Thyroid Ultrasound Basic

ATA Fellow Track 2013

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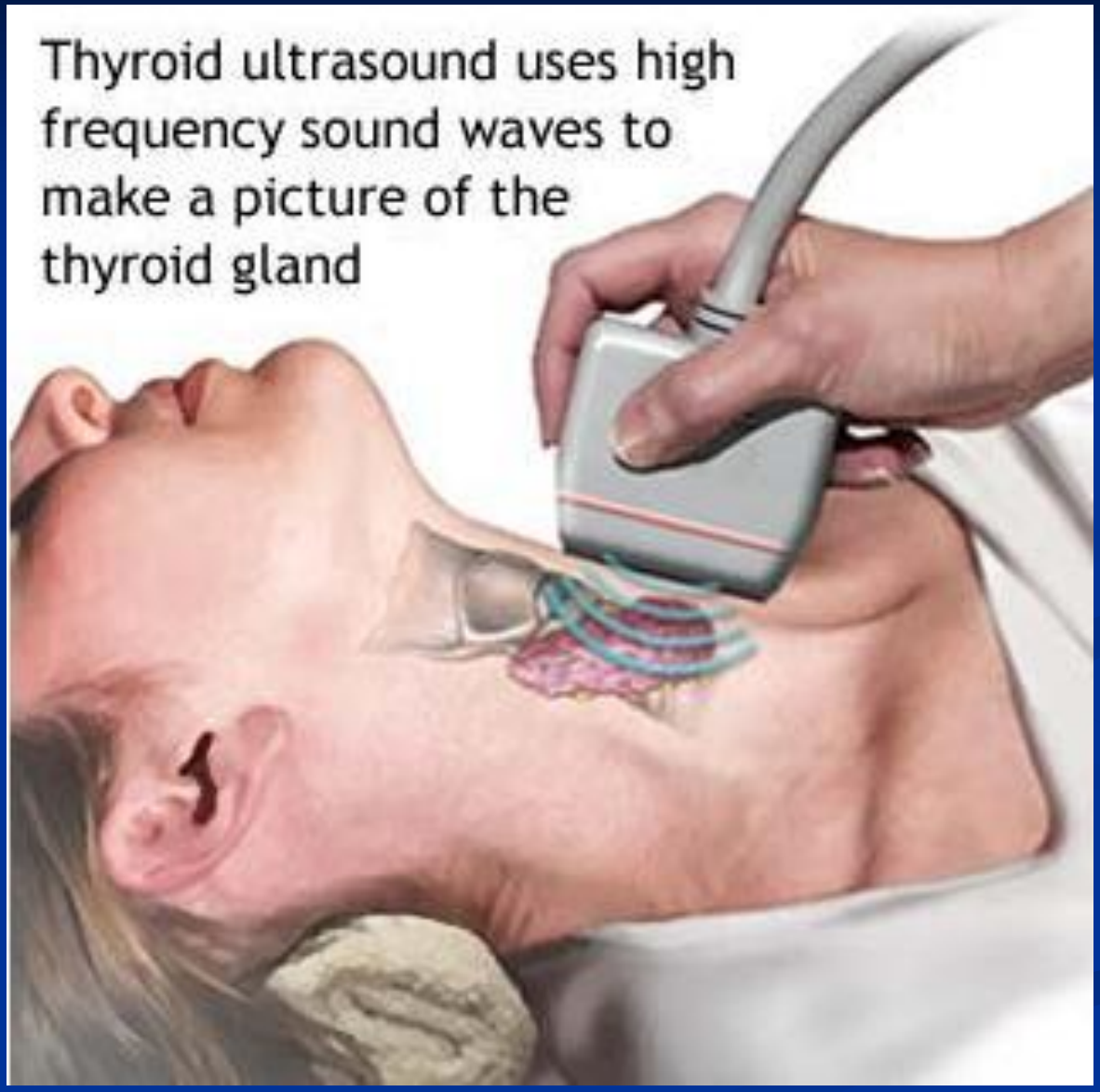
Objectives

- Basic Thyroid Ultrasonography
  - Neck Anatomy
  - Palpation vs US
  - Nodule US characteristics
- Advanced Thyroid Ultrasonography (Dr. Fish)
  - Fine needle aspiration
  - Lymph node evaluation
  - Parathyroid ultrasound


Thyroid ultrasound uses high frequency sound waves to make a picture of the thyroid gland

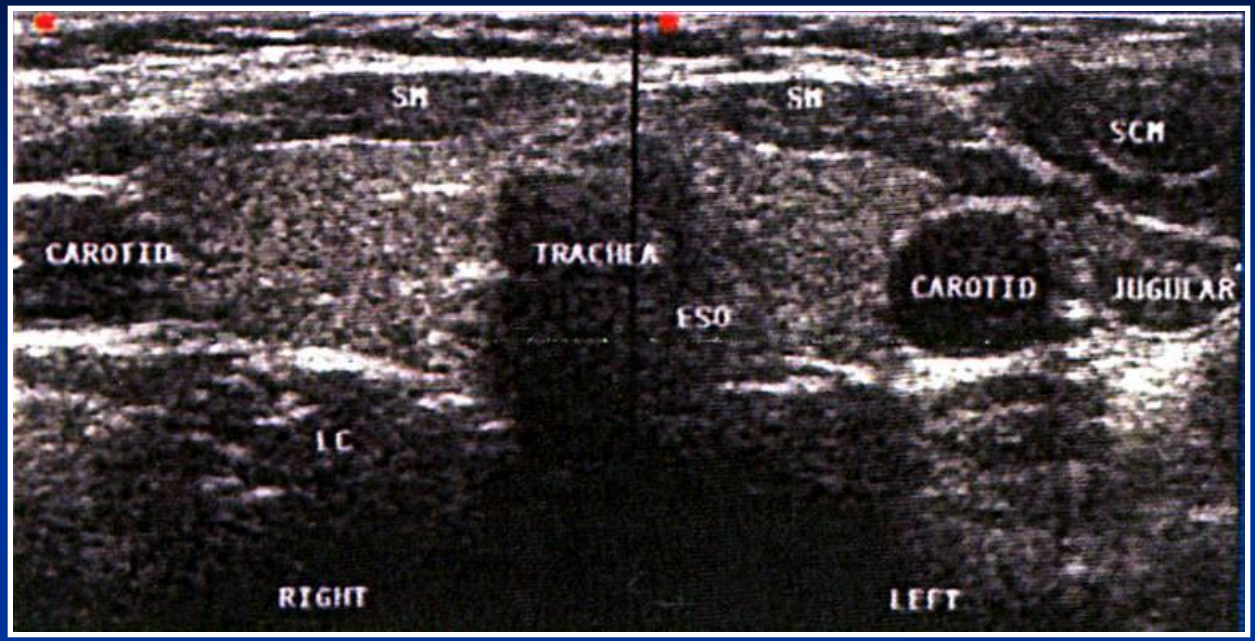
Thyroid Ultrasonography

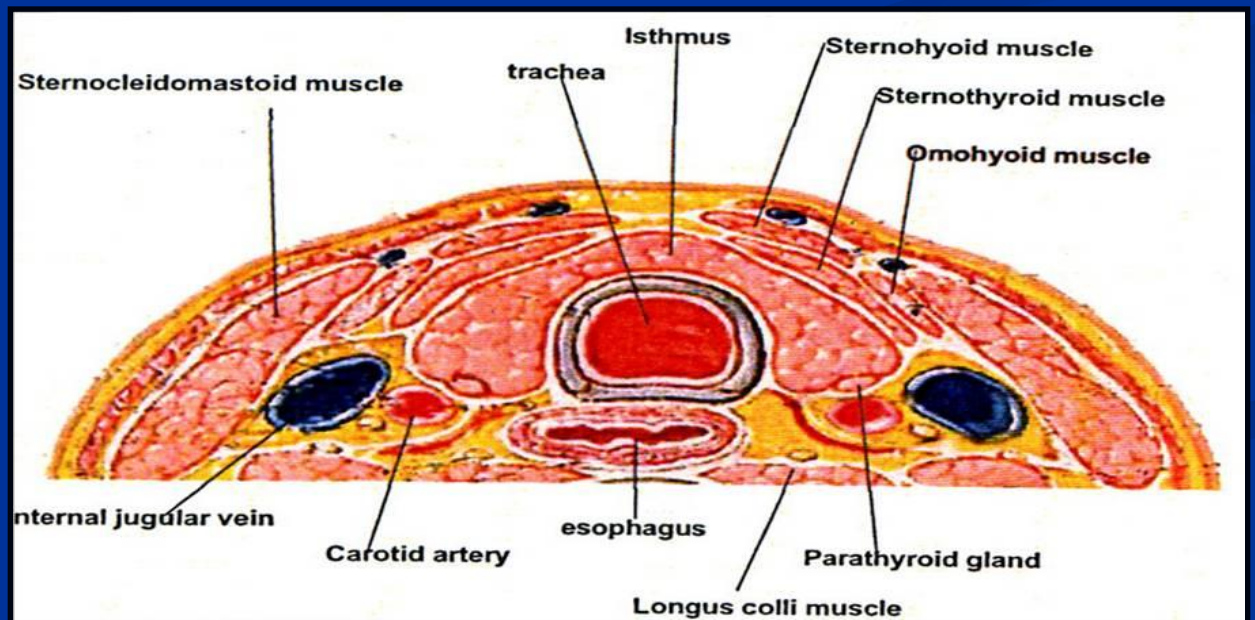
- Patient lies supine with neck hyper-extended
- US Gel is applied to facilitate transmission of sound waves from transducer to skin/tissue
- High resolution linear array transducer (7-15mHz), 4-5cm scanning depth
- The neck is scanned in both transverse and longitudinal planes

Thyroid Ultrasonography
Normal Anatomy

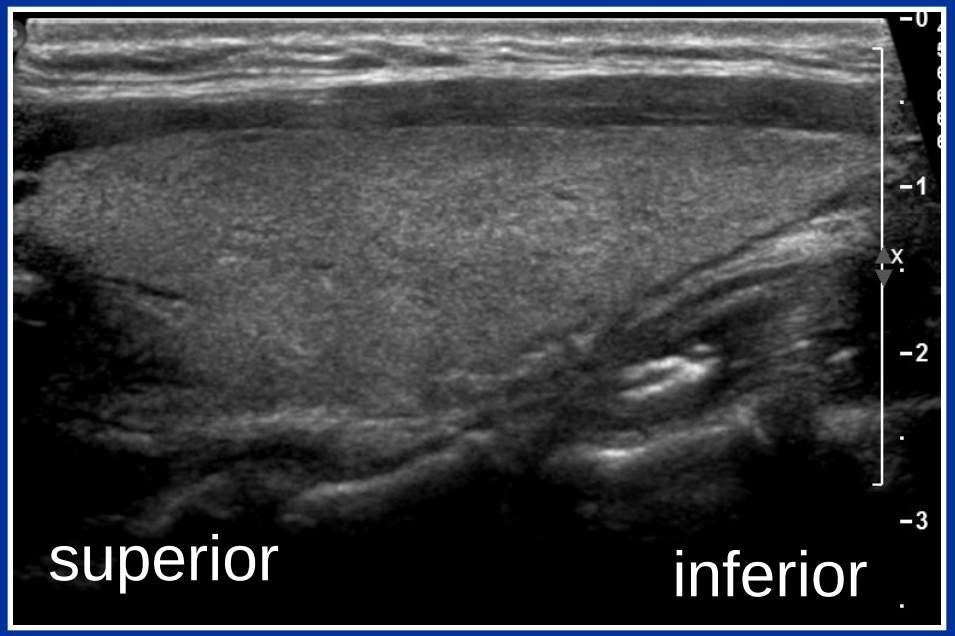
- Lobes are oval shaped with rounded superior pole and elongated inferior pole
- Lobe dimensions may vary greatly
  - 4-6cm in length
  - lobe thickness (AP dimension) ≤ 2cm
- Normal adult thyroid volume is ~10-15cc

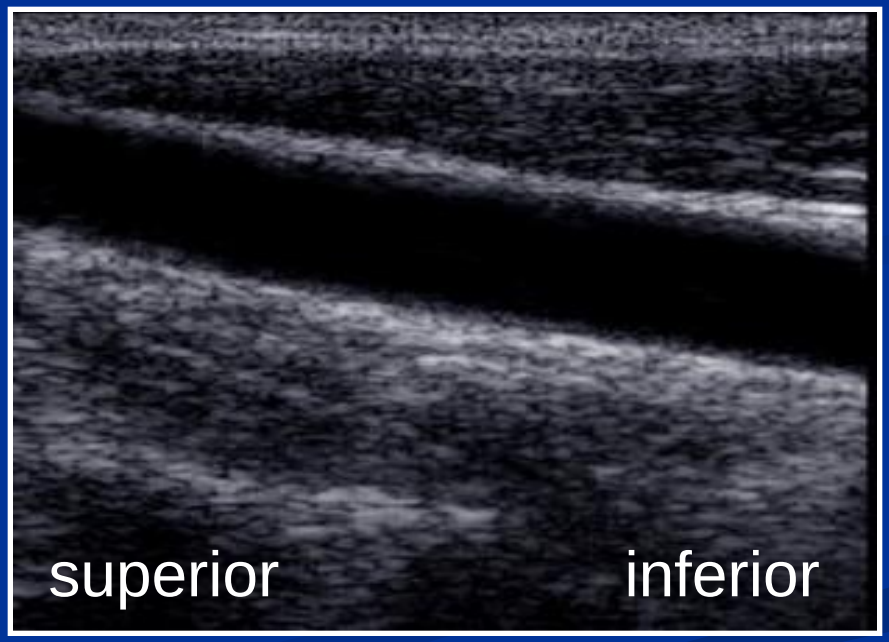
Transverse US scan of normal thyroid/neck





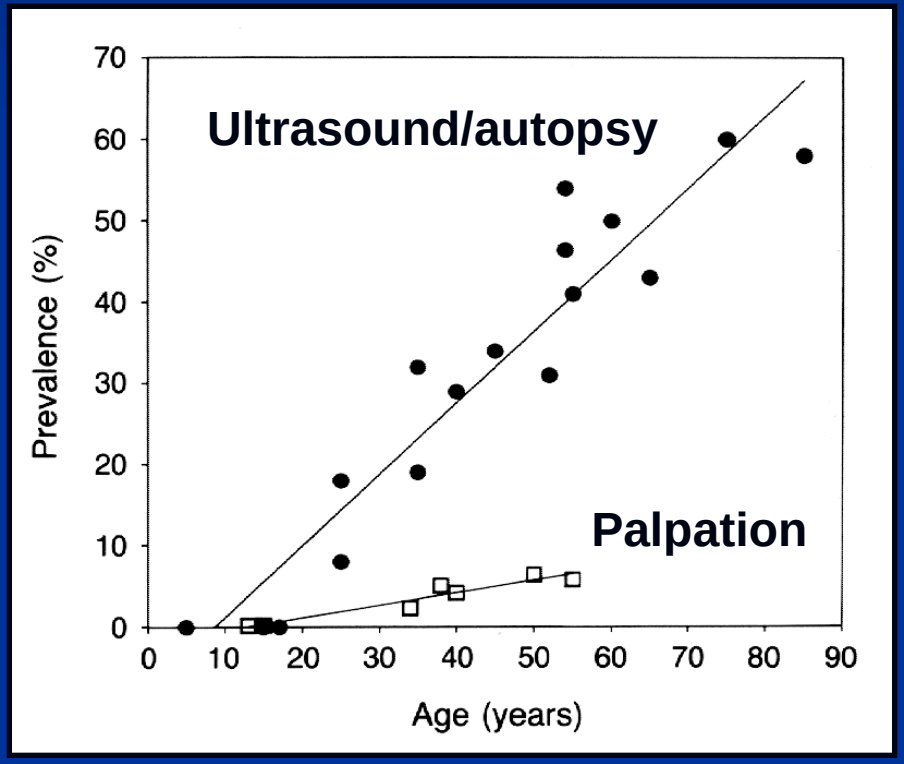
Longitudinal US scan of normal thyroid/neck





Thyroid Ultrasound in the diagnosis of thyroid nodules

Prevalence of thyroid nodules in the US



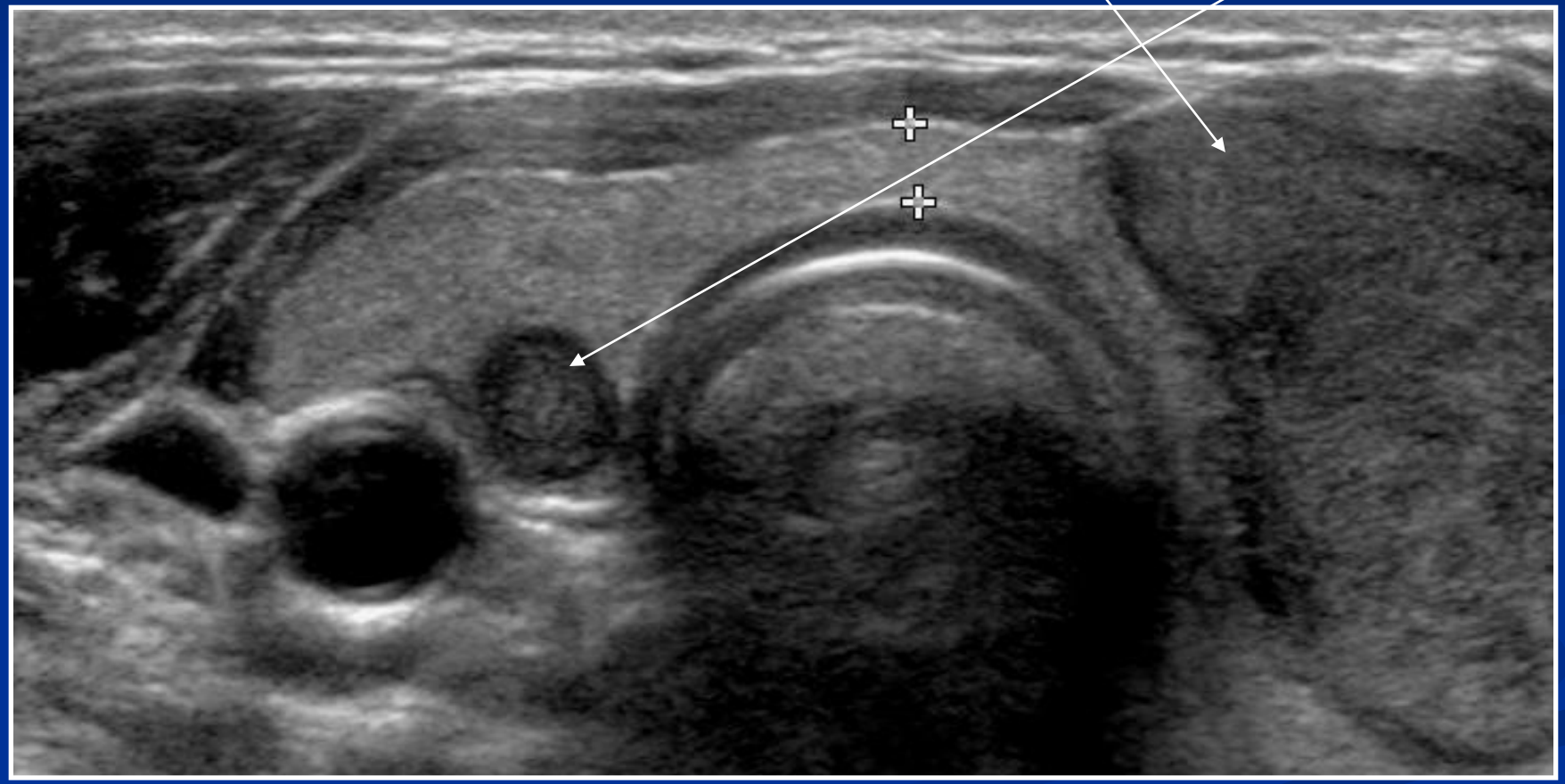
Mazzaferri, N Engl J Med 1993

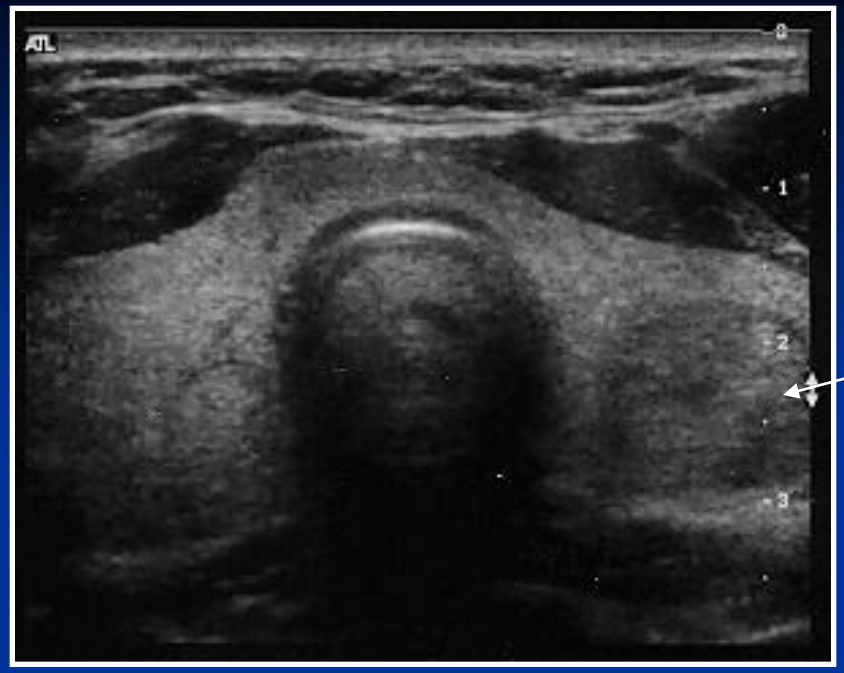
Prevalence of Echo Abnormalities by Age and Sex

Age Group (y)	Sex	*n*	Subjects with Abnormal Echo Pattern
20–29	M	39	6 (15)
19–29	F	37	11 (30)
30–39	M	38	5 (13)
30–39	F	44	14 (32)
40–50	M	46	13 (28)
40–50	F	49	20 (41)

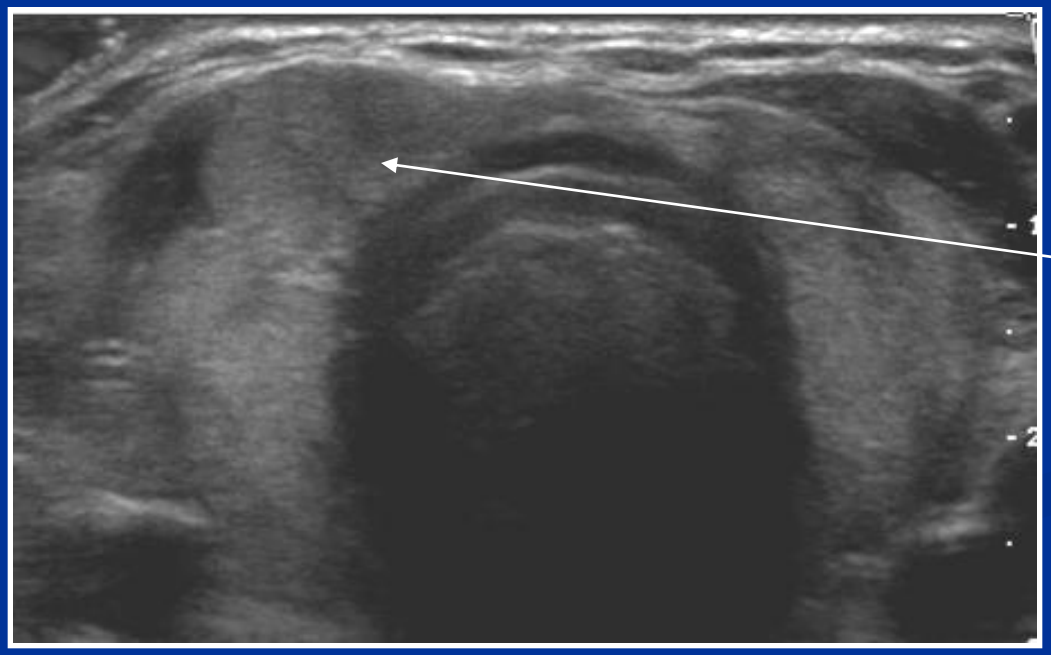
Brander et al Head & Neck Rad. 1991

You may palpate A but not B





Or this 1.5cm



Or this
Pseudo-nodule

What nodules are we missing?
Ultrasound vs. Palpation

Nodule Size (by US)	N	Missed (palpation)	%
<1cm	16	15	93.8
1-2 cm	28	14	50
> 2 cm	33	14	42.4
Total	**77**	**43**	**55.8**

Brander, J Clin Ultrasound 1992

Thyroid sonography should be performed in all patients with known or suspected thyroid nodules.
USPSTF Recommendation A

Revised ATA Management guidelines for patients with thyroid nodules and differentiated thyroid cancer, ATA Task Force, David Cooper, Chair, Thyroid, 2009

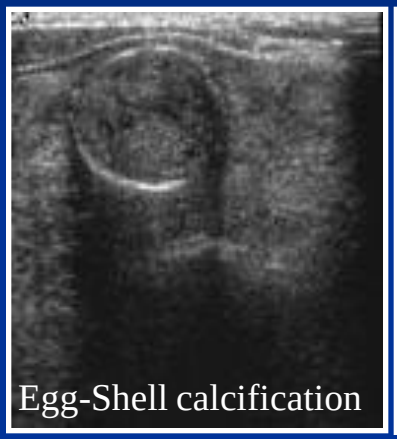
In all patients with palpable thyroid nodules or MNG's US should be performed.....
Grade B, BEL 3

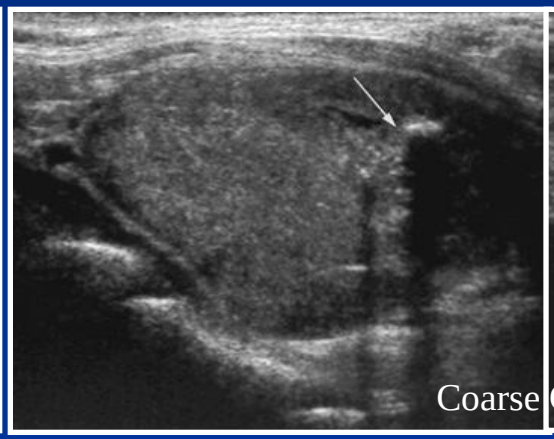
AACE/AME/ETA guidelines for clinical practice for the diagnosis and management of thyroid nodules, Endocrine Pract 2010

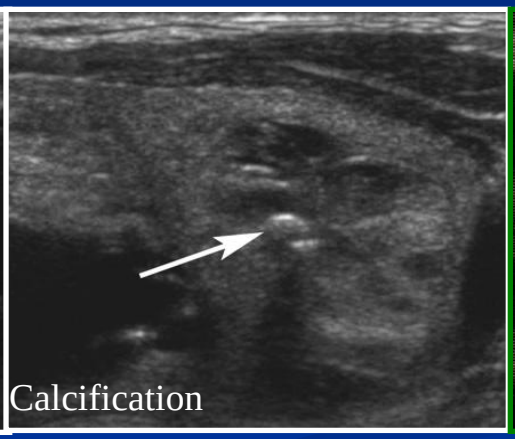
US Characteristics of Thyroid Nodules

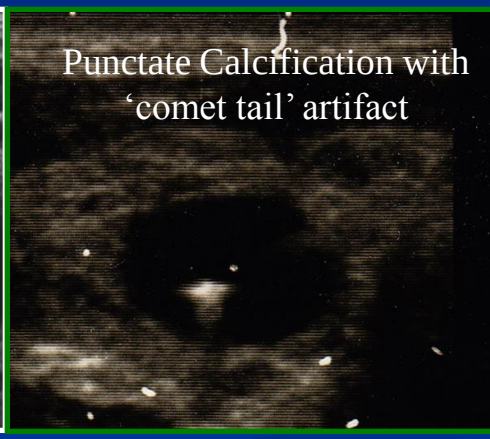
1. Echogenicity
2. Calcifications
3. Margins/Halo
4. Vascularity

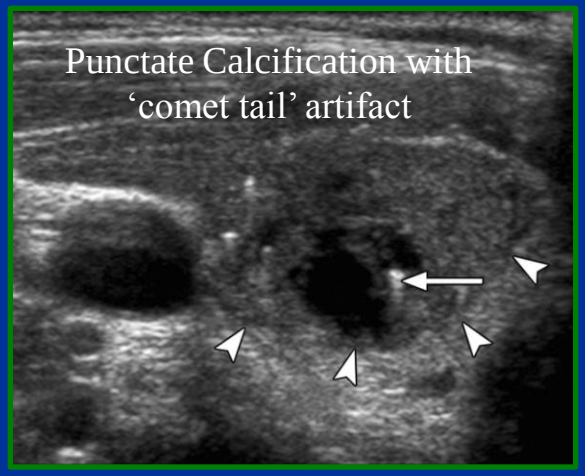
Calcification


Egg-Shell calcification


Coarse Calcification




Punctate Calcification with ‘comet tail’ artifact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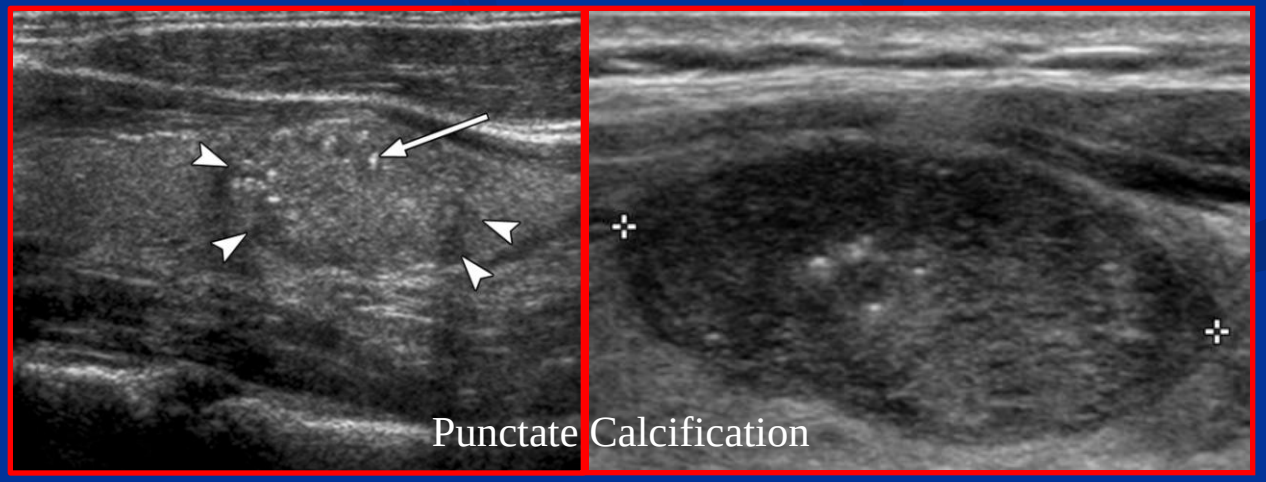
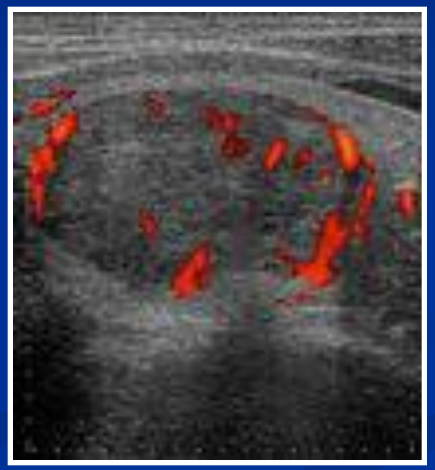
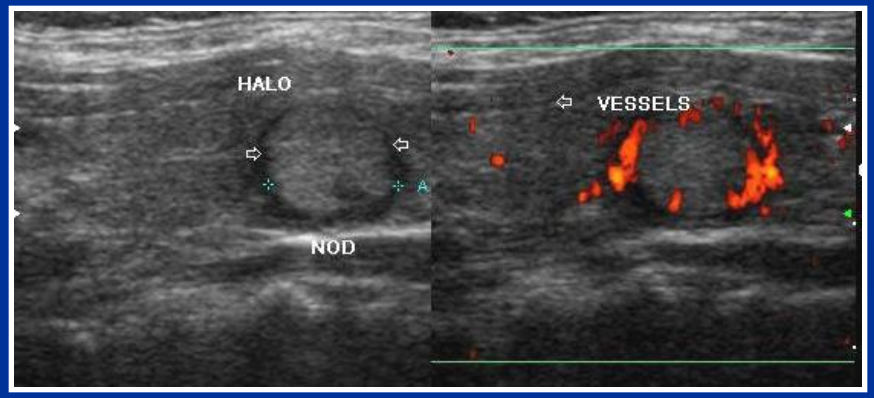
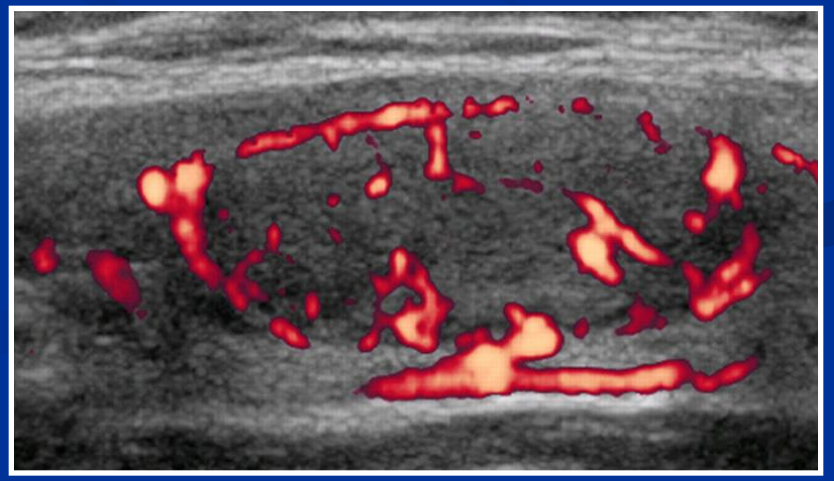

Punctate Calcification

Sonographically **Benign** ***appearing*** nodules

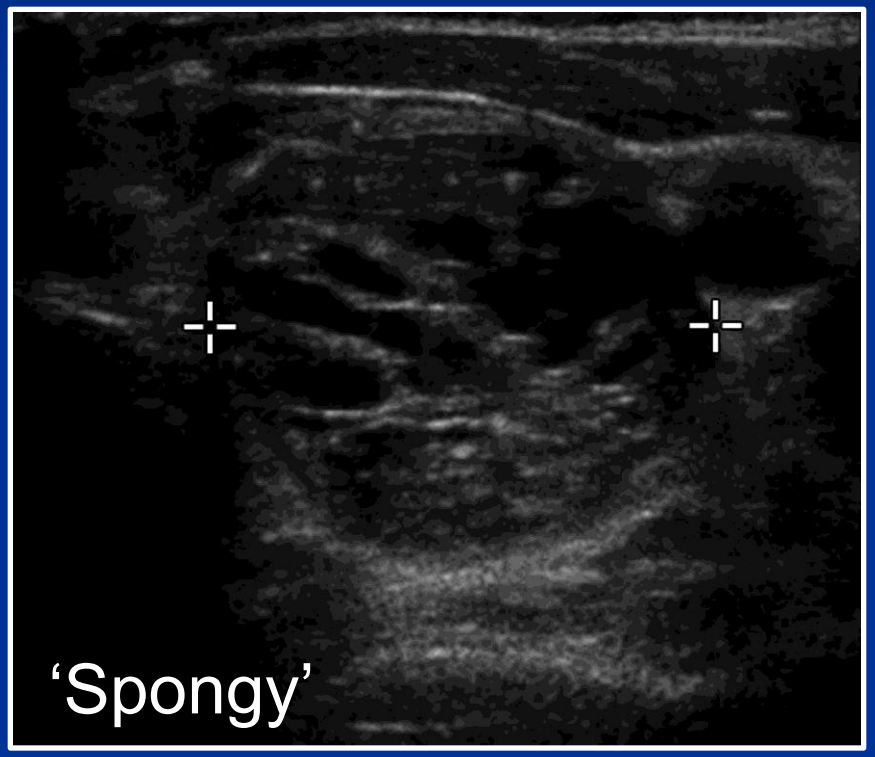
Iso/hyperechoic, halo, smooth margins, peripheral vascularity

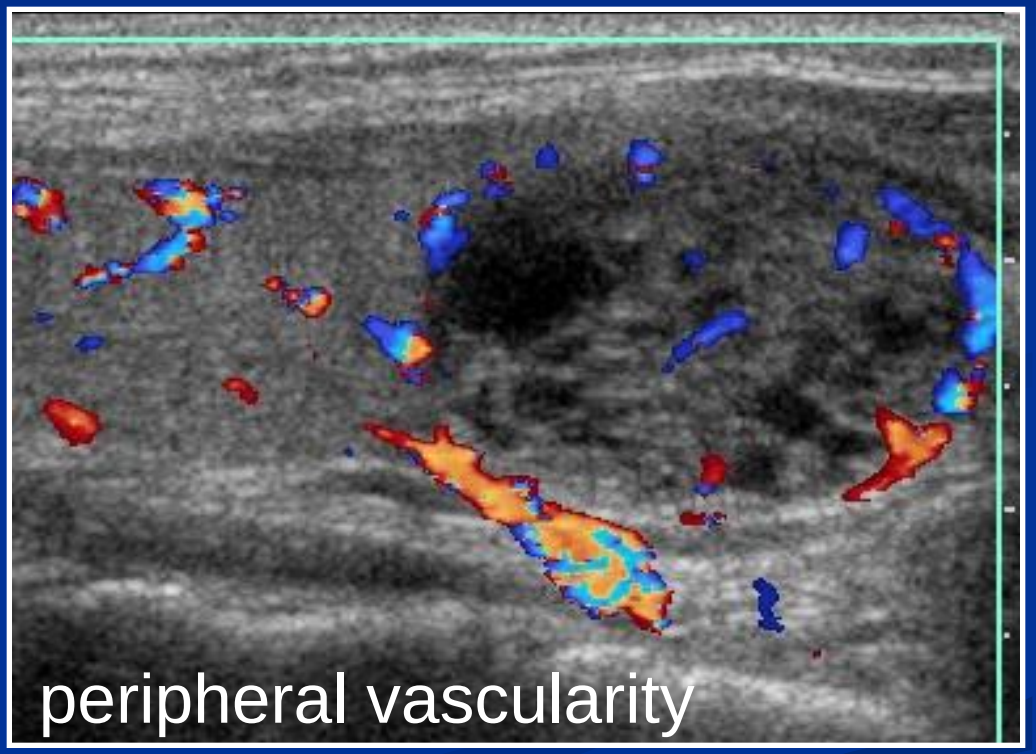




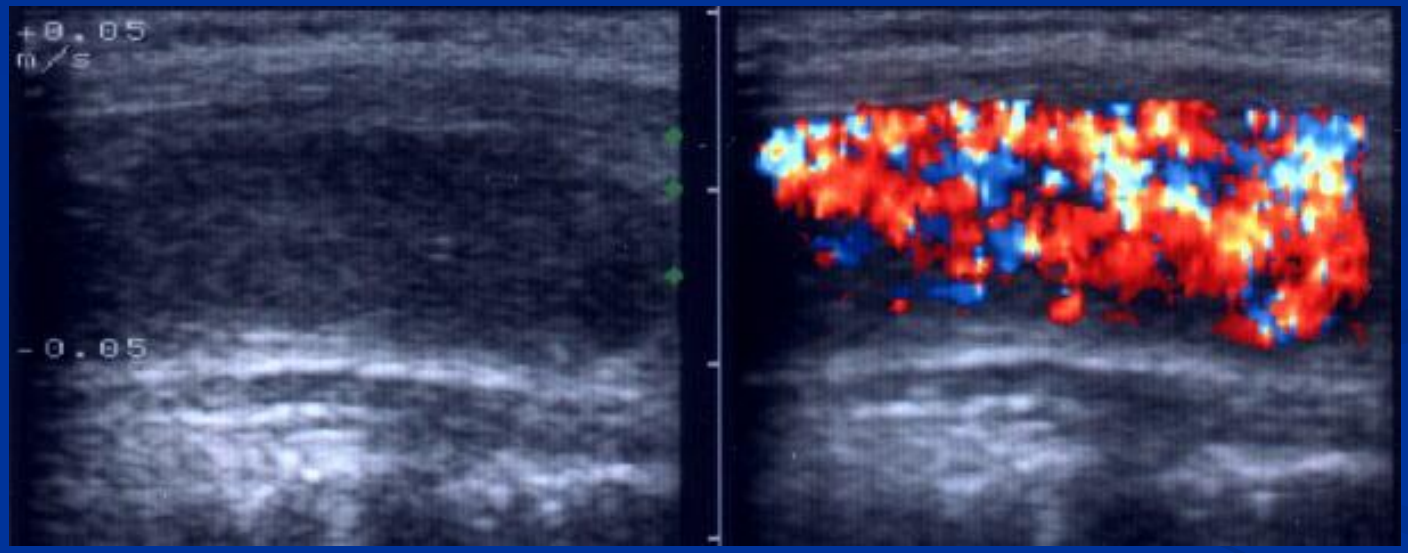


“Spongiform” nodules



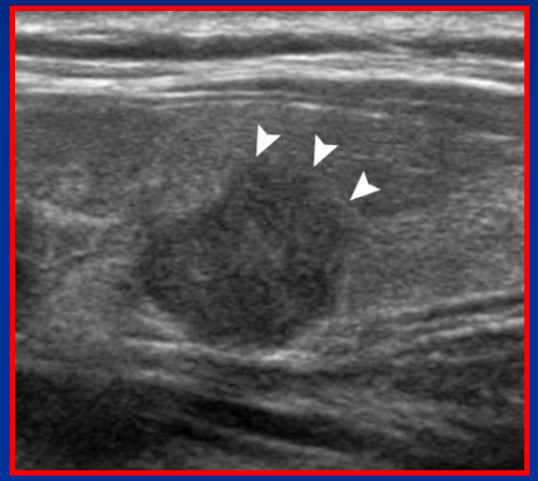


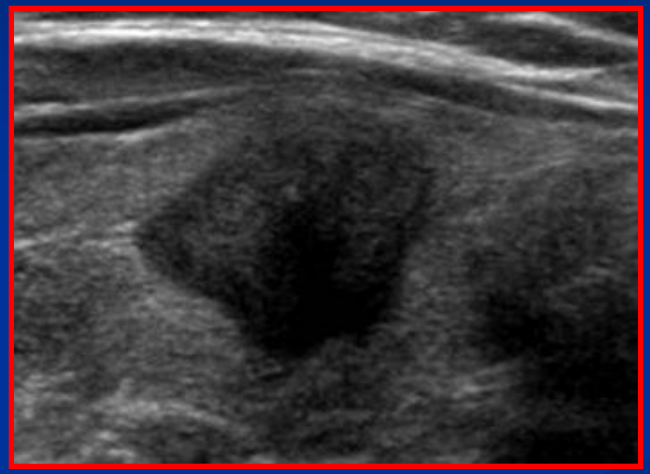
Graves' Gland

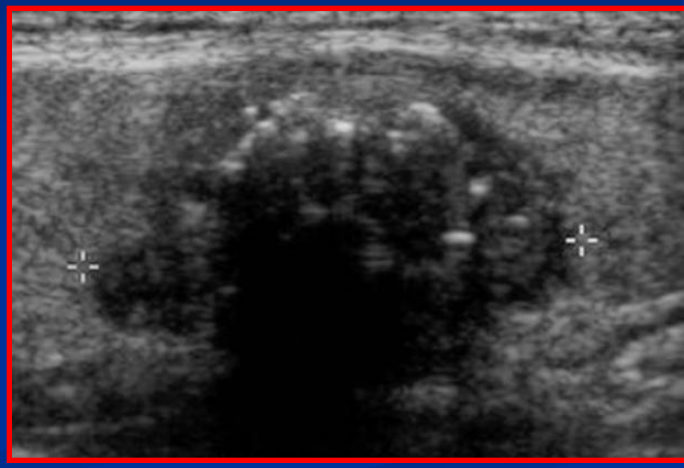


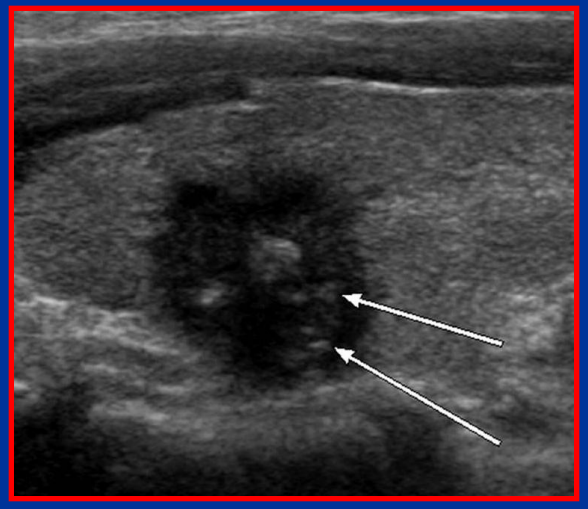
Sonographically **Suspicious** ***appearing*** nodules

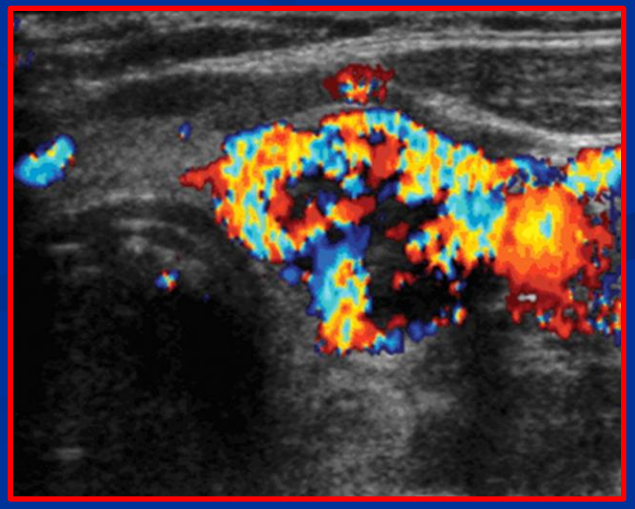
Hypoechoic, irregular margins, punctate microcalcifications, intra-nodular flow











- 66% of benign nodules have at least one positive US predictor of papillary thyroid cancer[1]

- 66% of papillary cancers have at least one non-suspicious US feature[2,3]

[1]Wienke J Ultrasound Med 2003; [2]Chan, J Ultrasound Med 2003; [3]Yuan, Clin Imaging 2006

Prediction of Thyroid Cancer by Thyroid Ultrasound characteristics

TABLE 1
US Features Associated with Thyroid Cancer

US Feature*	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)
Microcalcifications (1–5)	26.1–59.1	85.8–95.0	24.3–70.7	41.8–94.2
Hypoechogenicity (2–5)	26.5–87.1	43.4–94.3	11.4–68.4	73.5–93.8
Irregular margins or no halo (2–5)	17.4–77.5	38.9–85.0	9.3–60.0	38.9–97.8
Solid (4–6)	69.0–75.0	52.5–55.9	15.6–27.0	88.0–92.1
Intranodule vascularity (3, 6)	54.3–74.2	78.6–80.8	24.0–41.9	85.7–97.4
More tall than wide (2)	32.7	92.5	66.7	74.8

* Numbers in parentheses are reference numbers.

Frates, J Clin Endocrinol Metab 2006

Diagnosis of Thyroid Nodules

	Sensitivity	Specificity
Ultrasound features	Low	High
FNA	92%	84%

Diagnostic tests require high sensitivity!!

Thyroid US-Risk Stratification

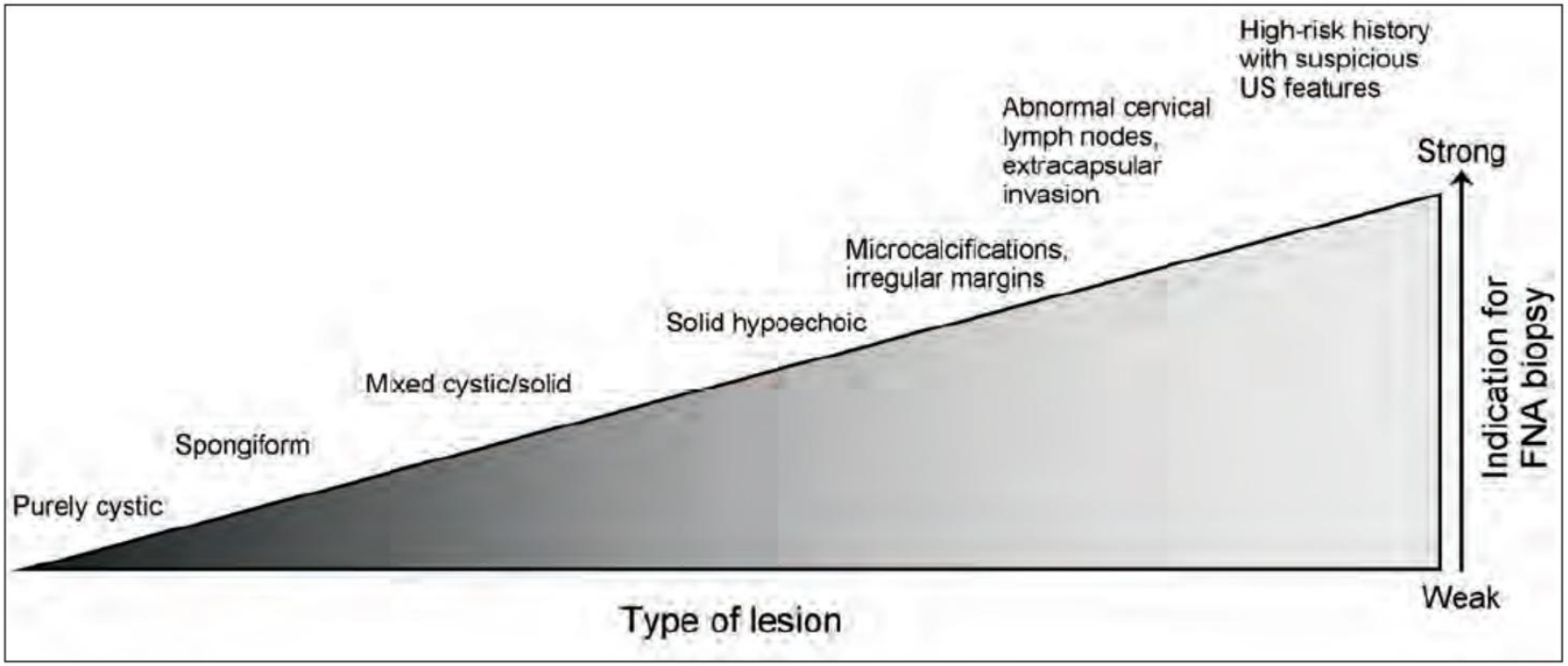


Fig. 2. Strength of indication for fine-needle aspiration (FNA) biopsy of thyroid nodules on the basis of ultrasonography (US) findings.

AACE/AME/ETA guidelines for clinical practice for the diagnosis and management of thyroid nodules, Endocrine Pract 2010

THANK YOU