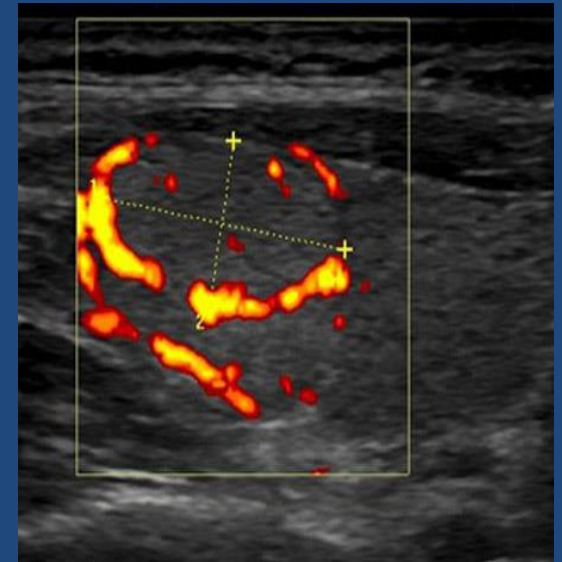
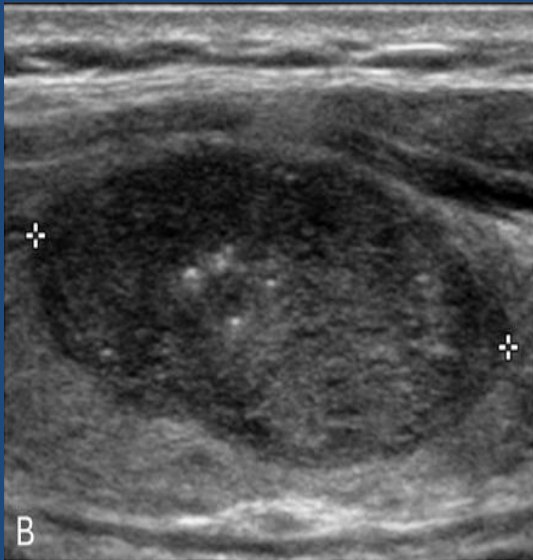


The Evaluation of Thyroid Nodules



Matthew P. Gilbert, DO, MPH
Assistant Professor of Medicine
The University of Vermont College of Medicine
Burlington, VT

Objectives

- Review the prevalence of thyroid nodules
- Discuss the various types of thyroid nodules
- Review the appropriate evaluation of clinically or incidentally discovered thyroid nodules
- Discuss the role of diagnostic imaging in the evaluation of thyroid nodules
- Long-term follow-up of thyroid nodules

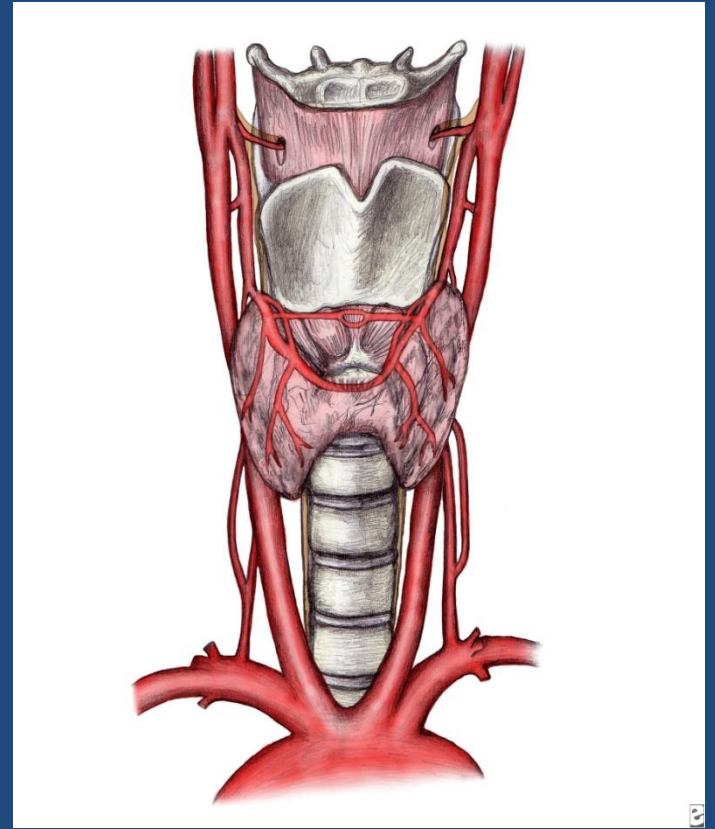
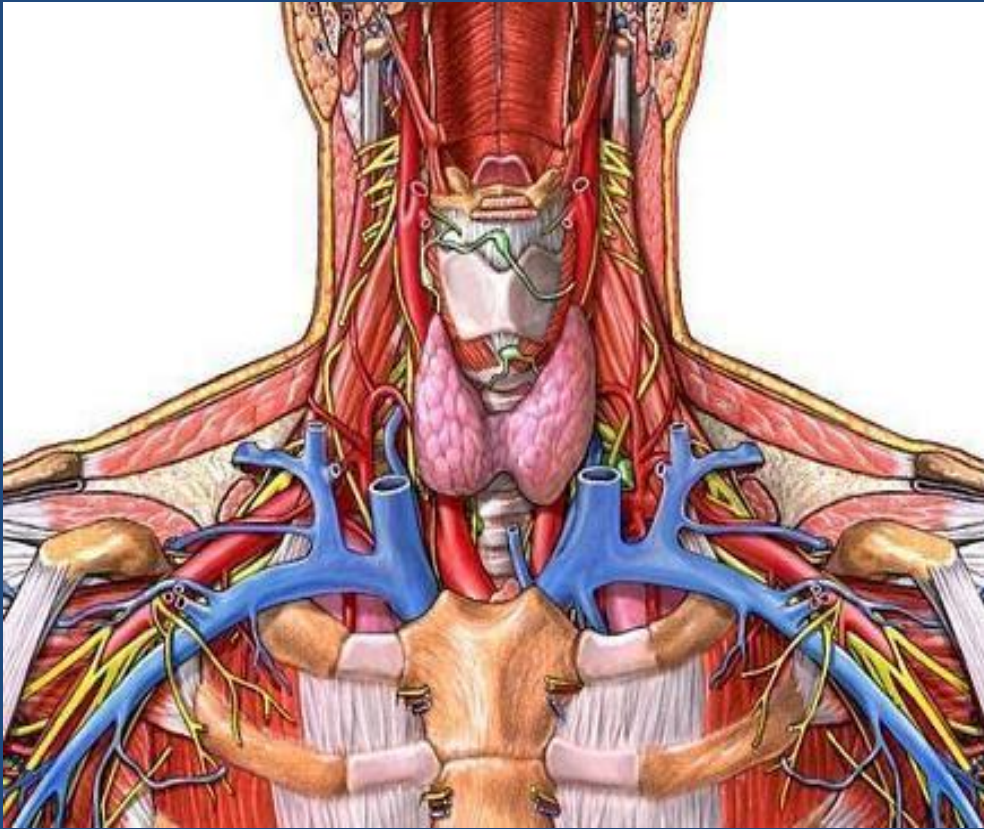
Prevalence of Thyroid Nodules

- Common clinical problem
- Prevalence of palpable thyroid nodules is 5% in women and 1% in men ¹
- Ultrasound can detect nodules in 16-67% of randomly selected individuals ²
- Need to exclude thyroid cancer and functional thyroid nodules

¹ Vander JB, et al. *Ann Intern Med.* 1968;69:537-540

² Tan GH, et al. *Ann Intern Med.* 1997;126:226-231

Normal Thyroid Anatomy



What is a Thyroid Nodule?

- Discrete lesion within the thyroid gland that is radiographically distinct
- Some palpable lesions may not correspond to distinct radiographic abnormalities
- Nonpalpable nodules have the same risk of malignancy as palpable nodules with the same size ¹

¹ Hagag P, et al. *Thyroid*. 1998;8:989-995

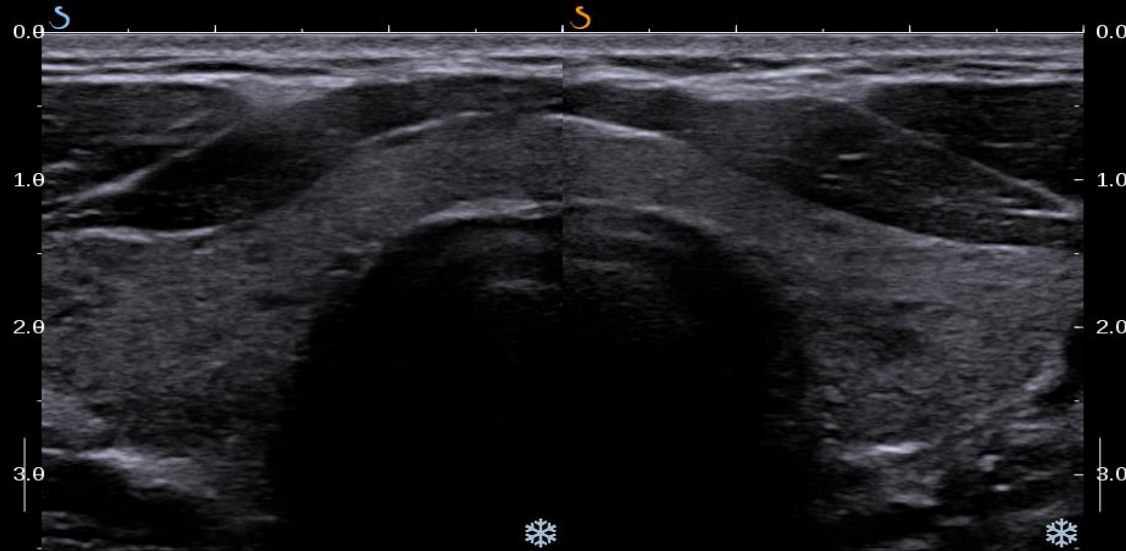
Normal Thyroid Anatomy

S 09/11/2009 07:10:03 PM

SUPERSONIC IMAGINE :
ID: 2009_11_09_184826_713

SL15-4 / Thyroid
MI1.6 TI 0.1

B
Tissue Average
Super Compound On
SuperRes 3
Gen / Med
Map 3 / 65 dB / Medium
Gain 43 %
Fr. 86 Hz
HD



Fr: 361/361

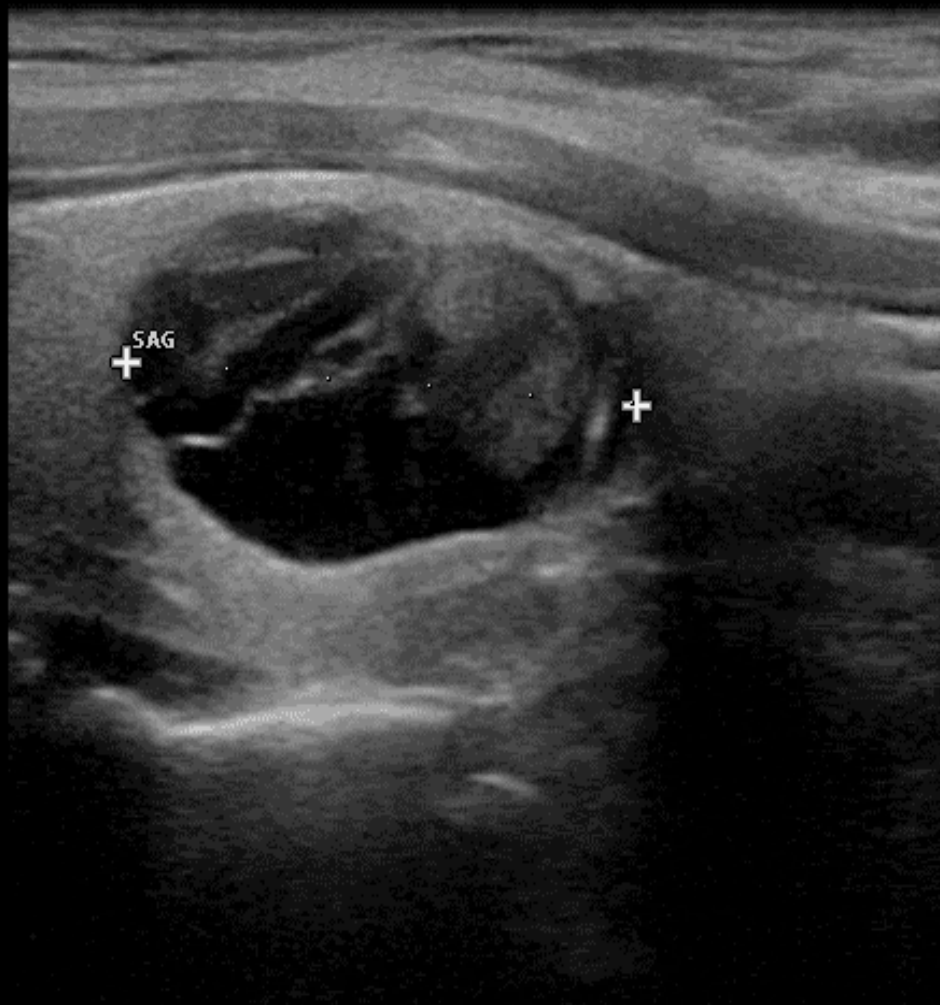
H-----

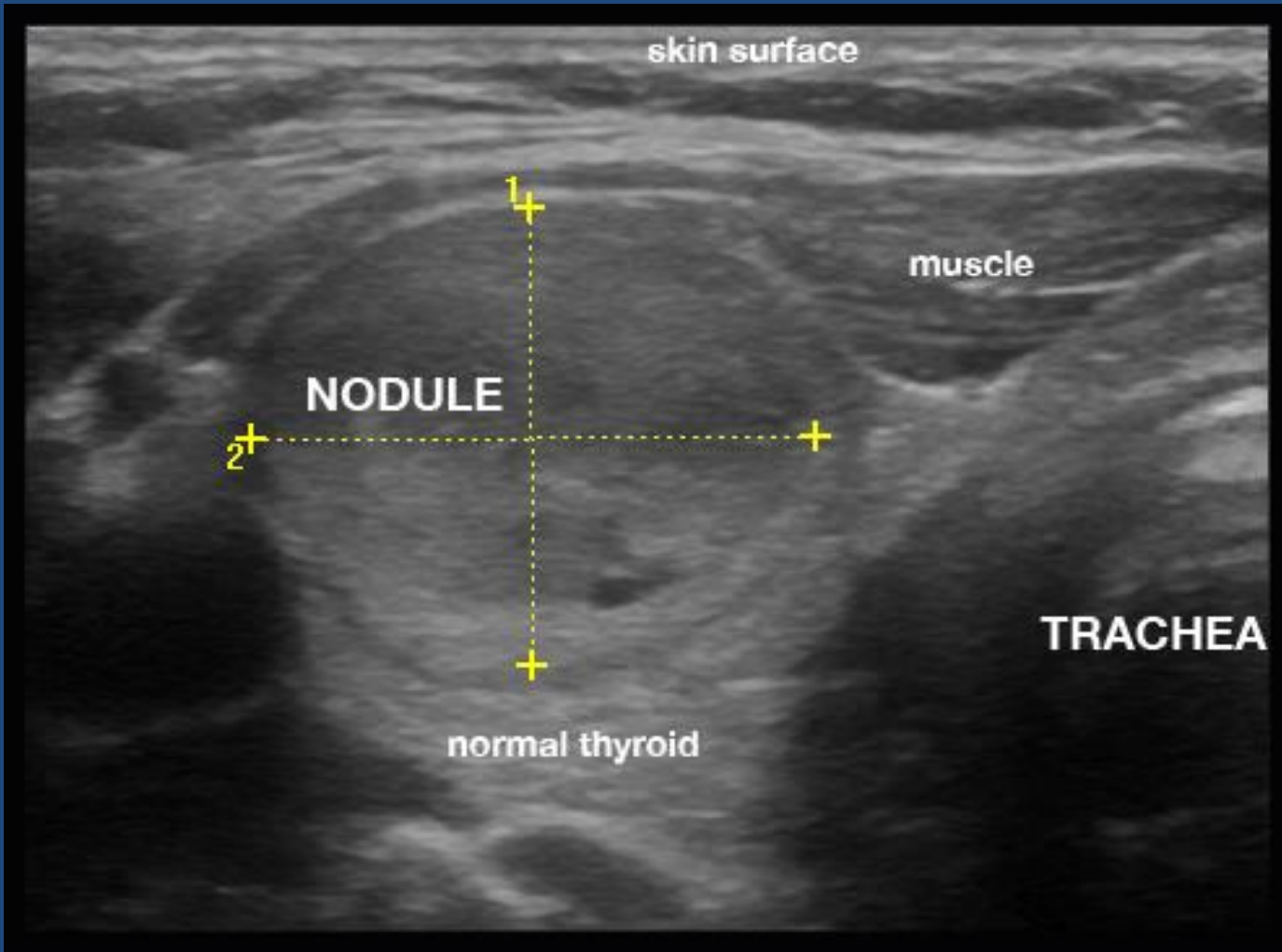
B	F	12	MHZ	G	64%
D	5	cm	XV	C	
PRC	15-3-L		PRS	5	
PST	3		MV	1	

THYROID LA523

NOD 1

AP	1.38	cm
TV	2.46	cm
SAG	2.52	cm
V	4.5	ml





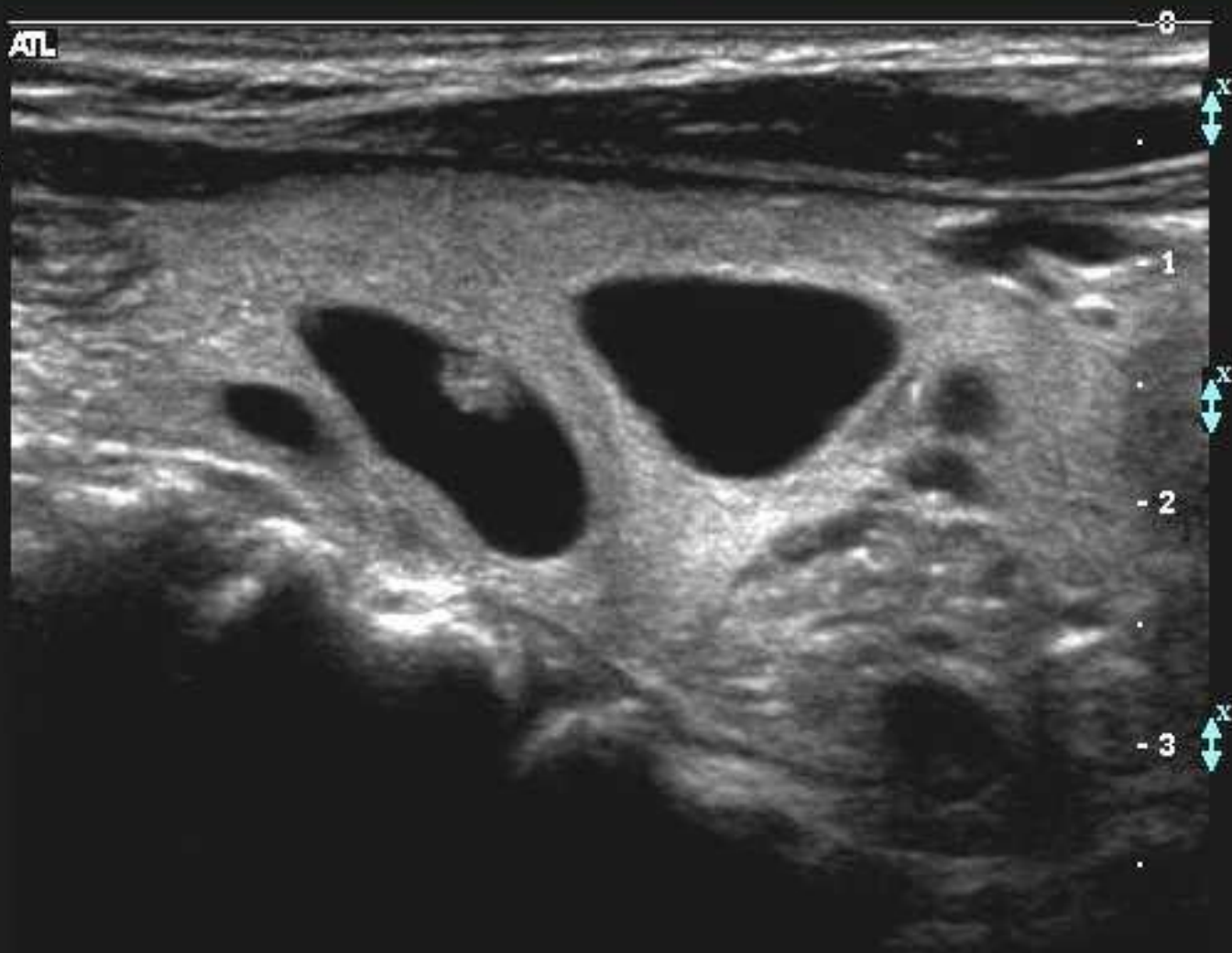
HDI
5000

L12-5 50 SmPrt/Thyr

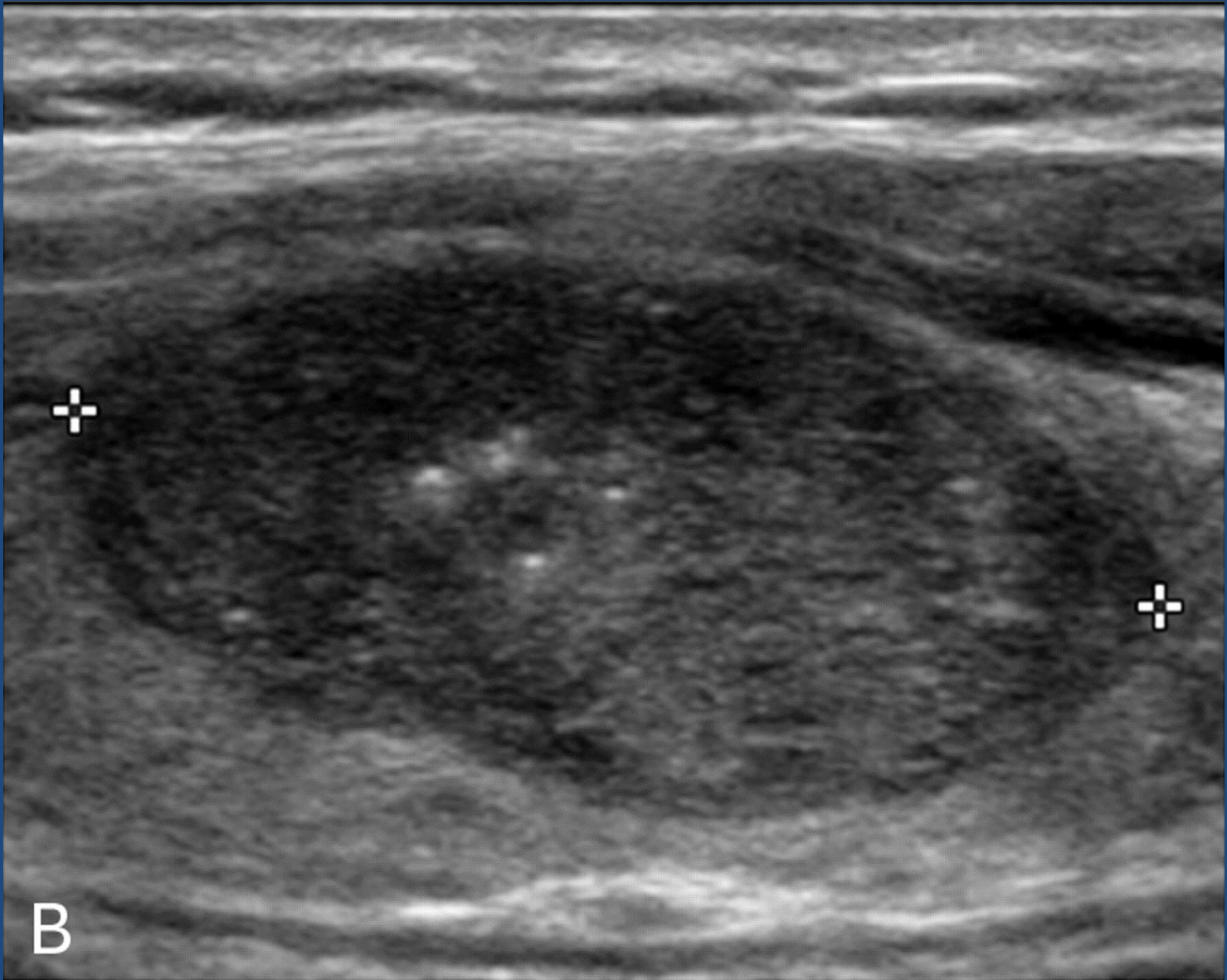
11:54:51 am

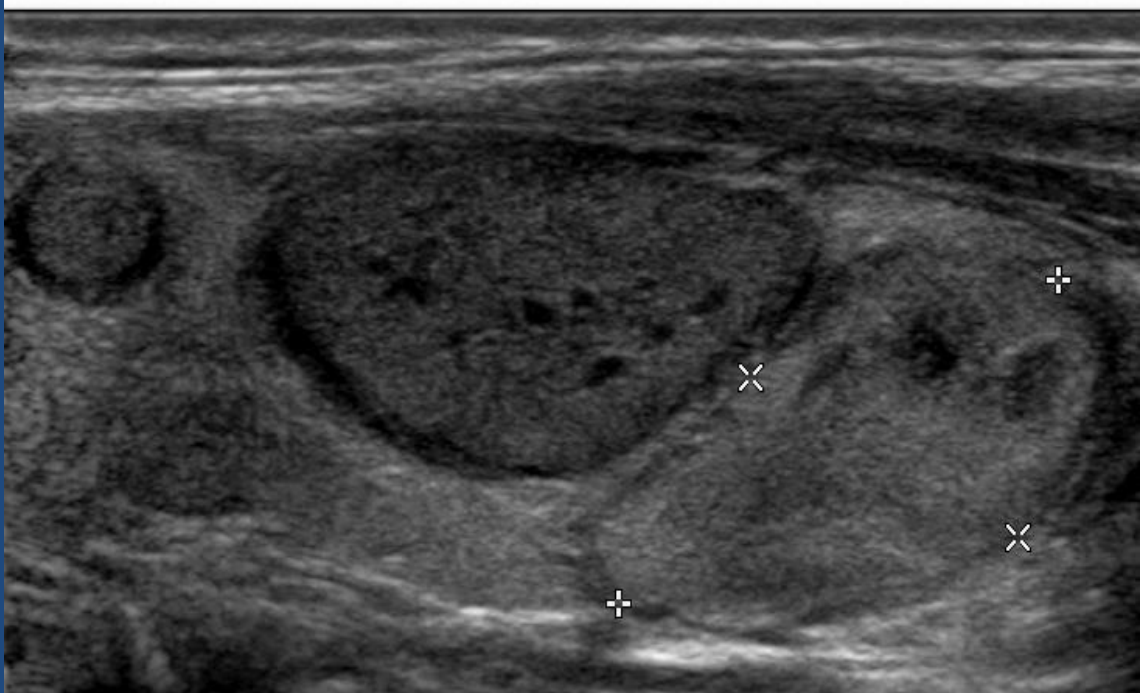
TIs 0.1 MI 0.57
Fr #136 3.9 cm

Map 3
170dB/C 2
Persist Off
2D Opt:FSCT
Fr Rate:Surv
SonoCT™
XRes™



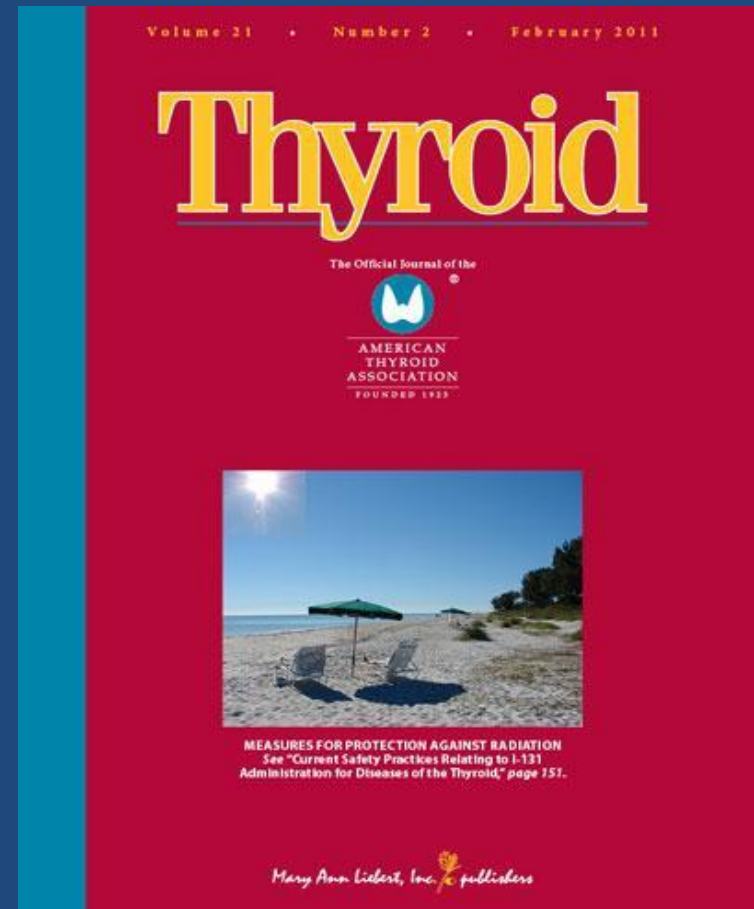
THYROID NODULES
SonoCT™ IMAGING WITH XRES™ TECHNOLOGY





Guidelines

- American Thyroid Association (ATA) first published in 1996
- Revised in 2009 ¹
- AACE, ACE, AAES, BTA have all published guidelines
- Current ATA guidelines are endorsed by many organizations



¹ Cooper DS, et al. *Thyroid*. 2009;19:1167

Evaluation of Thyroid Nodules

- History of childhood head and neck irradiation
- Total body irradiation
- Family history of thyroid cancer
- Thyroid cancer syndrome in 1st degree relative



Evaluation of Thyroid Nodules



- Vocal cord paralysis
- Lateral cervical lymphadenopathy
- Fixation of nodule to surrounding tissues
- Rapid growth and hoarseness

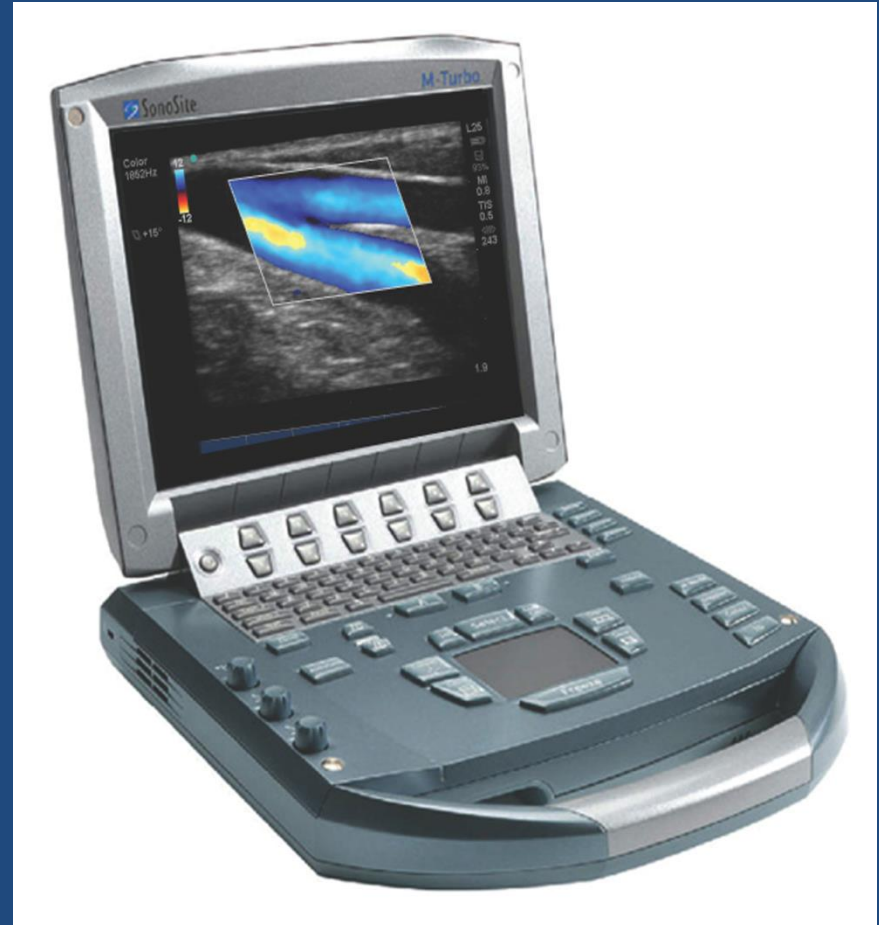
What lab tests are indicated?

- Obtain a serum TSH
- Anti-thyroglobulin and TPO antibodies are not helpful and should not be ordered
- If TSH subnormal, consider an uptake and scan
- Hyperfunctioning (hot) nodules rarely harbor malignancy
- Higher serum TSH is associated with increased risk of malignancy ¹

¹ Boelaert K, et al. *J Clin Endo Metab.* 2006;91:4295-4301

Thyroid Ultrasound

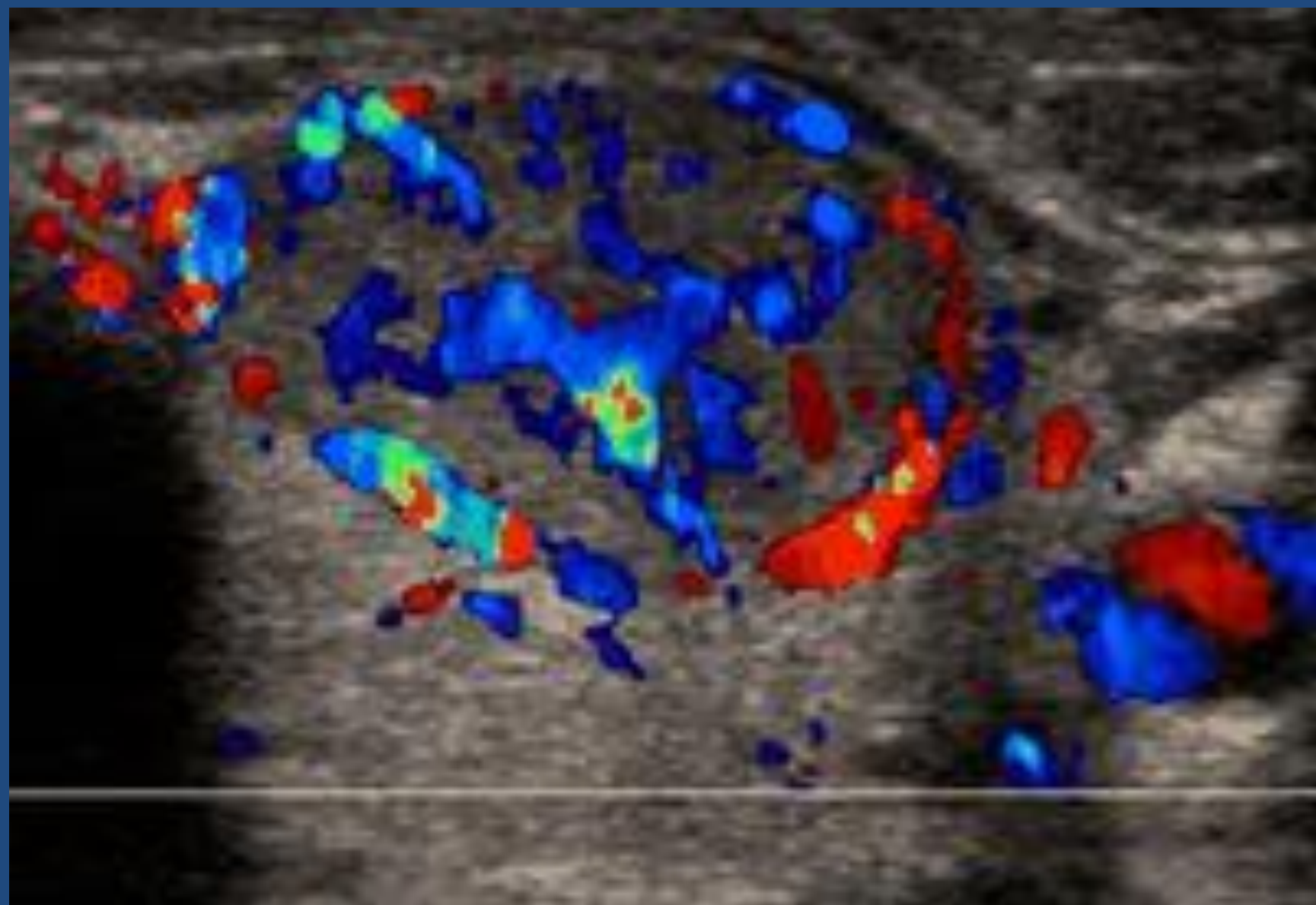
- Is there a nodule?
- How large is the nodule?
- Does the nodule have benign or suspicious features?
- Cervical lymphadenopathy?
- Is the nodule >50% cystic?



Suspicious Features

- Microcalcifications
- Increased nodular vascularity
- Infiltrated or irregular margins
- Taller than wider on transverse view
- Hypoechoic







Ultrasound Features

TABLE 3. SONOGRAPHIC AND CLINICAL FEATURES OF THYROID NODULES AND RECOMMENDATIONS FOR FNA

<i>Nodule sonographic or clinical features</i>	<i>Recommended nodule threshold size for FNA</i>	
High-risk history ^a		
Nodule WITH suspicious sonographic features ^b	>5 mm	Recommendation A
Nodule WITHOUT suspicious sonographic features ^b	>5 mm	Recommendation I
Abnormal cervical lymph nodes	All ^c	Recommendation A
Microcalcifications present in nodule	≥1 cm	Recommendation B
Solid nodule		
AND hypoechoic	>1 cm	Recommendation B
AND iso- or hyperechoic	≥1–1.5 cm	Recommendation C
Mixed cystic–solid nodule		
WITH any suspicious ultrasound features ^b	≥1.5–2.0 cm	Recommendation B
WITHOUT suspicious ultrasound features	≥2.0 cm	Recommendation C
Spongiform nodule	≥2.0 cm ^d	Recommendation C
Purely cystic nodule	FNA not indicated ^e	Recommendation E

^aHigh-risk history: History of thyroid cancer in one or more first degree relatives; history of external beam radiation as a child; exposure to ionizing radiation in childhood or adolescence; prior hemithyroidectomy with discovery of thyroid cancer, ¹⁸FDG avidity on PET scanning; MEN2/FMTC-associated RET protooncogene mutation, calcitonin >100 pg/mL. MEN, multiple endocrine neoplasia; FMTC, familial medullary thyroid cancer.

^bSuspicious features: microcalcifications; hypoechoic; increased nodular vascularity; infiltrative margins; taller than wide on transverse view.

^cFNA cytology may be obtained from the abnormal lymph node in lieu of the thyroid nodule.

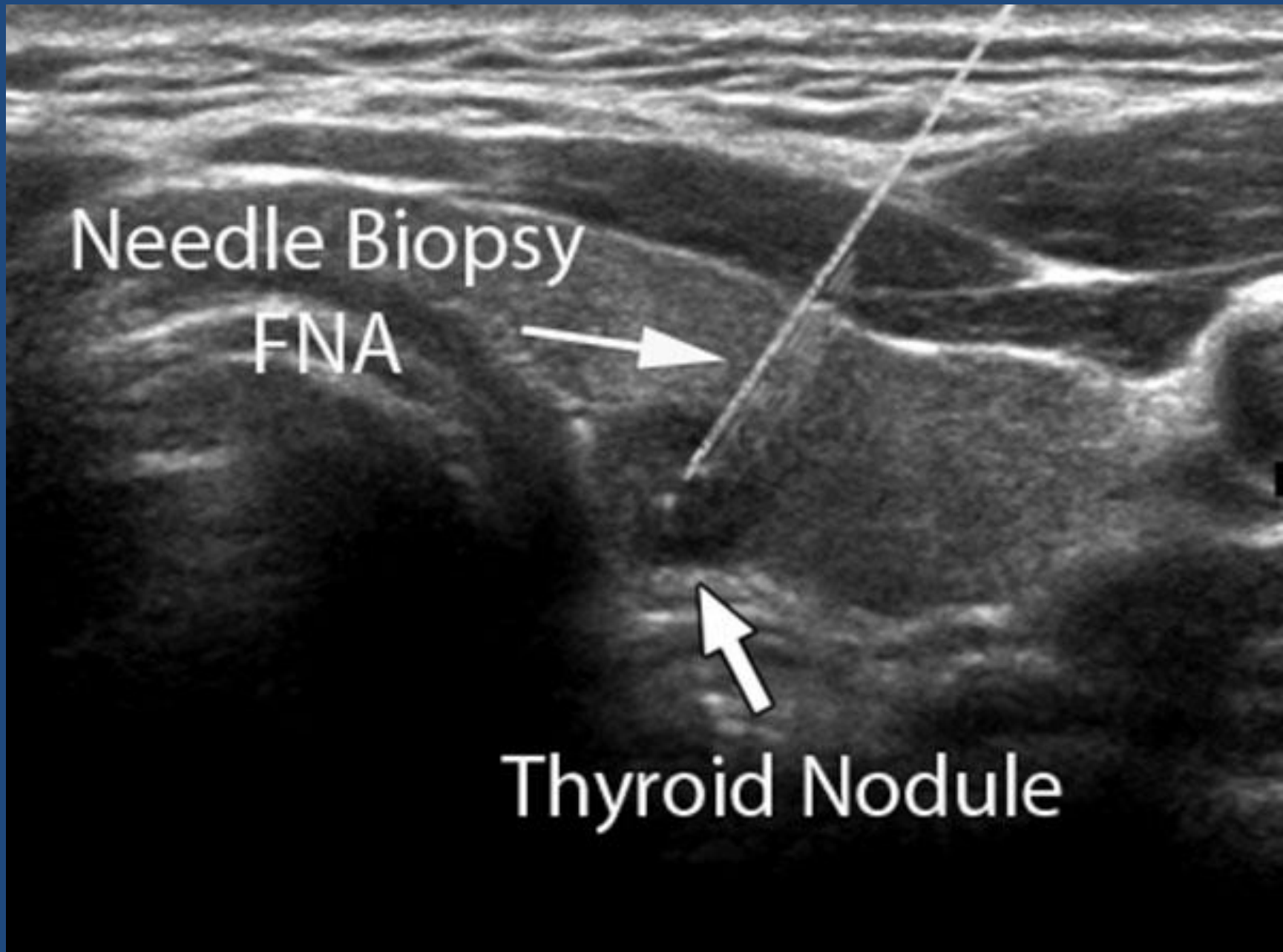
^dSonographic monitoring without biopsy may be an acceptable alternative (see text) (48).

^eUnless indicated as therapeutic modality (see text).

FNA of Thyroid Nodules

- Most accurate and cost-effective
- Lower rates of false negatives and nondiagnostic samples with ultrasound guidance vs. palpation ¹
- Results grouped into one of five categories
- Nondiagnostic, benign, AFCUS, suspicious for carcinoma, malignant

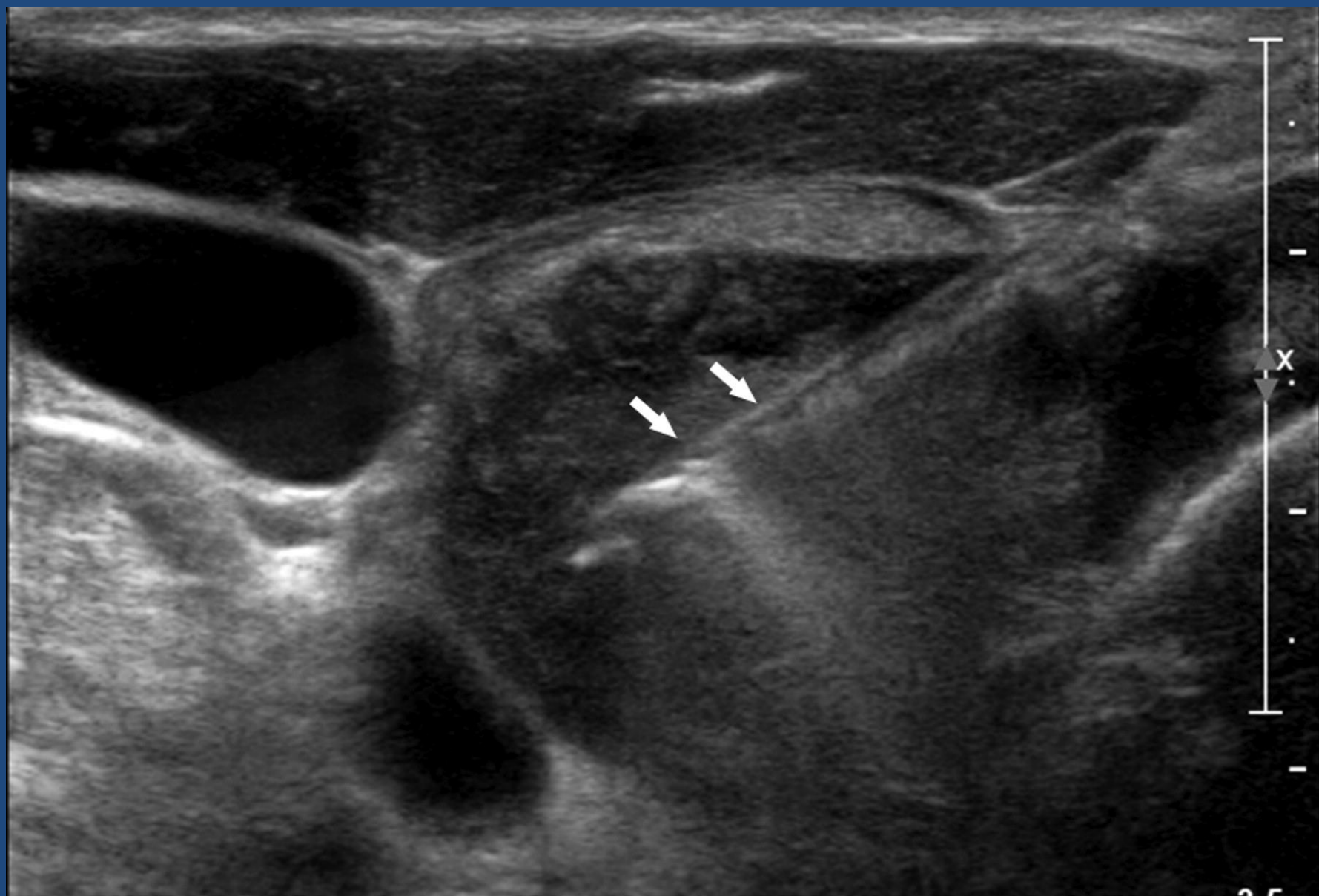
¹ Carmwci C, et al. *Thyroid*. 1998;8:15-21.



Needle Biopsy

FNA

Thyroid Nodule



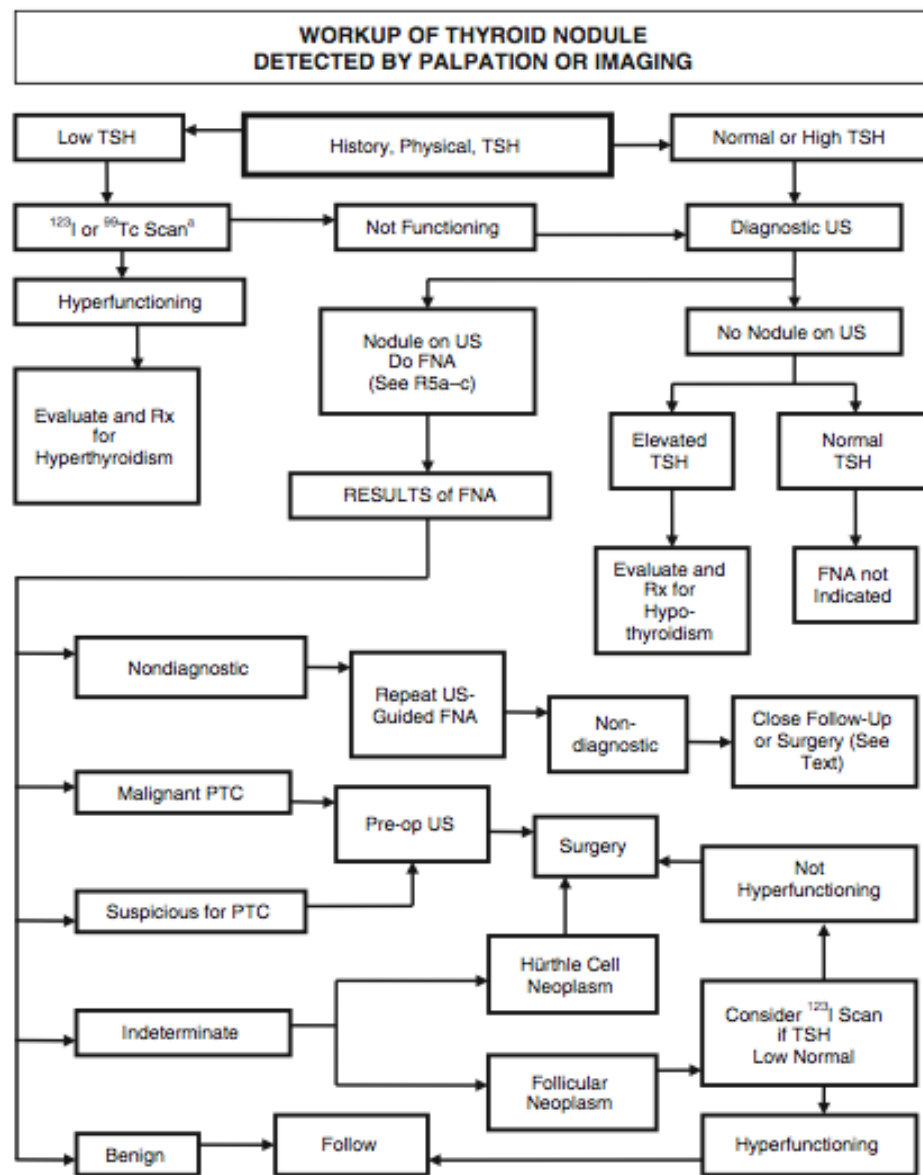


FIG. 1. Algorithm for the evaluation of patients with one or more thyroid nodules.
^aIf the scan does not show uniform distribution of tracer activity, ultrasound may be considered to assess for the presence of a cystic component.

Follow-up of Thyroid Nodules

- Low, but not negligible, false-negative rate with FNA
- False-negative rate estimated at 1-5%
- Rate is higher in nodules > 4 cm in size
- Benign nodules grow
- Rate of growth did not predict malignancy

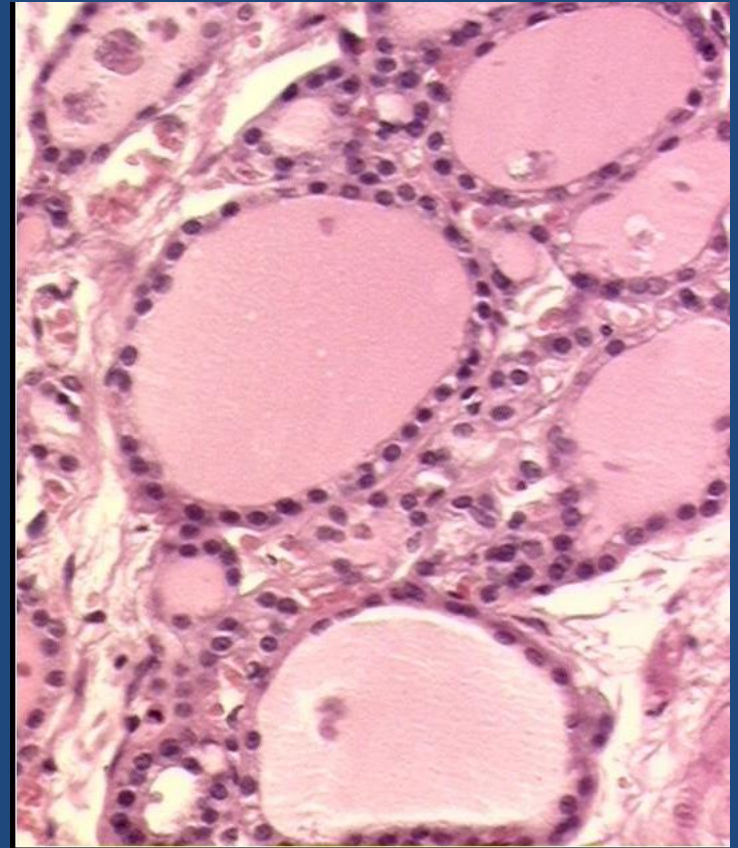


Follow-up of Thyroid Nodules

- All benign thyroid nodules should be followed with serial ultrasound examinations
- Repeat ultrasound 6-18 months after biopsy
- If nodule is stable (i.e., no more than 50% change in volume) the interval between examinations may be longer
- Repeat ultrasound in 2-5 years.
- Repeat FNA if nodule meets growth criteria

Multinodular Goiter

- Similar risk of malignancy
- Role for uptake and scan?
- All suspicious nodules should be biopsied
- Aspirate the largest on each side if no suspicious nodules are present
- Follow-up with ultrasound



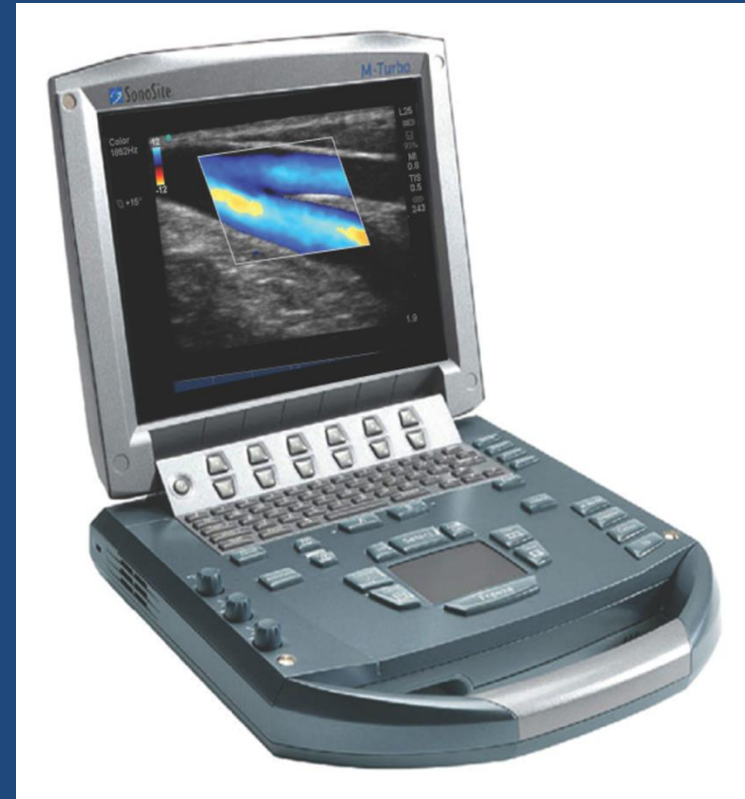
Clinical Case 1

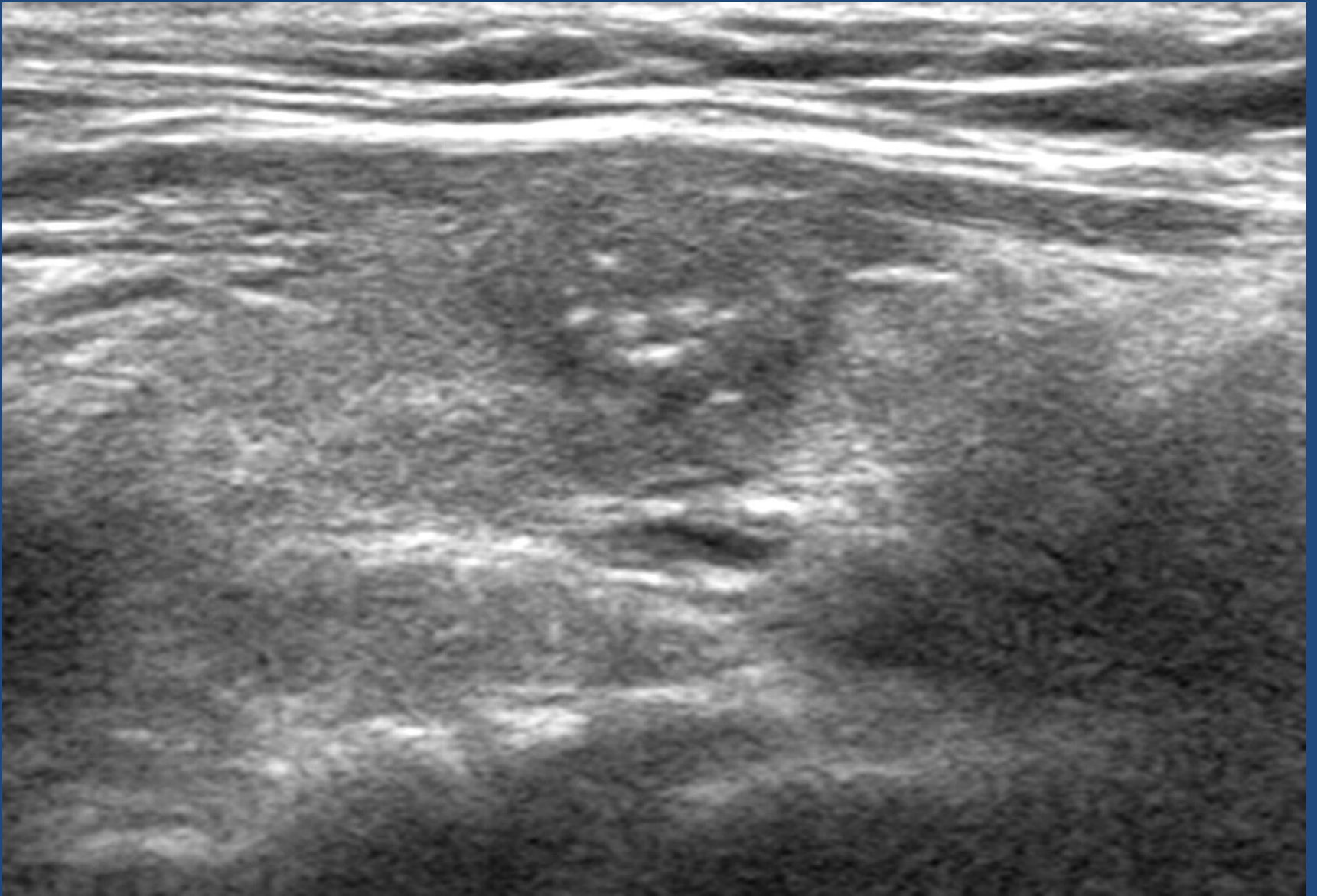
- Pt is a 45 year-old male with hypothyroidism
- CT head after recent MVA showed a 0.5 cm thyroid nodule
- No history of neck or mantle radiation
- No family history of thyroid cancer



Clinical Case 1

- Get an ultrasound
- All radiographic abnormalities should be followed up by formal ultrasound
- Patients with chronic lymphocytic thyroiditis may have pseudo nodular pattern





Ultrasound showed a 0.8 x 1.2 x 0.8 cm thyroid nodule

What is the next appropriate step in the evaluation of this patient's thyroid nodule?

TABLE 3. SONOGRAPHIC AND CLINICAL FEATURES OF THYROID NODULES AND RECOMMENDATIONS FOR FNA

<i>Nodule sonographic or clinical features</i>	<i>Recommended nodule threshold size for FNA</i>	
High-risk history ^a		
Nodule WITH suspicious sonographic features ^b	>5 mm	Recommendation A
Nodule WITHOUT suspicious sonographic features ^b	>5 mm	Recommendation I
Abnormal cervical lymph nodes	All ^c	Recommendation A
Microcalcifications present in nodule	≥1 cm	Recommendation B
Solid nodule		
AND hypoechoic	>1 cm	Recommendation B
AND iso- or hyperechoic	≥1–1.5 cm	Recommendation C
Mixed cystic–solid nodule		
WITH any suspicious ultrasound features ^b	≥1.5–2.0 cm	Recommendation B
WITHOUT suspicious ultrasound features	≥2.0 cm	Recommendation C
Spongiform nodule	≥2.0 cm ^d	Recommendation C
Purely cystic nodule	FNA not indicated ^e	Recommendation E

^aHigh-risk history: History of thyroid cancer in one or more first degree relatives; history of external beam radiation as a child; exposure to ionizing radiation in childhood or adolescence; prior hemithyroidectomy with discovery of thyroid cancer, ¹⁸FDG avidity on PET scanning; MEN2/FMTC-associated RET protooncogene mutation, calcitonin >100 pg/mL. MEN, multiple endocrine neoplasia; FMTC, familial medullary thyroid cancer.

^bSuspicious features: microcalcifications; hypoechoic; increased nodular vascularity; infiltrative margins; taller than wide on transverse view.

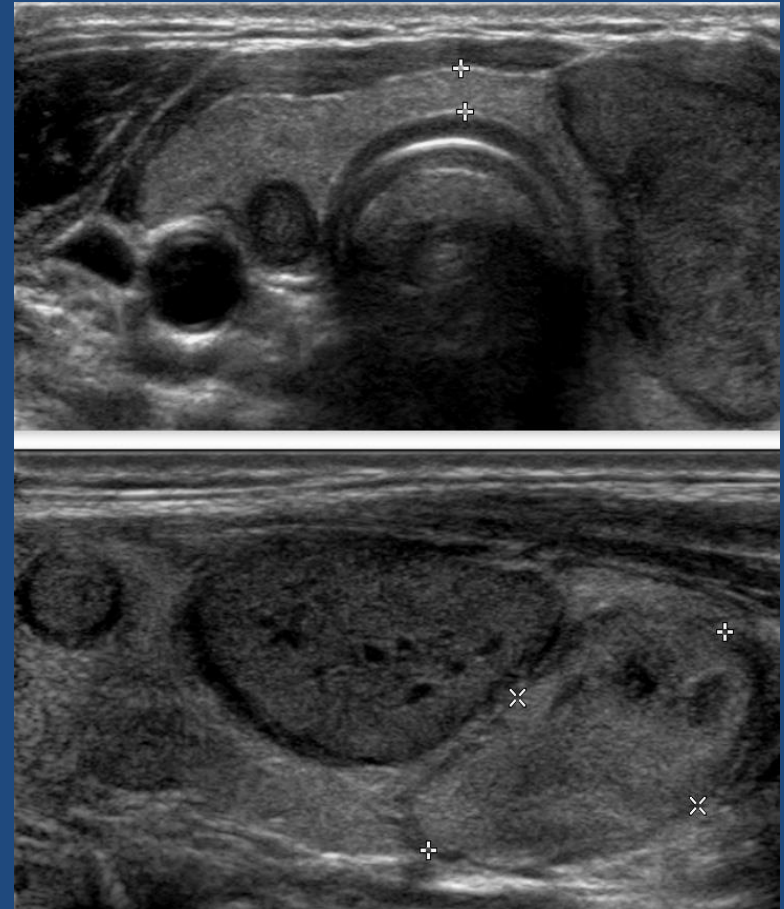
^cFNA cytology may be obtained from the abnormal lymph node in lieu of the thyroid nodule.

^dSonographic monitoring without biopsy may be an acceptable alternative (see text) (48).

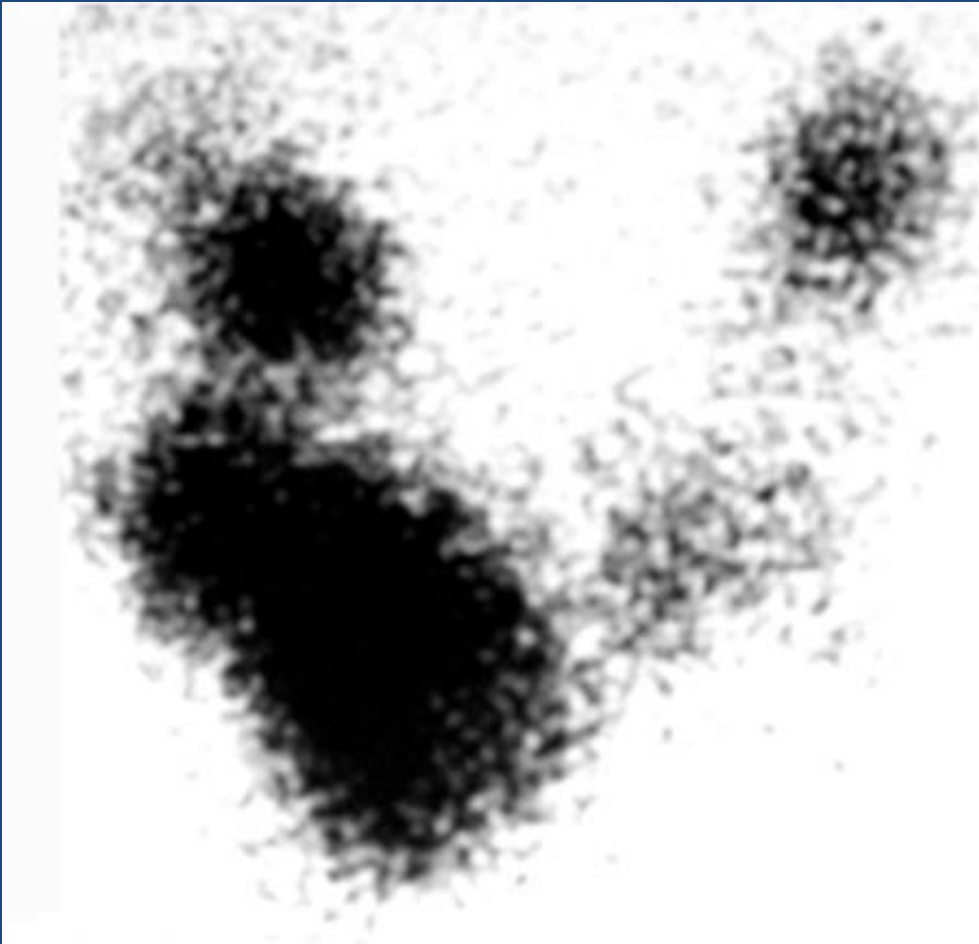
^eUnless indicated as therapeutic modality (see text).

Clinical Case 2

- Pt is 55 year-old female who presents with palpitations, weight loss, and heat intolerance
- Abnormal thyroid gland
- Ultrasound shows multiple thyroid nodules
- TSH is < 0.02



What is the next appropriate step in the evaluation of the multinodular goiter?



Clinical Case 3

- Patient is a 38 year-old female who presents after finding a “lump in my neck”
- You palpate a right-sided thyroid nodule that you estimate to be between 1.5 and 2.0 cm
- TSH obtained after office visit was normal
- Ultrasound report confirms right-sided thyroid nodule 1.1 x 1.7 x 1.9 cm
- Radiologist recommends uptake and scan

What is the next appropriate step in the evaluation of the patient's thyroid nodule?

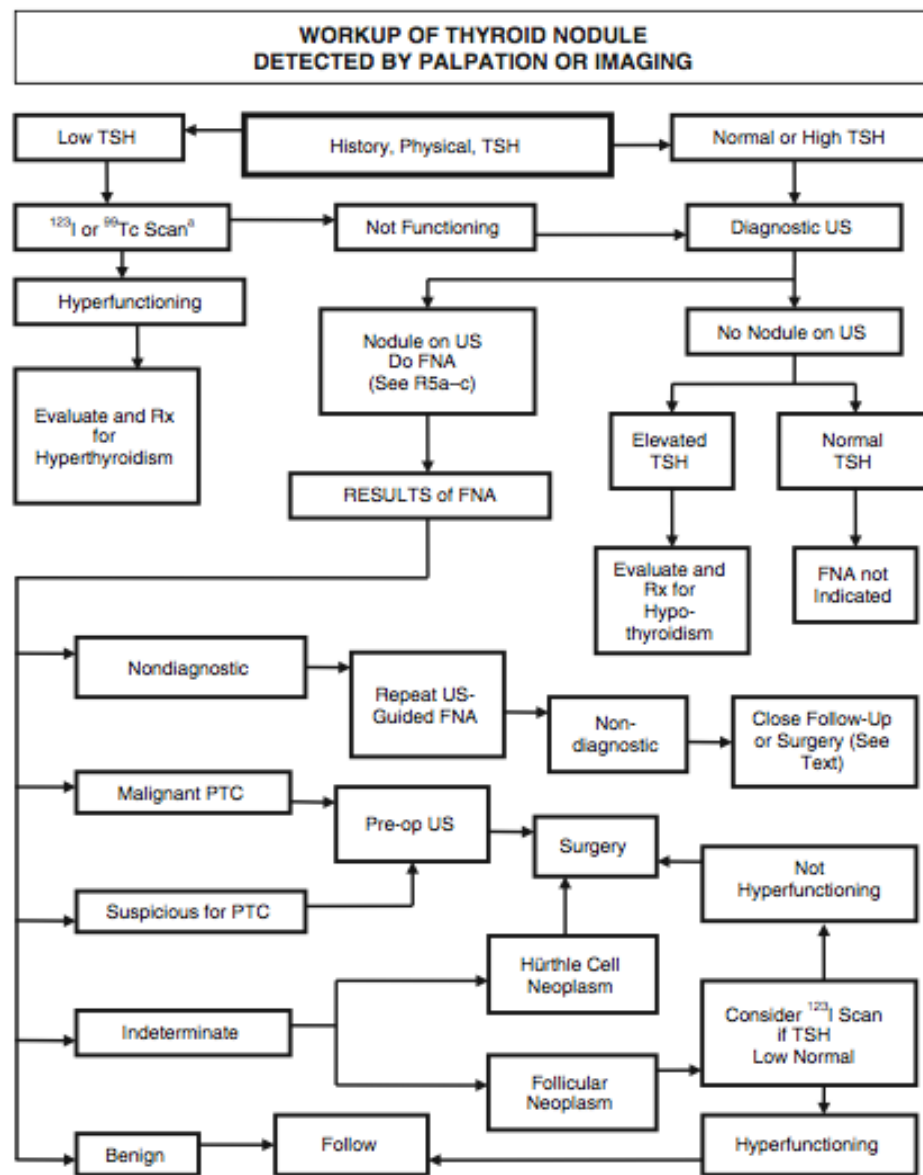


FIG. 1. Algorithm for the evaluation of patients with one or more thyroid nodules.
^aIf the scan does not show uniform distribution of tracer activity, ultrasound may be considered to assess for the presence of a cystic component.

Clinical Case 4

- Patient is a 35 year-old male with an enlarging neck mass
- Mother has thyroid cancer
- Ultrasound shows 4 nodules on the right all > 1.8 cm and 3 nodules on the left all > 2.0 cm.
- Multiple nodules on both sides have increased internal blood flow and calcifications
- Significant bilateral lymphadenopathy

What is the next appropriate step in the evaluation of the multinodular goiter?

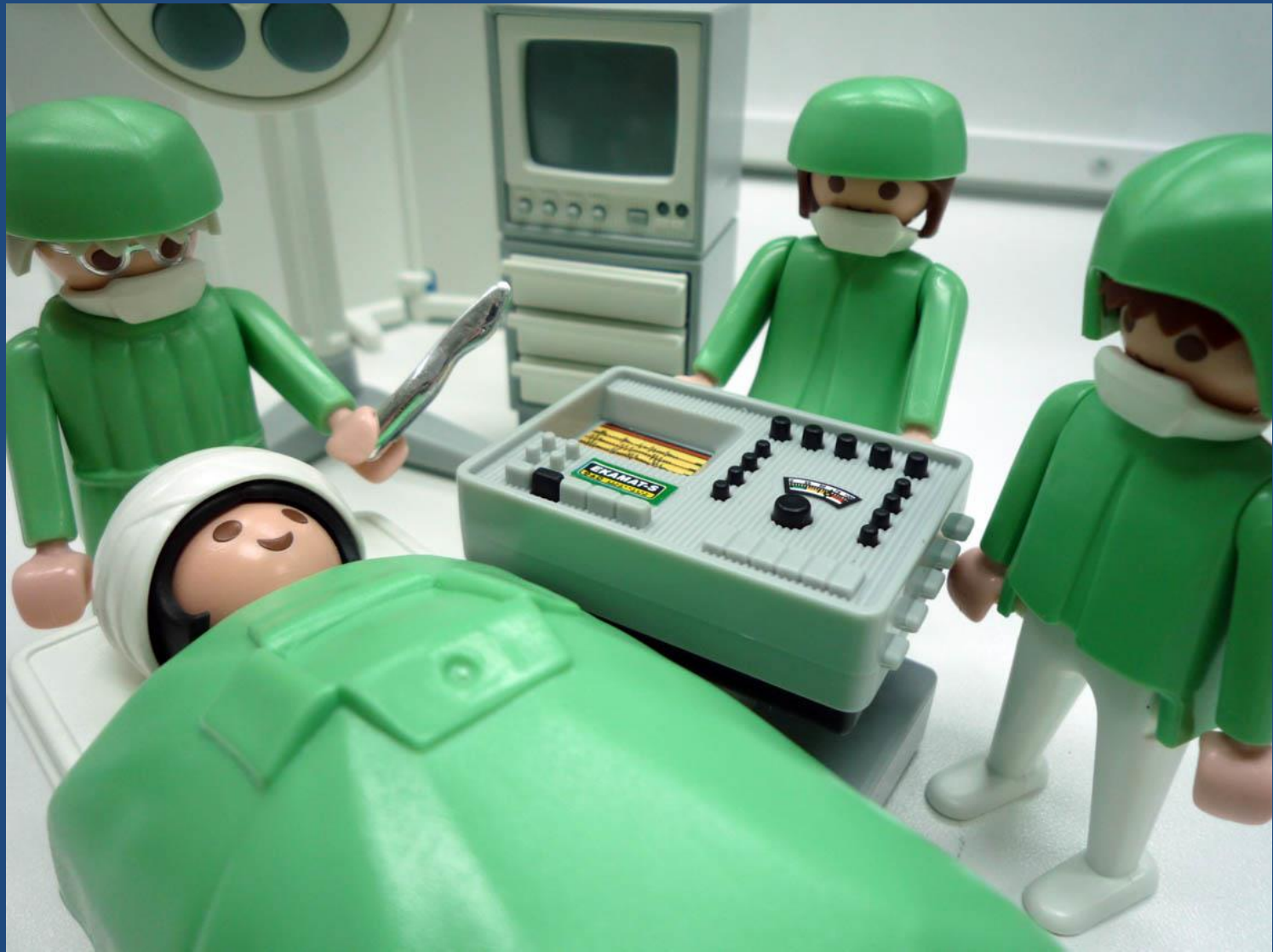


Clinical Case 5

- Patient is a 65 year-old female with a neck mass
- Ultrasound shows a right-sided 4.8 cm nodule
- No suspicious findings on ultrasound
- No previous biopsy



What is the next appropriate step in the evaluation of the patient's thyroid nodule?



Conclusions

- Thyroid nodules are common
- Initial work-up includes a TSH and thyroid ultrasound
- Uptake and scan is rarely needed
- Follow FNA guidelines
- Ultrasound follow-up for benign nodules
- Call with questions

Questions?

