hyperechoic • Wider than tall • Mixed solid /cystic • Spongiform 	<ul style="list-style-type: none"> • Irregular margins • Disrupted halo sign • Increased vascularity • Hypoechoic • Taller than wide • Microcalcifications • Extrathyroidal extension



» Grading/scoring systems

1. First TI-RADS (2009)
2. Korean TI-RADS (2011)
3. U classification of British Thyroid Association (BTA) (2016)
4. American Thyroid Association (ATA) (2016)
5. ACR TI-RADS (2017)

No one system has achieved universal acceptance
This lead to some confusion for practitioners of sonography

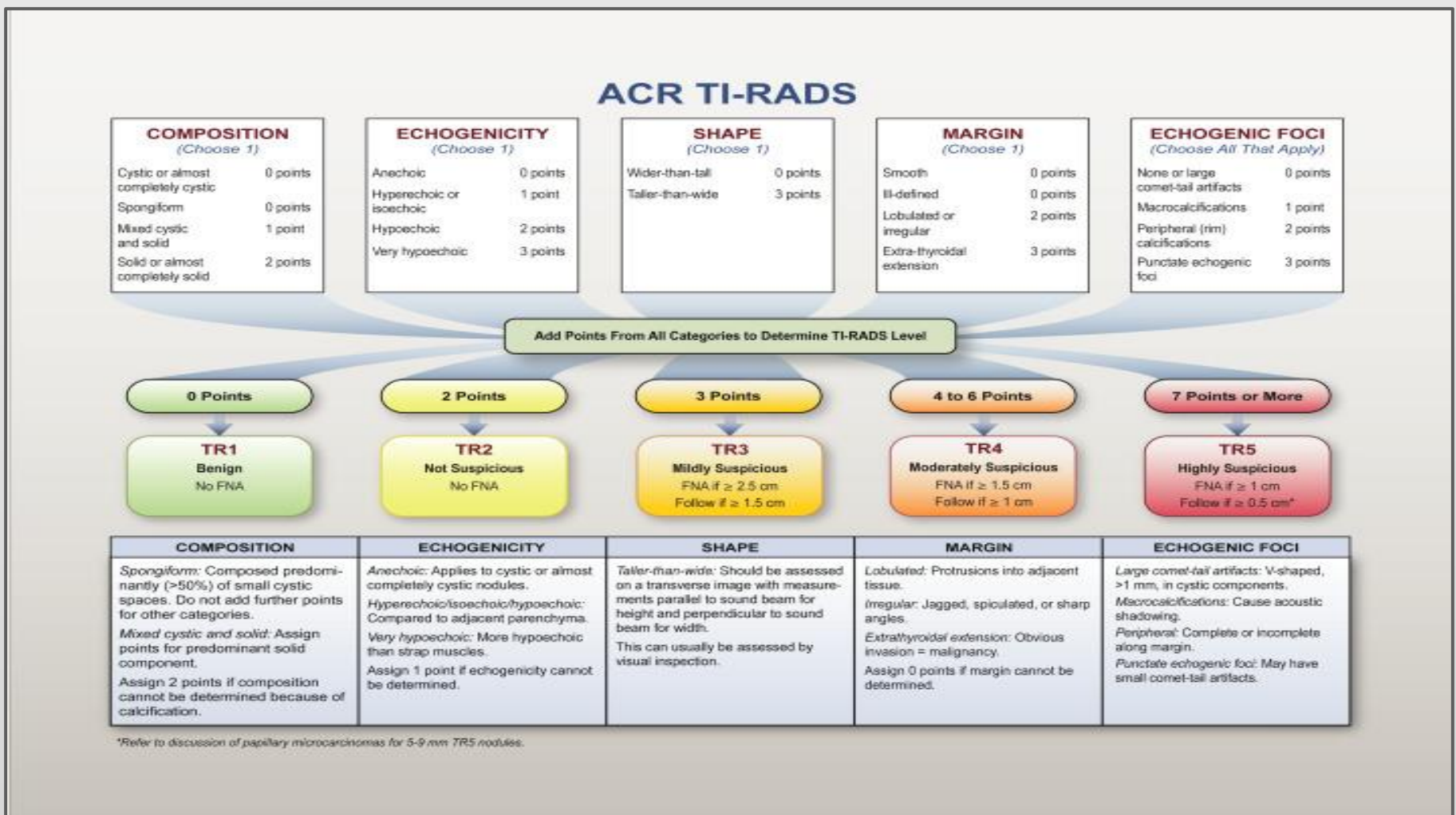
Just know that we have a system , you don't have to know the details

Thyroid Nodules

ACR TI-RADS

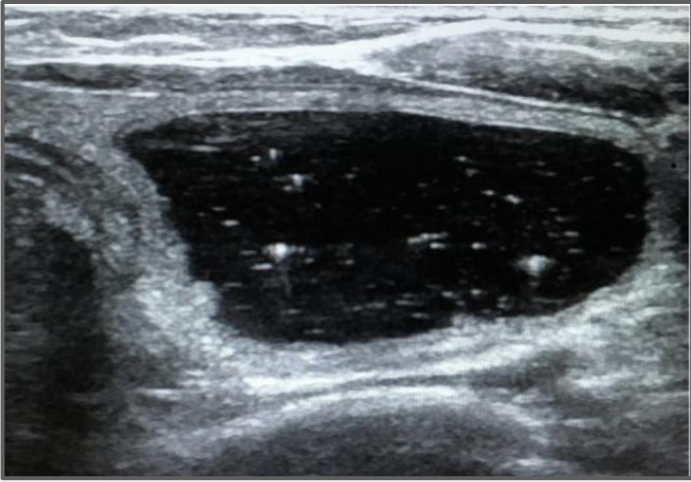
Category	US Features	Points
Composition: Choose only one	Cystic or a,most completely cystic Spongiform > 50% of small cystic spaces Mixed cystic and solid Solid or almost completely solid	0 point 0 point 1 point 2 points
Echogenicity: Choose only one	Anechoic Hyperechoic or isoechoic Hypoechoic Very hypoechoic	0 point 1 point 2 points 3 points
Shape: Choose only one	Wider than tall Taller than wide	0 point 3 points
Margins: Choose only one	Smooth or ill-defined Lobulated or irregular Extrathyroidal extension	0 point 2 points 3 points
Echogenic Foci: All that apply	No echogenic foci or large comet-tail artifacts Microcalcifications Peripheral (rim) calcifications Punctate echogenic foci (microcalcifications)	0 point 1 point 2 points 3 points

- Less concerning features are awarded less or no points.
- More suspicious features are awarded higher points.
- Add points of all categories to determine ACR TI-RADS



Thyroid Nodule Characteristics

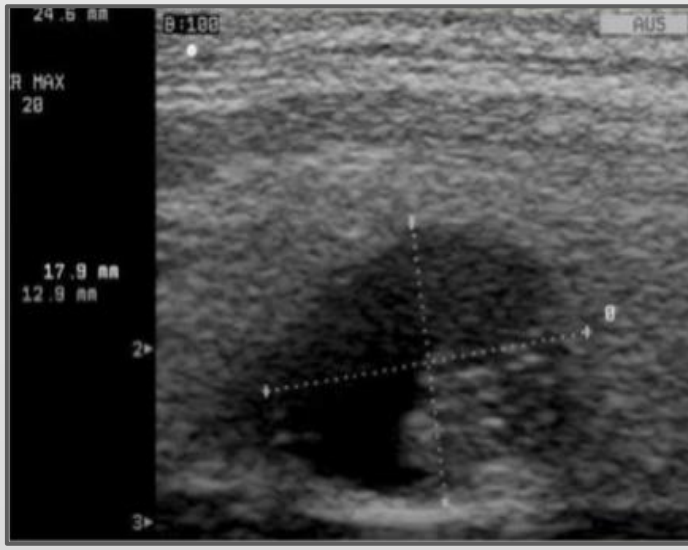
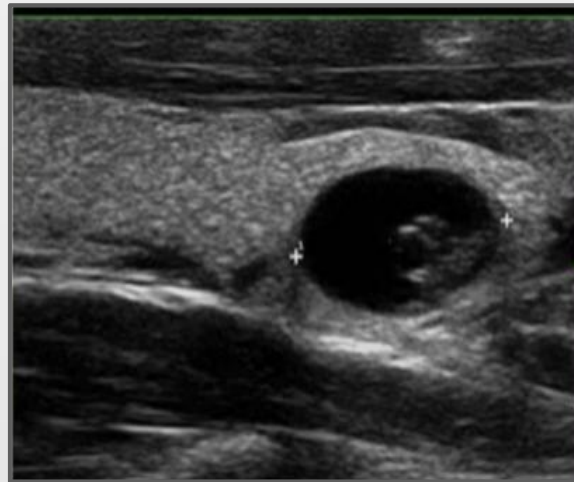
» 1) Composition (degree of cystic change)



Composition: Cystic

- Mass in the left side
- 3cm thin walled
- Cystic nodule With multiple echogenic foci

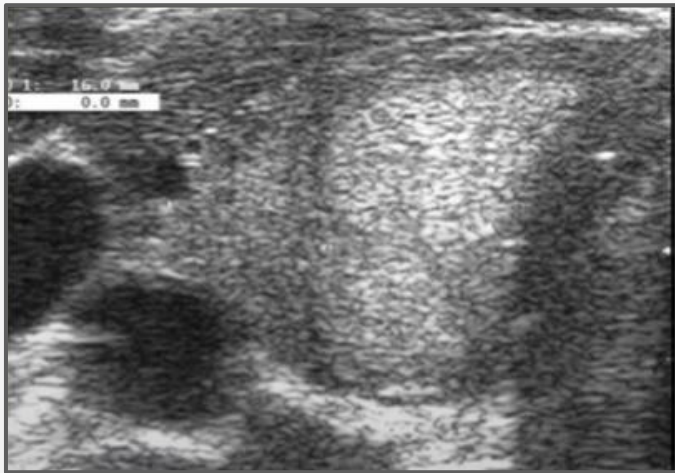
- Marked hypoechoic solid lesion
- Surrounded by normal thyroid tissue.
- Also checking for any acoustic shadow/intense enhancement of the cyst -solid part of the periphery



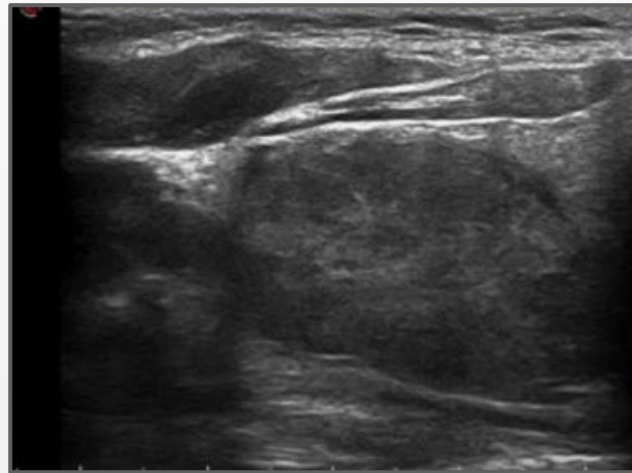
- Mixed density nodule
- With cystic center
- Halo periphery
- Effacement outline

Thyroid Nodule Characteristics

» 2) Echogenicity



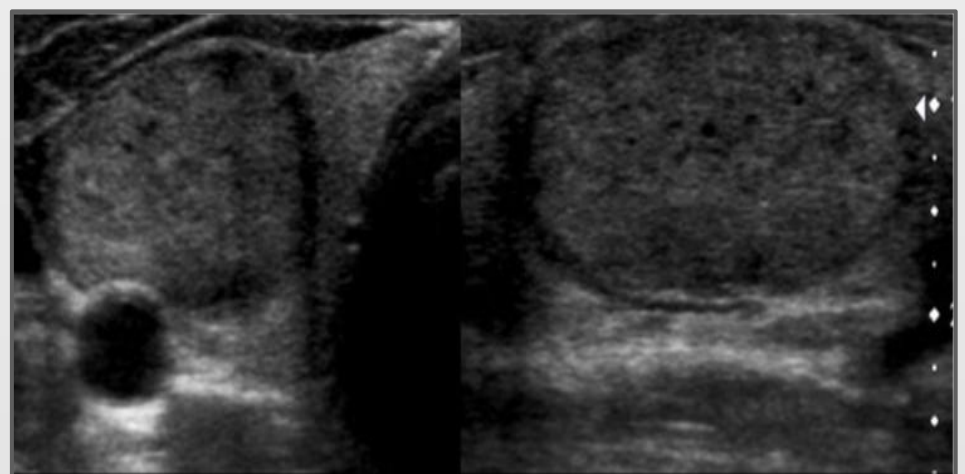
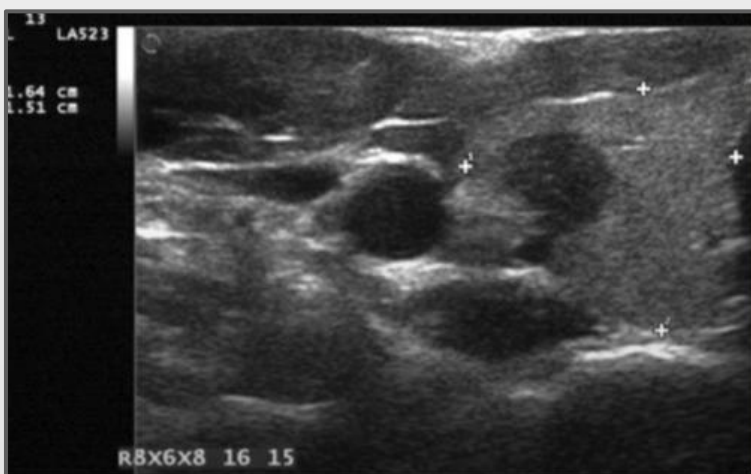
- Hyperechoic lesion
- With a surrounded hypoechoic halo



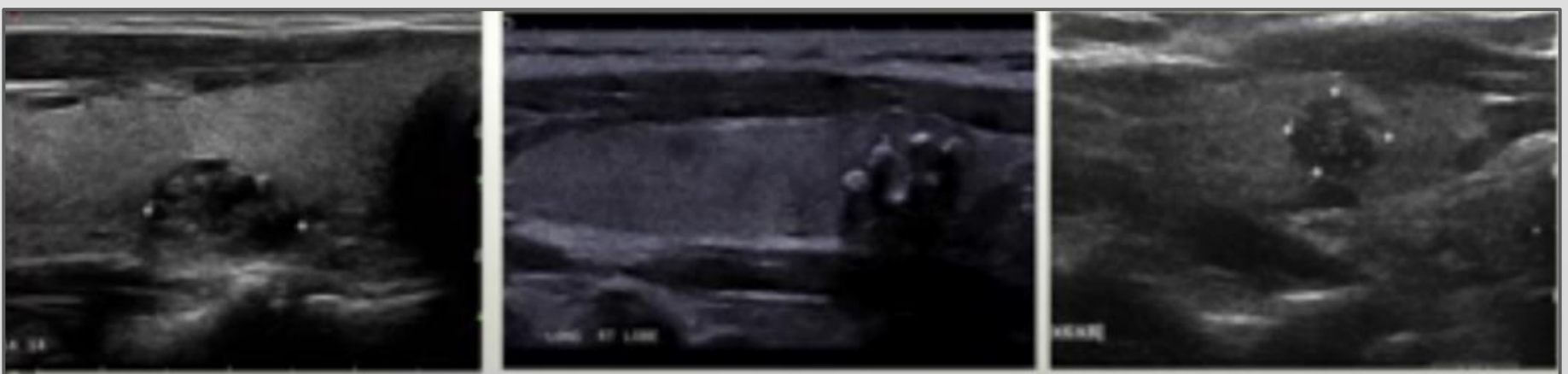
- Hypoechoic lesion
- With regularity

» 3) Margins (smooth or irregular)

» 4) Presence of halo



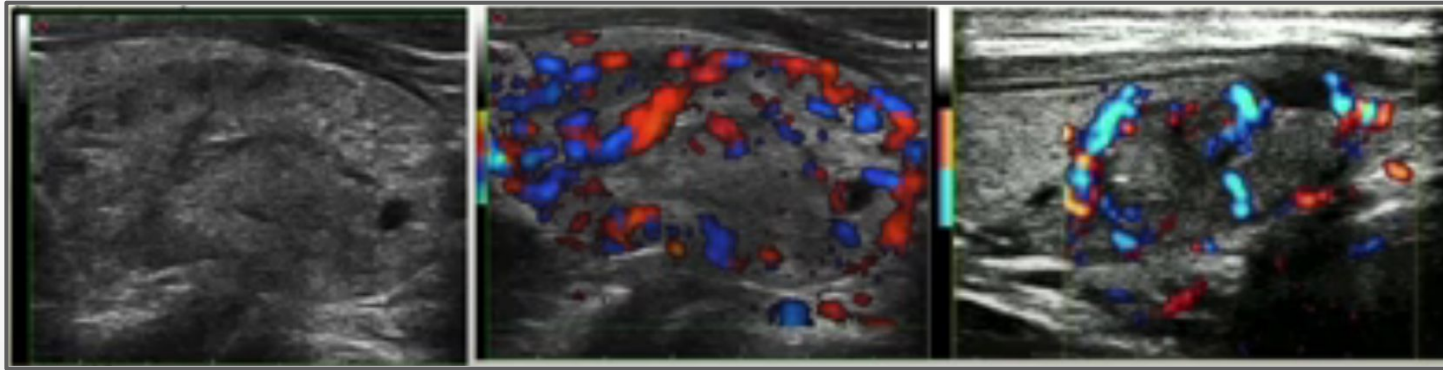
» 5) Presence and type of calcification (if present)



- Possible malignancy
- Describe the location, irregularity, texture etc.

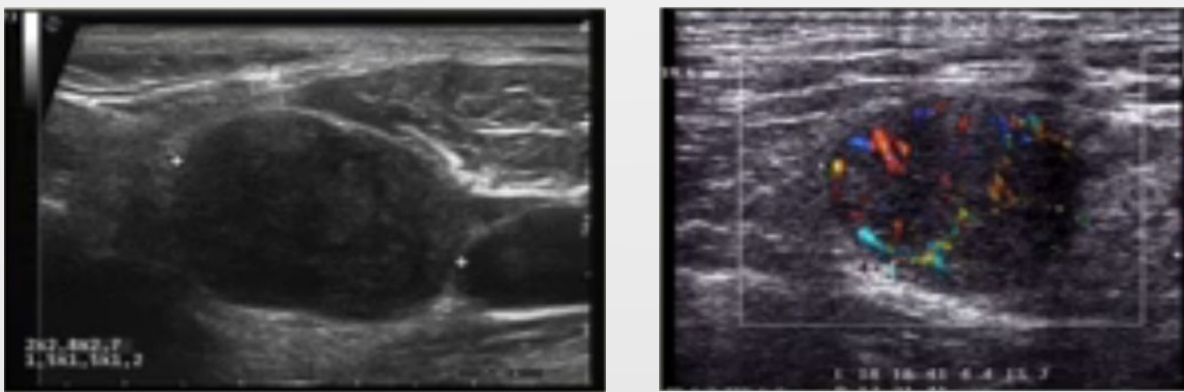
Thyroid Nodule Characteristics

» 6) Other relevant sonographic patterns, peripheral vascularity and Color Doppler



- Confirming malignancy through Color Doppler
- Lesion presenting with central vascularity.
- Check in all 3 dimensions.

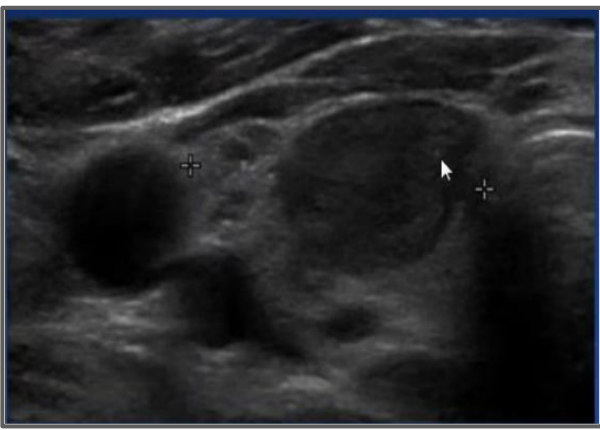
» 7) The presence and size of any abnormal lymph node in the lateral compartment of the neck



- Oval/Round shaped not regular
- With marked vascularity inside and outside
- Indicating Malignancy

Thyroid Nodules : Malignant Features

US patterns	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Microcalcifications	6.1–59.1	85.8–95.0	24.3–70.7	41.8–94.2
Hypoechoogenicity	26.5–87.1	43.4–94.3	11.4–68.4	73.5–93.8
Irregular margins or no halo sign	17.4–77.5	38.9–85.0	15.6–27.0	88.0–92.1
Solid	26.5–87.1	43.4–94.3	11.4–68.4	73–93.8
Intranodular vascularity	54.3–74.2	78.6–80.8	24.0–41.9	85.7–97.4
Taller than wide	32.7	92.5	66.7	74.8



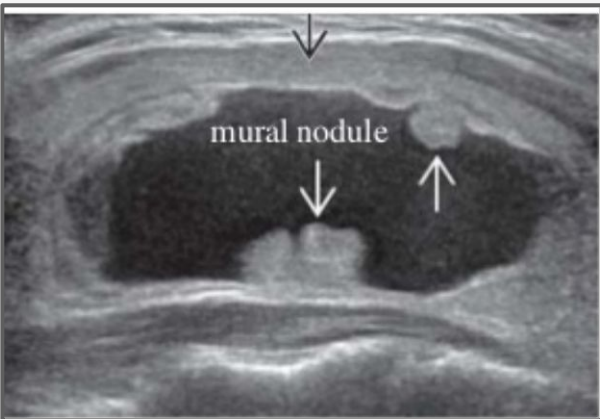
Follicular Carcinoma



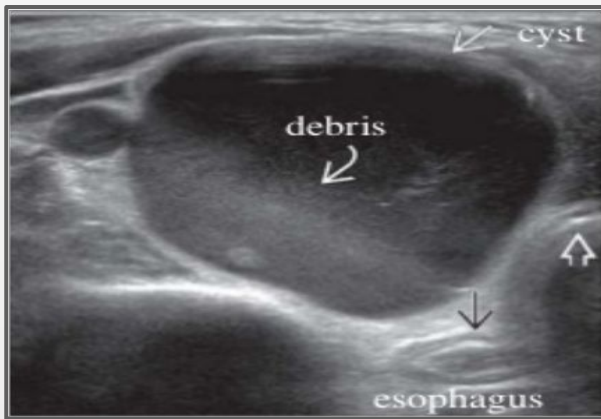
Completely Cystic



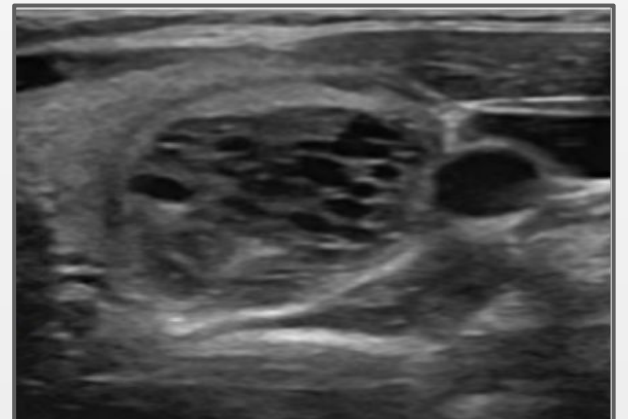
Colloid Cyst



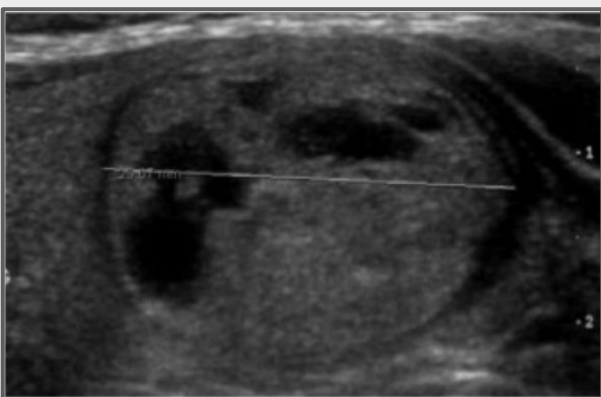
Hemorrhagic Cyst



Hemorrhagic Cyst



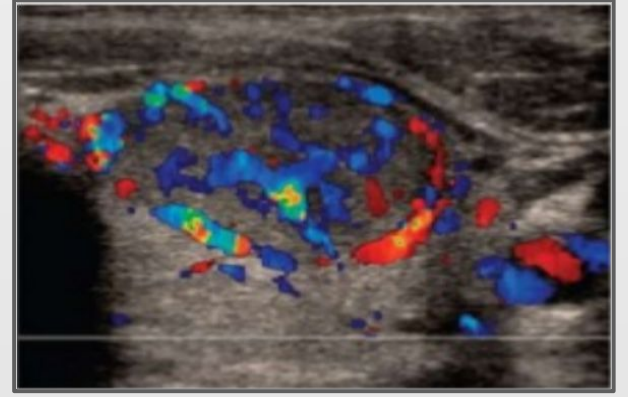
Spongiform / Honeycomb



Predominantly Solid



Papillary Thyroid Carcinoma



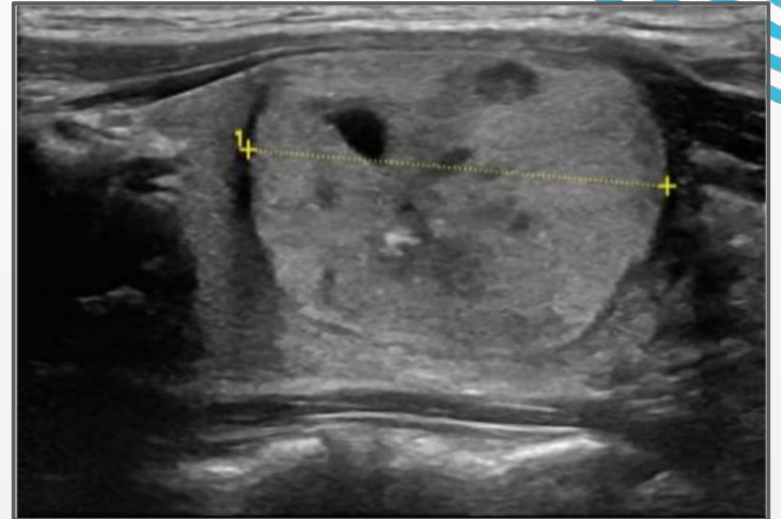
Advantages and disadvantages of Acr ti-rads

Advantages	Disadvantages
- Standard terms for ultrasound reporting.	- High size threshold for FNA in mild and moderate suspicious lesions,
- Able to classify almost all thyroid nodules.	- Doesn't take into consideration - thyroid nodule vascularity
- Evidence based to the greatest extent possible.	- Doesn't take into consideration - Elastography

Examples

» Case 1

- Almost completely solid (2 points)
- Hyperechoic nodule (1 point)
- Wider than tall (0 point)
- Smooth margin (0 Point)
- No calcification (0 point)
- Total : 3 points
- **ACR TR3**
- Mildly suspicious - FNA if more or equal to 2.5cm



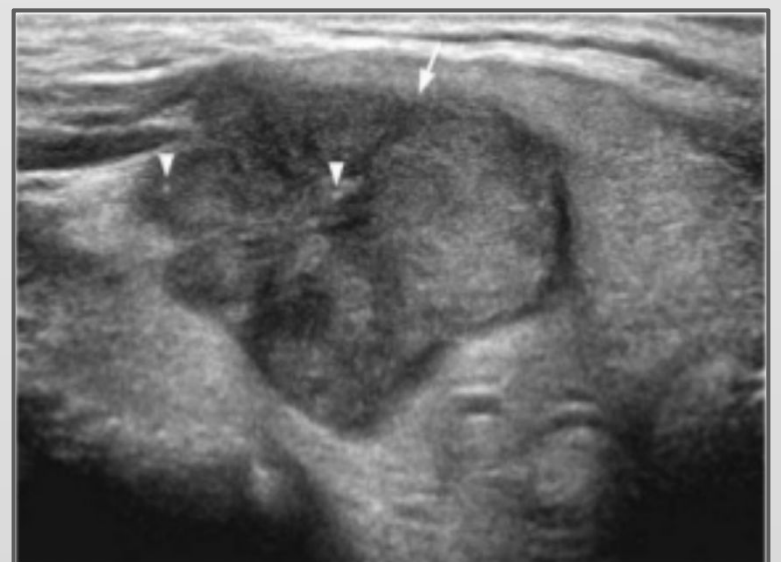
» Case 2

- Completely solid (2 points)
- Hyperechoic (1 point)
- Smooth margin (0 point)
- Wider than tall (0 point)
- No echogenic foci/micro-calcification. (0 point)
- Total - 3 points
- **ACR TR3**
- Mildly suspicious - FNA if more or equal to 2.5cm



» Case 3

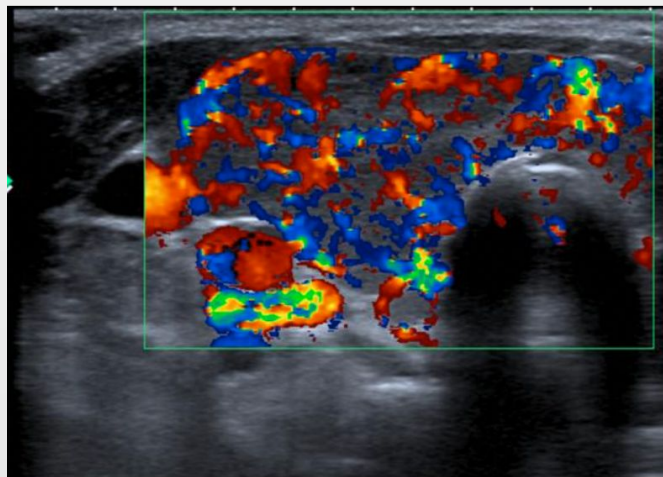
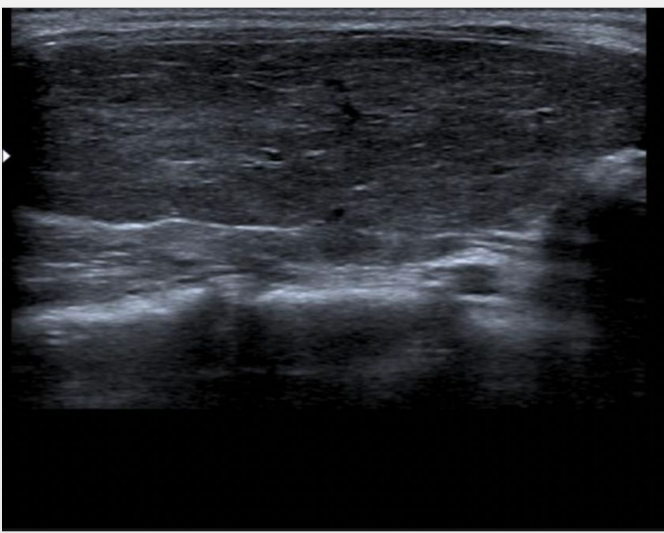
- Completely solid (2 points)
- Hyperechoic (1 points)
- Lobulated margin (2 points)
- Taller than wide (3 points)
- Micro-calcifications/echogenic foci (3 points)
- Total - 11 points
- **ACR TR5**
- Highly suspicious - FNA if more or equal to 1.0 cm
- Papillary Carcinoma on FNA



thyroid Diseases

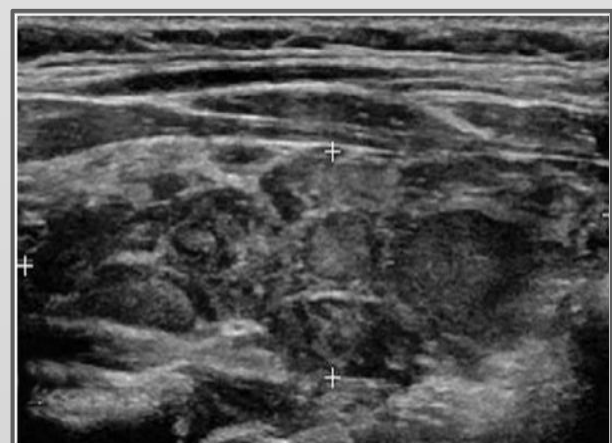
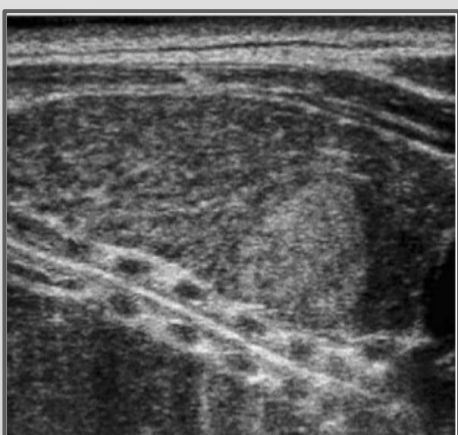
» Grave's disease

- Is an autoimmune thyroid disease.
- It is the most common cause of hyperthyroidism.
- The gland is usually enlarged by x2 to x3 of its normal size, and is usually homogeneously hypoechoic.
- Doppler US will show diffuse increased vascularity with multiple areas of intense intrathyroid flow, called "Thyroid inferno".



» hashimoto's thyroiditis

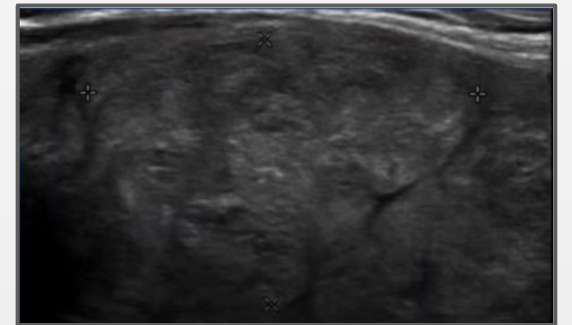
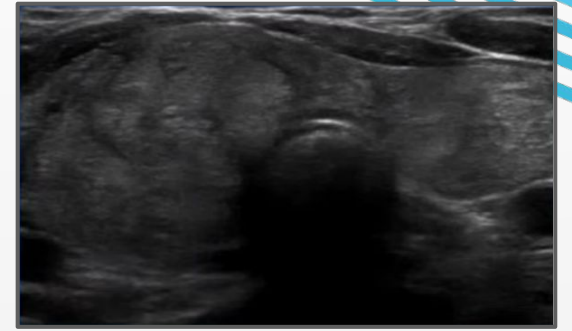
- Causes hypo/hyperthyroidism
- Enlarged heterogeneous gland.
- Presence of Pseudo-nodules
- Vascularity may be normal or decreased.
- Increased risk of (Hashimoto)
 - Papillary thyroid carcinoma
 - Thyroid lymphoma



thyroid Diseases cont.

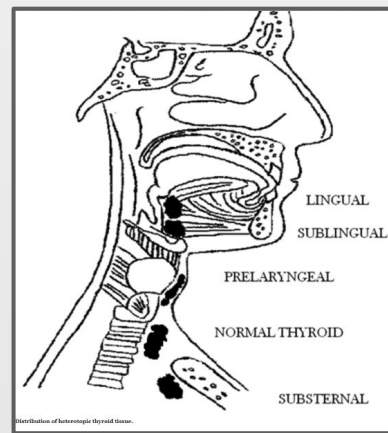
» multinodular goiter (MNG)

- MNG is an enlarged gland with multiple nodules that maybe hypo or hyper functioning (Toxic MNG)
- Iso-hyperechoic
- Surrounding hypoechoic halo
- Spongiform/honeycomb pattern
- anechoic areas may contain colloid fluid which may show echogenic foci with comet tail artifacts
- Peripheral (eggshell) or coarse calcifications
- Doppler: peripheral vessels are usually noted, may show intranodular vascularity (mostly in hyperfunctioning nodules)



» ectopic thyroid

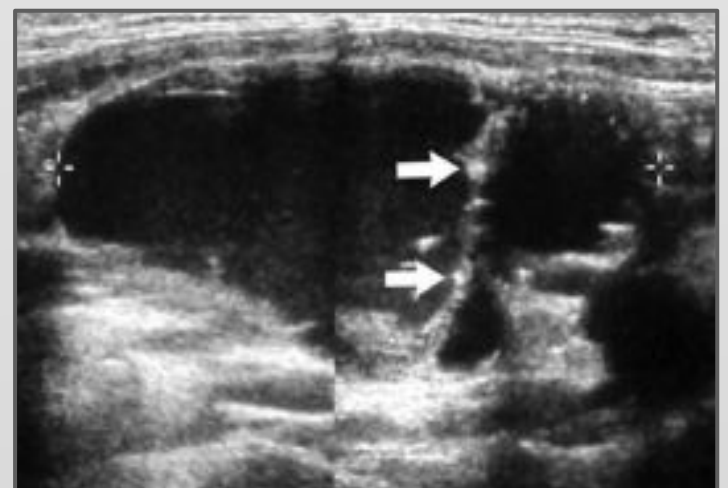
- Can be found anywhere in the central neck compartment, including esophagus, trachea and anterior mediastinum
- **Lingual : Most common (90%)**
- Imaging is performed to demonstrate absent thyroid tissue in the normal location.



Papillary carcinoma and cystic lymph node metastasis in a 28Y woman

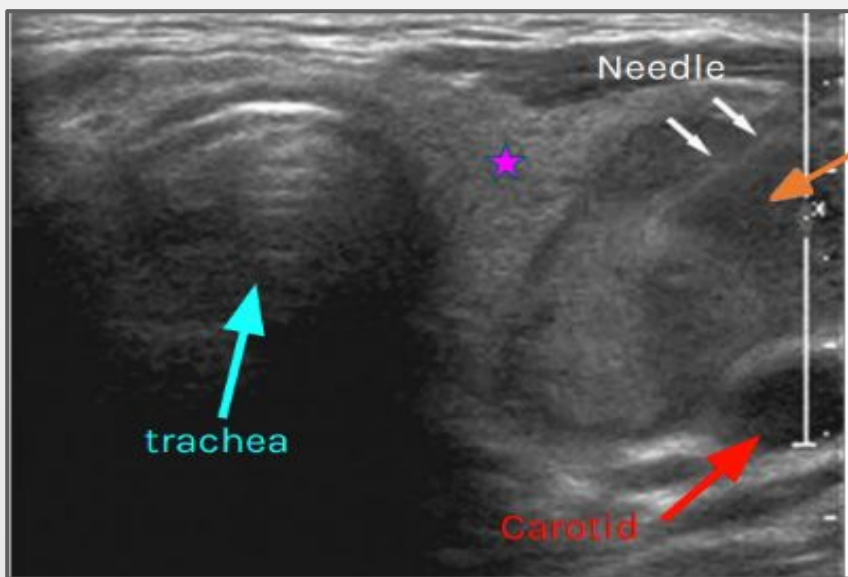
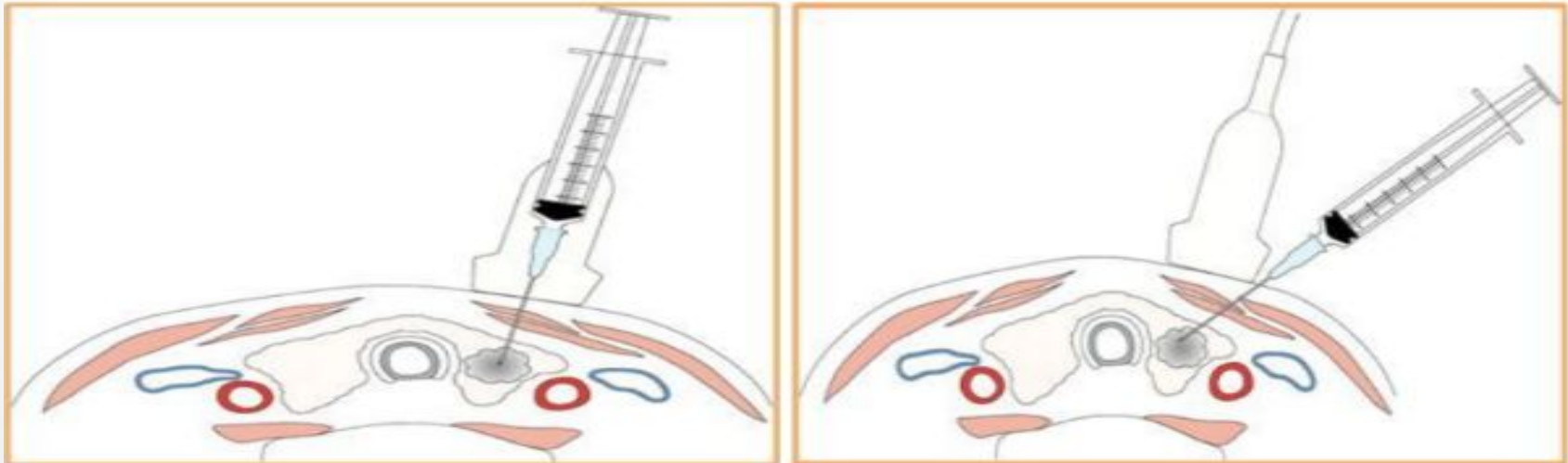
Cystic degeneration

(If you are suspicious and not sure; you have to do an **FNA**)



Fine needle aspiration

- FNA is a minimally invasive tissue sampling procedure, usually done under ultrasound guidance. It can be done under Fluoroscopy, CT, or MRI.
- Technique: The needle may be introduced parallel or perpendicular to the transducer, and the needle tip should be carefully monitored during the procedure.



You have to use US guidance :

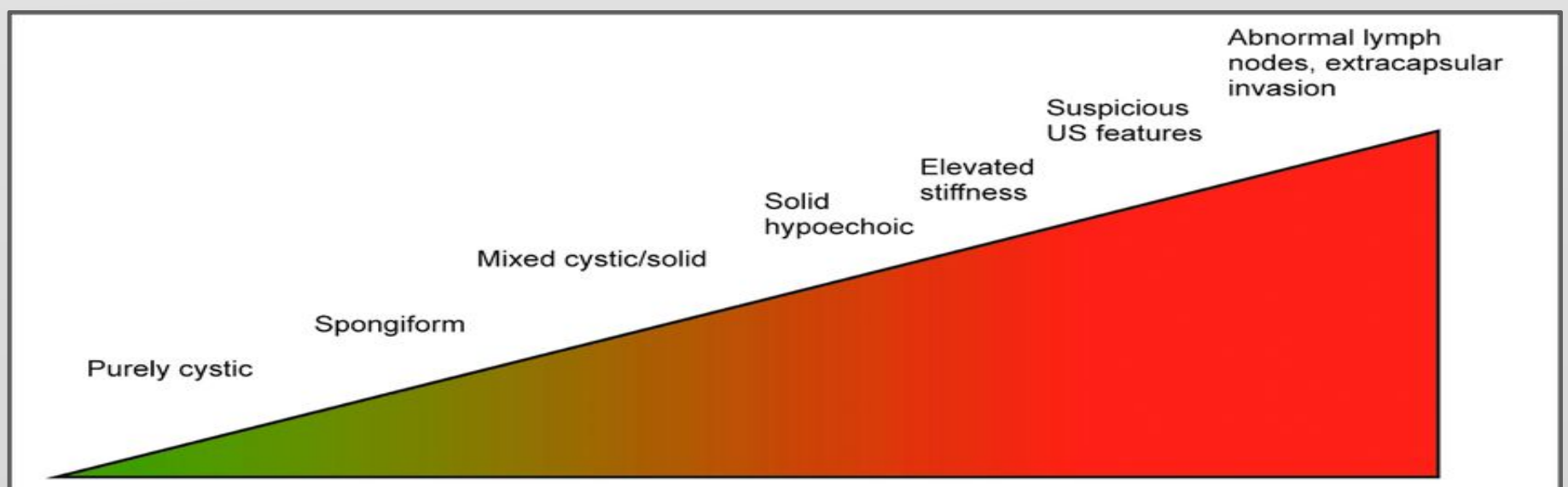
1. To target the needle to go inside the nodule.
2. To not injure the carotid.
3. To not injure the trachea

the lesion is less echoic (hypoechoic) when compared with the echogenicity of the **normal thyroid**. Indicating a more malignant lesion

If you were to insert the needle in the normal thyroid tissue you will get a normal false negative result.. that why we need US :)

To summarize: First you have to identify whether it is euthyroid or hyperthyroid → If it is hyper you have to assess if it's solid nodule or multiple or Grave's → You have to assess by US if it is neoplastic or not → If you suspect malignancy do FNA to confirm. * If it is papillary carcinoma, it is hard to diagnose even by FNA.

Indications for FNA biopsy according to US findings



Fine needle aspiration

Indications of FNA in ACR TI-RADS

- TR3 (mildly suspicious nodules): if they are ≥ 2.5 cm
- TR4 (moderately suspicious nodules): if they are ≥ 1.5 cm
- TR5 (highly suspicious nodules): if they are ≥ 1 cm
- No FNA of nodules < 1 cm even if they are highly suspicious
This is in concordance with other guidelines
FNA of **5-9 mm** nodules may be done in certain conditions:
Shared decision making between referring physician and patient

Advantages	Inexpensive, widely available, easy to perform, accurate ($>90\%$) and cost-effective
Disadvantages	Depends on skill of operator & cytopathologist
Complications	Rare – no reported case of cutaneous implantation of malignancy following FNA
False negative rate	0.5 – 11.8% (pooled rate 2.4%)
False positive rate	0 – 7.1% (pooled rate of 1.2%)
Non-diagnostic rate	Vary among different centers 5% is the maximum acceptable limit

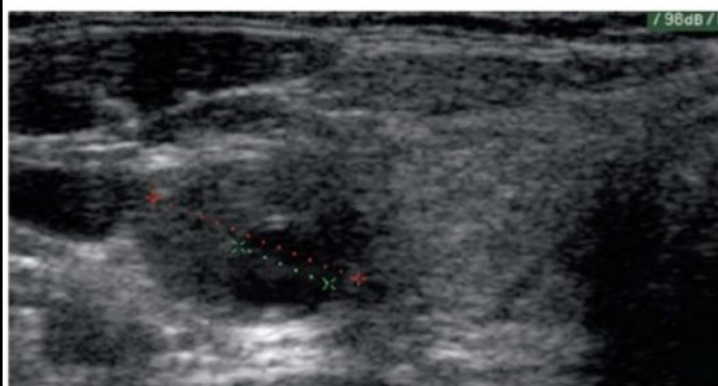


» Complications of FNA

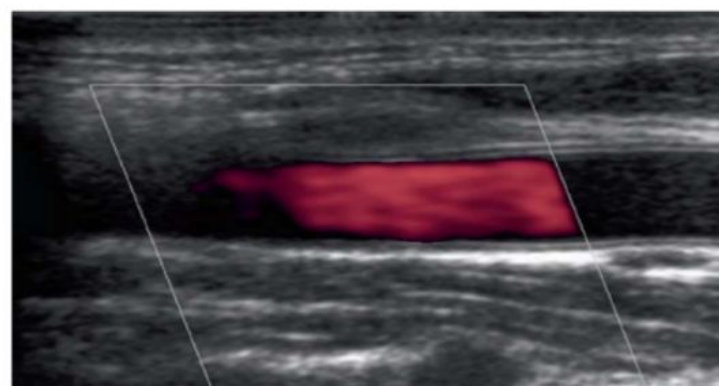
1. Hematoma
2. Injury of CCA
3. Injury of IJV
4. Nerve puncture
5. Trachea puncture
6. Esophageal puncture



Transverse US of CCA



Longitudinal color Doppler of CCA

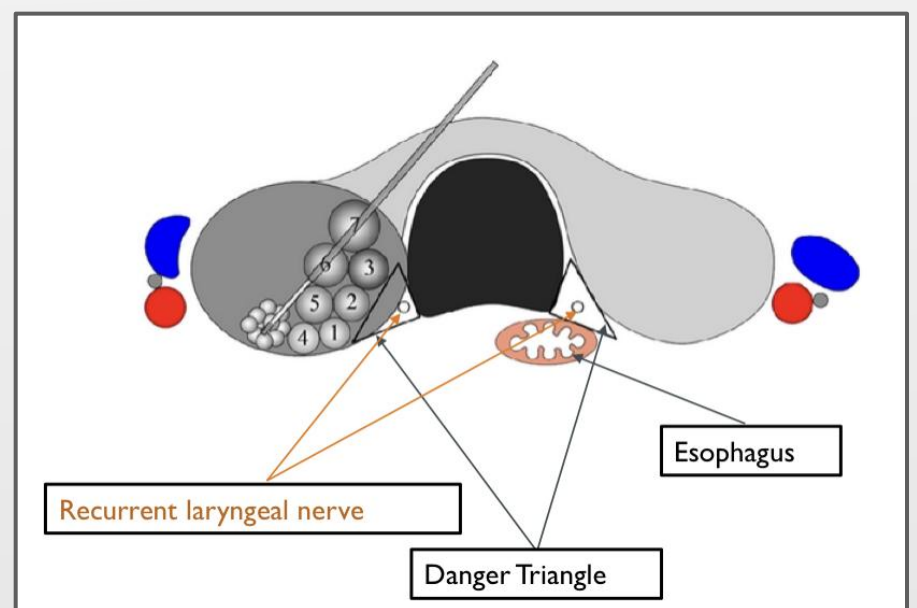


RFA (radiofrequency ablation)

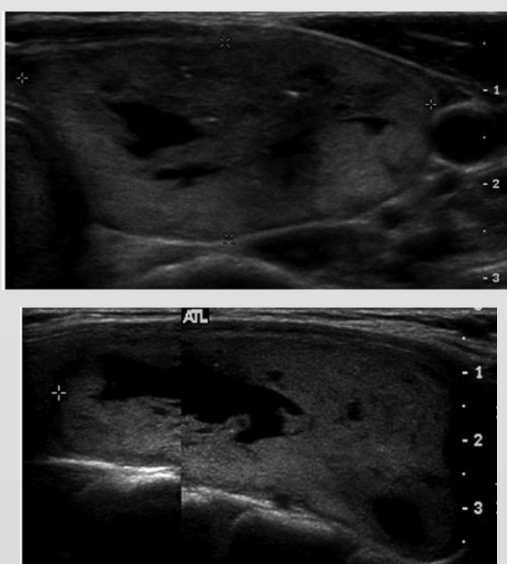
- Radiofrequency ablation, or RFA, is a minimally invasive technique that shrinks the size of tumors, nodules or other growths in the body.
- RFA is used to treat a range of conditions, including benign and malignant tumors, chronic venous insufficiency in the legs, as well as nerve ablation(chronic back and neck pain).
- The procedure is similar to a needle biopsy, and involves inserting a needle-like probe into the body.
- Radiofrequency waves are sent out from the probe into the surrounding tissue, which causes the nearby cells to heat up, thereby killing the cells. As these cells die, the immune system removes them, which causes an internal reaction and generally results in shrinkage of the nodule.

Procedure

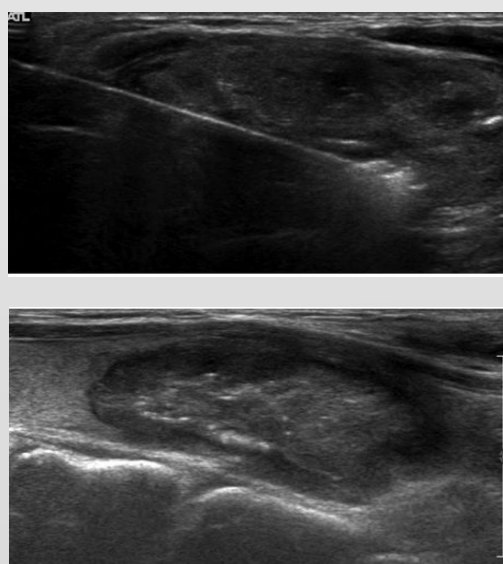
- Patient is placed in the supine position with mild neck extension.
- Trans-isthmic approach: the electrode is inserted from the isthmus to the lateral aspect of the targeted nodule.
- Minimal heat exposure to the danger triangle (which includes the recurrent laryngeal nerve and/or the esophagus).



Before

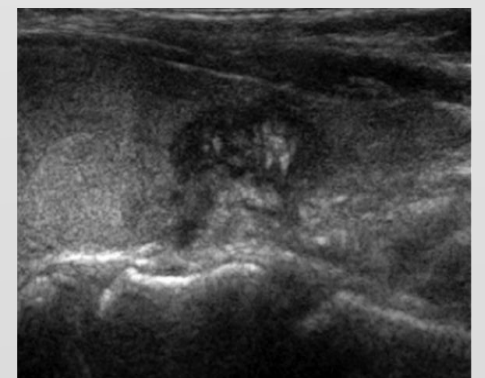


**Predominantly
solid nodule**



**Ablation of the periphery
(Top) and center (Below)**

After (Shrinkage)



[Summary](#)

Thyroid Ophthalmopathy

Thyroid Ophthalmopathy (Grave's disease)

Clinical history:

- **Slow onset** (months), **painless** exophthalmos. (Usually presented by bilateral proptosis)
- disease causing painful exophthalmos =infection, orbital pseudotumor

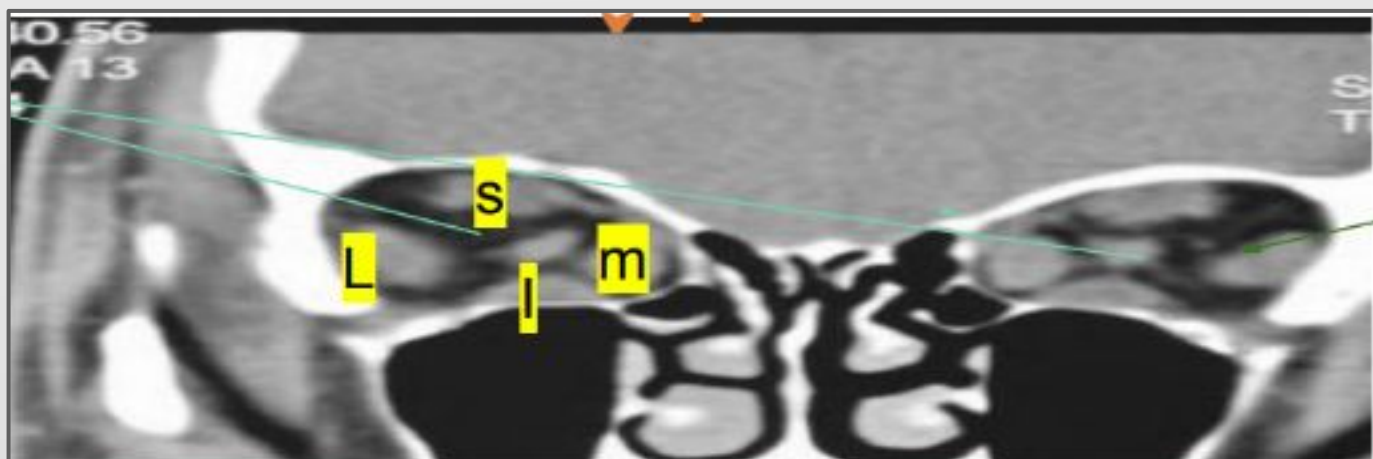
Patterns of muscle involvement in thyroid ophthalmopathy:

- Bilateral (85%) ex;graves disease
- Unilateral (5%) ex:orbital pseudotumor
- Normal muscles (10%)
- Involvement of **All** muscles is **the most common scenario** of extraocular muscle enlargement.
- If only individual muscles involved, commonly its **Inferior** then **Medial recti muscles**
- **Lateral rectus muscle: last to become involved**; rarely/never the only muscle involved
- The first muscles get affected respectively are: **I'M SLOW** (**I**nferior, **M**edial, **S**uperior , **L**ateral)**IMP**
- Muscle enlargement characteristically involves the body of the muscle, sparing the tendinous attachment to the globe. (does not affect the tendon)
- Patients should not be having hyperthyroid (some have euthyroid).
- CT Coronal imaging is **the method of choice** for assessing muscle thickness.



optic nerve

the circle in the middle between 4 rectus muscles

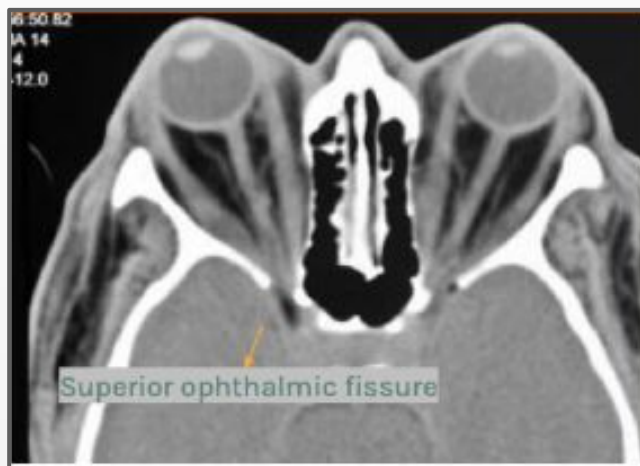


Lateral rectus muscle

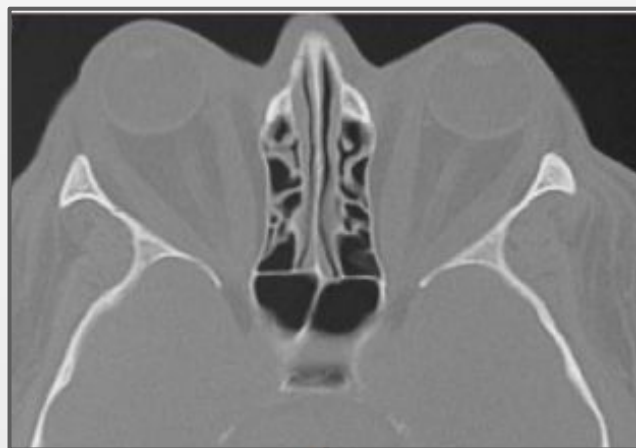
- Almost symmetrical and bilateral enlargement of the muscle belly
- Diffuse enlargement of the extraocular muscles, why are we afraid?

○ because there is bilateral ptosis and stretches of the optic nerve and we are afraid of the compression around the orbital apex

Thyroid Ophthalmopathy

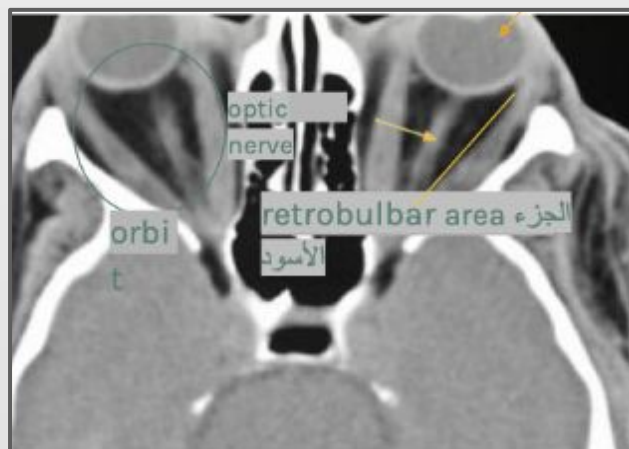
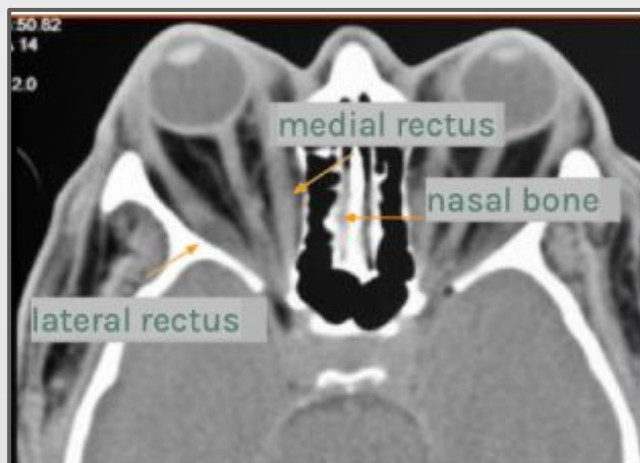


symmetrical and bilateral enlargement of muscle belly



Bilateral; exophthalmos there is protrusion of the globe abundant of retrobulbar fat

CT axial image level of orbit:



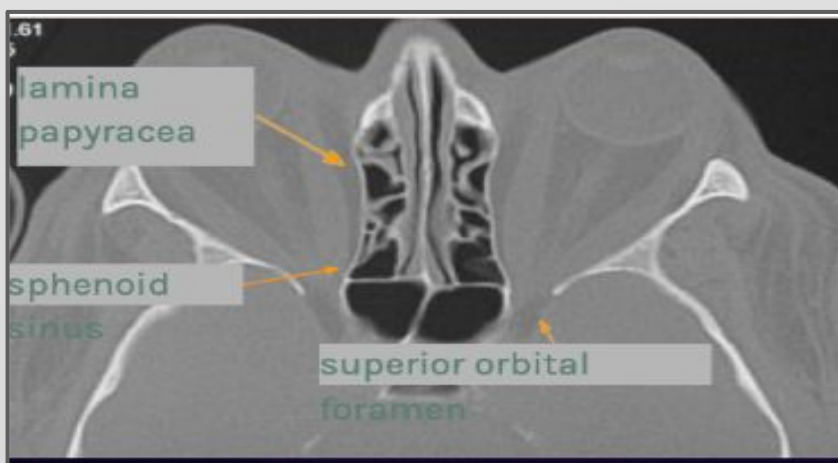
Soft tissue window

globe

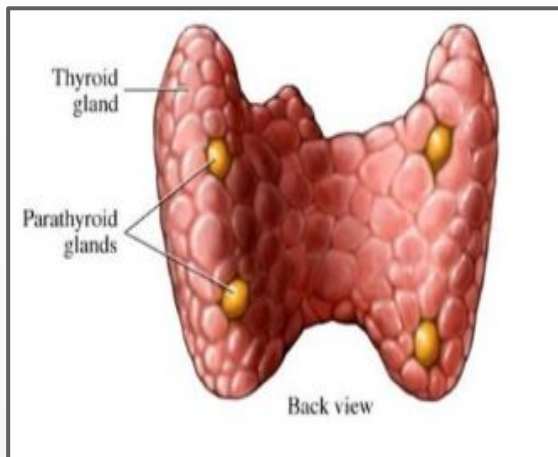
Bone window

Radiological features: The disease is bilateral 1. Exophthalmos protrusion (because the globe is outside the orbit). 2. Enlargement of extraocular muscles. 3. increased retrobulbar fat pad.

4. 4. herniation in the fat through superior orbital fissure.
5. 5. lamina papyracea.(convex to outside concave inside) secondary to the compression of the medial rectus
6. 6. .Stretching of optic nerve.



Anatomy of the Parathyroid gland



- Parathyroid: 4 glands, located behind the upper and lower lobes of the thyroid. They release PTH to regulate serum calcium.
- Two pairs of glands usually positioned behind the left and right lobes of the thyroid
- The 2 Superior parathyroid are slightly more medial than the 2 inferior one.
- Typically they are symmetric.

» Parathyroid Cells Extra

Normal parathyroid glands comprise 2 cell types:

- i. Chief cells: responsible for PTH production
- ii. Oxyphil cells: eosinophilic cells whose cytoplasm is composed almost entirely of mitochondria.

While the normal oxyphil cell does not synthesize and secrete PTH, the oxyphil cells of pathologic parathyroid glands do secrete the hormone.

» Renal Osteodystrophy

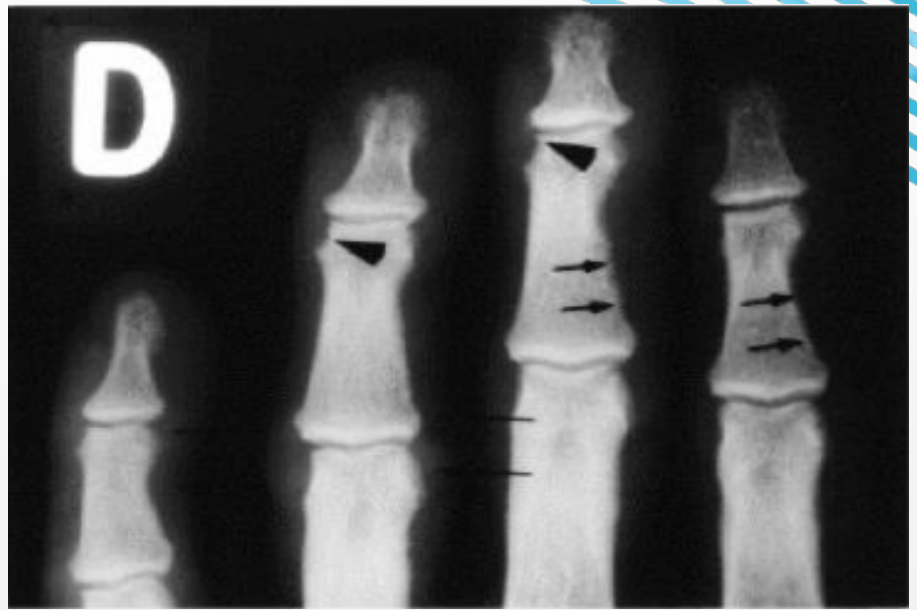
- Seen in setting of: chronic, **end-stage renal disease**.
- Related to combination of:
 - **Osteomalacia.**
 - **Secondary hyperparathyroidism (in primary the patient will present with renal stones)**
- **Radiological manifestation**
 - **Bone resorption** mainly (Sub-periosteal)
 - Cortical thinning.
 - **Soft tissue and vascular calcifications**
 - **Osteosclerosis**
 - Brown tumors (**Osteolytic bone lesions**) (seen in primary rather in secondary).
- **Osteopenia** is the most common finding; however, **10-20%** of patients also exhibit osteosclerosis.
- Characteristic finding of osteosclerosis is "**Rugger jersey spine**", Bands of hazy sclerosis that **parallels the vertebral body endplates**. happens in ESRD
- Both axial and appendicular skeleton involved.
- Increased risk for **pathologic fracture**.



Osteodystrophy



Soft tissue calcification



Typical subperiosteal bone resorption at the “**radial aspects of the middle phalanges**” (small arrows) with bone resorption (subligament resorption) at the margins of the distal interphalangeal joints (short arrows).



Rugger jersey spine (diffuse osteopenia)



Cortical thinning with subperiosteal resorption



Subligamentum resorption + **Brown tumors**

Doctor's questions

- Structures relations to the thyroid gland;

Posteromedially:

tracheoesophageal groove (containing lymph nodes, recurrent laryngeal nerve, parathyroid glands).

Posterolaterally:

carotid space (carotid artery, internal jugular vein, vagus nerve).

- What is Ruggier jersey spine?

A Characteristic finding of osteosclerosis with Bands of hazy sclerosis that parallels the vertebral body endplates.

- What are the causes of thyrotoxicosis?

- **Hyperthyroidism causes:**

- Early phase subacute thyroiditis.
- Exogenous thyroid hormone intake

1- Diffuse toxic goiter (Grave's disease)

. 2- Single toxic nodule.

3- Multinodular toxic goiter.

- What are the malignant features of thyroid nodule?

- **Micro-calcifications.**
- Local invasion
- **Markedly reduced echogenicity (hypoechoic=less white).**
- **Increased Vascularity in duppler US**

- What are the structures affected by Thyroid ophthalmopathy?

The fist muscles get affected respectively are:

I'M SLOW

1- Inferior 2- Medial 3- Superior 4- Lateral

- What is the location of subperiosteal resorption?

Typical subperiosteal bone resorption location is at the "radial aspects of the middle phalanges"

- How does of hemorrhagic cyst manifest?

Overnight enlargement of cyst due to bleeding

- What are the radiological manifestation of renal osteodystrophy ?

1. **Bone resorption** mainly (Sub-periosteal)
2. Cortical thinning.
3. **Soft tissue and vascular calcifications**
4. **Osteosclerosis**
5. Brown tumors

- What is the appearance of Graves' disease and hashimoto thyroiditis in US ?

- Know the position of recurrent pharyngeal nerve in CT and US



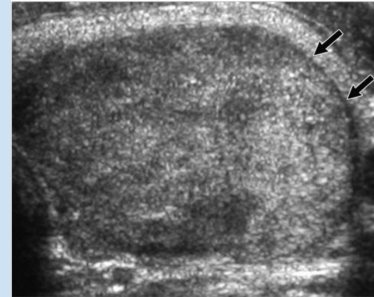
Summary

<p>Normal thyroid US</p>	<ul style="list-style-type: none"> - Normal thyroid gland appears homogeneous and moderately echogenic. - Similar appearance to normal liver and testes parenchyma. - It is hyperechoic relative to adjacent musculature. - Parathyroid appear flat, hypoechoic structures lying between the thyroid gland anteriorly and longus colli muscle posteriorly. 	
<p>Thyroid nodules</p>	<p>Benign characteristics:</p>	<ul style="list-style-type: none"> - Isoechoic - Hyperechoic - Mixed solid/cystic - Spongiform - Smooth or regular margins - Positive halo - Peripheral vascularity - Anechoic - Wider than tall
	<p>Suspicious characteristics:</p>	<ul style="list-style-type: none"> - Hypoechoic - Microcalcifications - Extrathyroidal extension - Irregular margins - Disrupted halo sign - Increased vascularity - Taller than wide
<p>ACRTI-RADS</p>	<p>Advantages:</p>	<ul style="list-style-type: none"> - Standard terms for ultrasound reporting. - Able to classify almost all thyroid nodules. - Evidence based to the greatest extent possible.
	<p>Disadvantages:</p>	<ul style="list-style-type: none"> - High size threshold for FNA in mild and moderate suspicious lesions, - Doesn't take into consideration - thyroid nodule vascularity - Doesn't take into consideration - Elastography
<p>Thyroid diseases</p>	<p>Graves disease</p>	<ul style="list-style-type: none"> - It is the most common cause of hyperthyroidism. - Usually enlarged by x2 to x3 of its normal size - Usually homogeneously hypoechoic. - Doppler US will show diffuse increased vascularity with multiple areas of intense intrathyroid flow, called "Thyroid inferno".
	<p>Hashimoto's thyroiditis</p>	<ul style="list-style-type: none"> - Enlarged heterogeneous gland - Presence of Pseudo-nodules - Vascularity may be normal or decreased.
	<p>Multinodular goiter (MNG)</p>	<ul style="list-style-type: none"> - Enlarged gland with multiple nodules that maybe hypo or hyper functioning. - Iso-hyperechoic. - Surrounding hypoechoic halo. - Spongiform/honeycomb pattern. - Peripheral (eggshell) or coarse calcifications - Doppler: peripheral vessels are usually noted, may show intranodular vascularity (mostly in hyperfunctioning nodules)
	<p>Ectopic thyroid</p>	<ul style="list-style-type: none"> - Imaging is performed to demonstrate absent thyroid tissue in the normal location.
	<p>Thyroid ophthalmopathy (Graves disease)</p>	<ul style="list-style-type: none"> - Painless exophthalmos. - All muscles involved is most common scenario of extraocular muscle enlargement. - Muscle involvement (I'M SLOW) Inferior → Medial → Superior → Lateral - Muscle enlargement characteristically involves the body of the muscle, sparing the tendinous attachment to the globe.
<p>Renal osteodystrophy</p>	<ul style="list-style-type: none"> - Osteopenia is most common finding - 10- 20% of patients also exhibit osteosclerosis. - Characteristic finding of osteosclerosis is "Rugger jersey spine" - Both axial and appendicular skeleton involved. - Increased risk for pathologic fracture. 	

Quiz

1- 36 year old patient with neck swelling. What is the most likely diagnosis from thyroid doppler ultrasound?

- a. Carcinoma
- b. Adenoma
- c. Thyroiditis
- d. Hemorrhagic cyst



2- In hyperparathyroidism which of the following will be affected by subperiosteal resorption ?

- a. Ulnar deviation of proximal phalanx
- b. Ulnar deviation of middle phalanx
- c. Radial deviation of proximal phalanx
- d. Radial deviation of middle phalanx

3- Rugger jersey spine is a pathological feature of :

- a. Renal osteodystrophy
- b. Clay- shoveler's
- c. Spondylodiscitis
- d. Hangman's fracture

1- brown tumors are specific to which one of the following diseases ?

- a. Hyperparathyroidism
- b. Rheumatoid arthritis
- c. Gout
- d. Metastasis

Answers
1)B
2)D
3)A
4)A

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