Office-based evaluation and intervention for thyroid nodules

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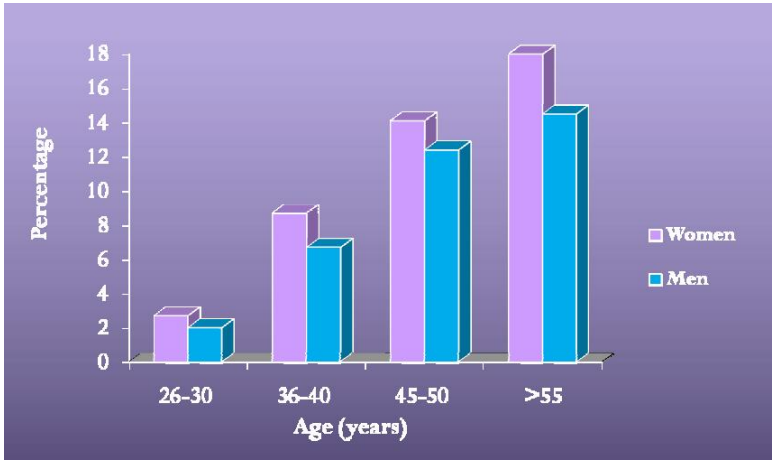
I am an OTOLARYNGOLOGIST, SO Why Do Office Based Ultrasound and Intervention?

- Patient service
  - Can quickly offer diagnostic procedures to patients
  - Can reassure patients regarding neck fullness questions
- Building practice
  - FNA, RFA
  - Streamline patient care for referring providers

Thyroid nodules

- Very Common
  - F>M
  - ~5% of population have palpable nodules
  - 19-70% of population have nodules using US
  - Prevalence increases with age



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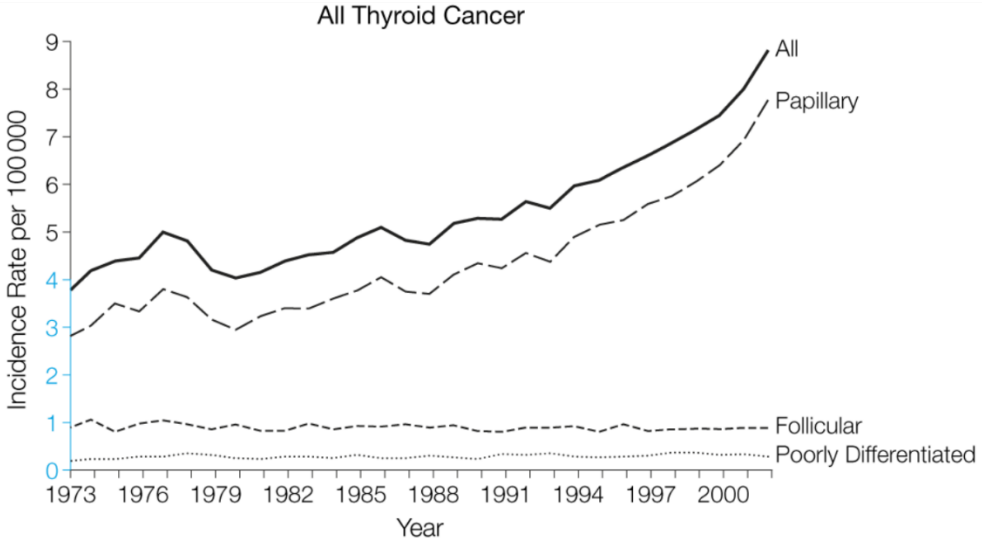
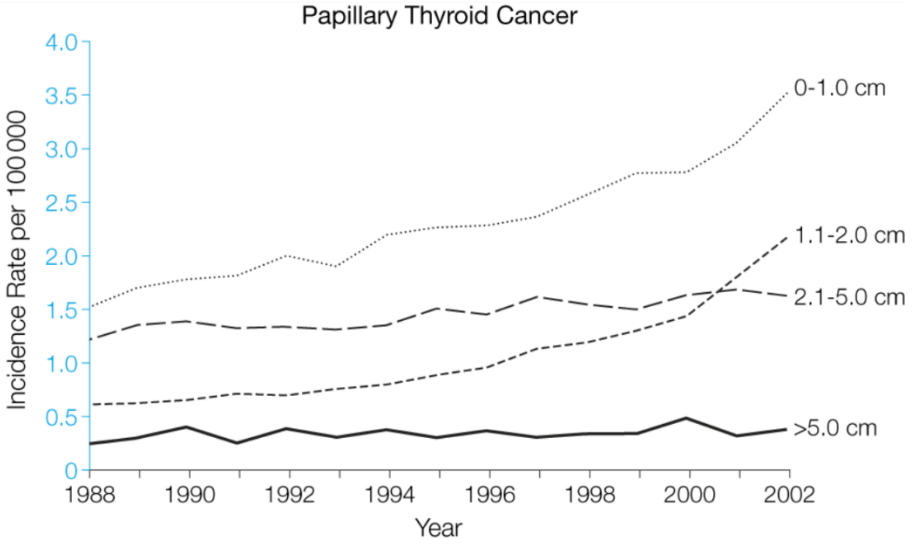
Thyroid nodules

- 5-10% harbor malignancy
  - High-risk population
    - Children
    - Men
    - Adults <30 and >60
    - History of radiation exposure
    - Family history

Thyroid cancer incidence





Davies L. *JAMA*. 2006; 2164-2167

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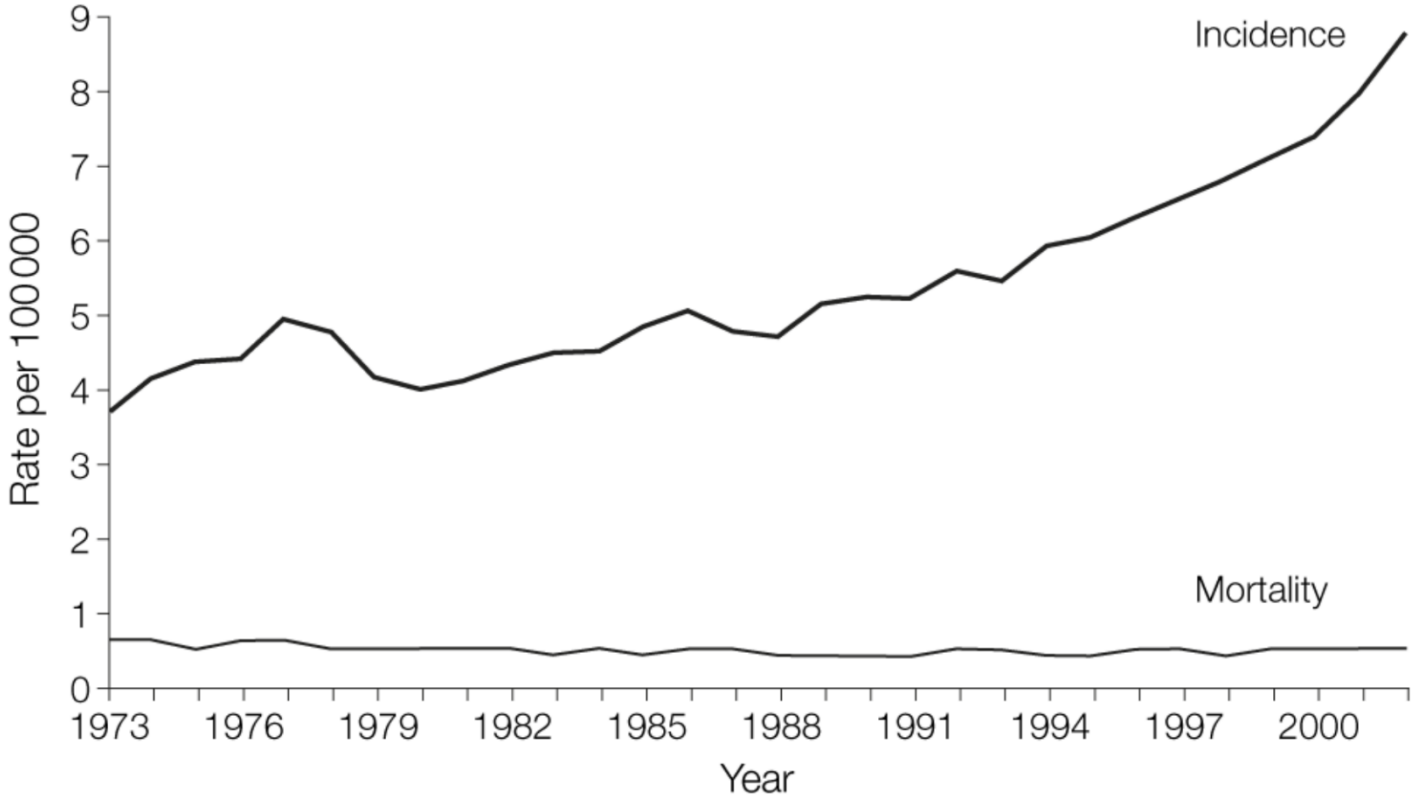
Big deal?



Davies L. *JAMA*. 2006; 2164-2167

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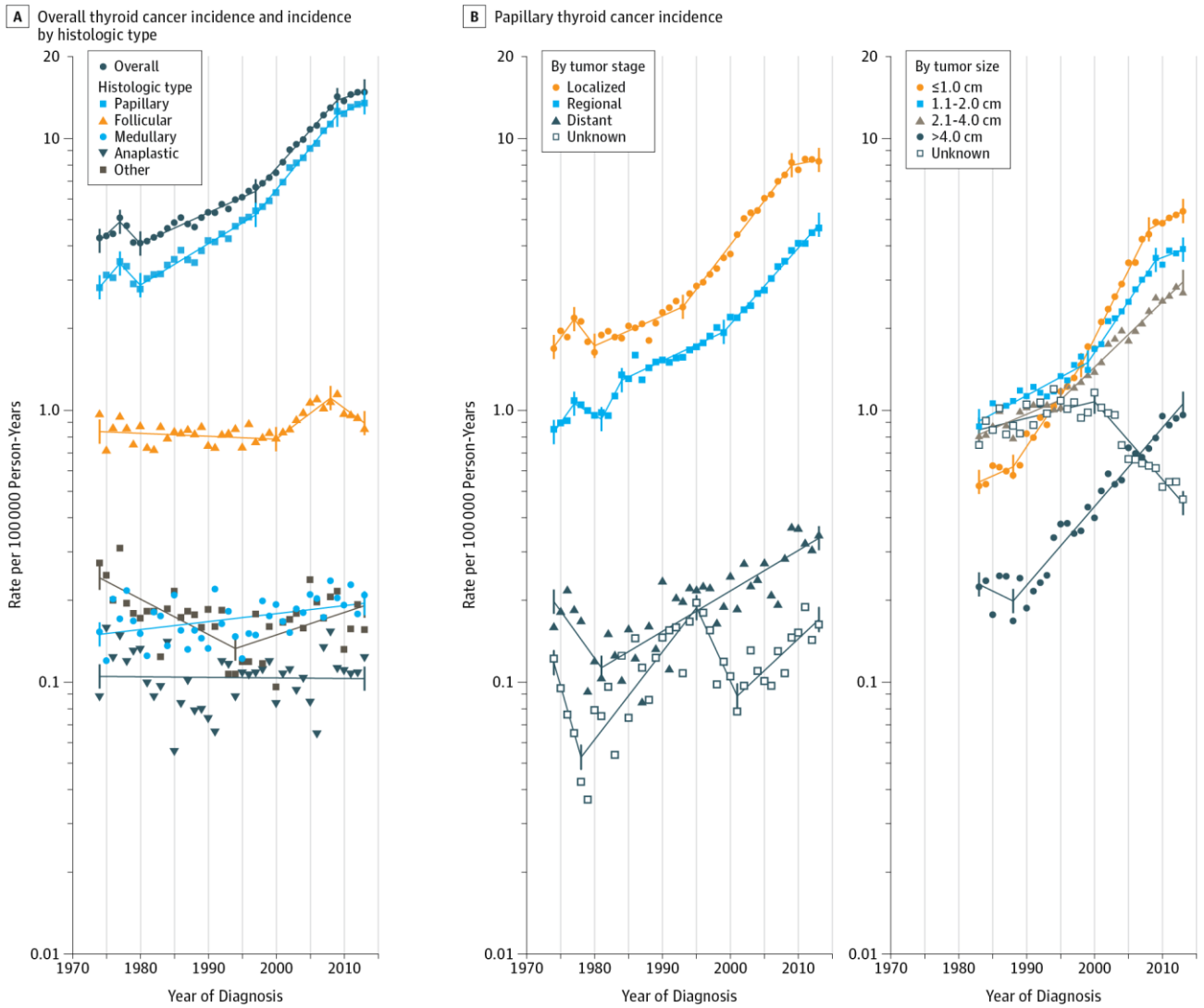
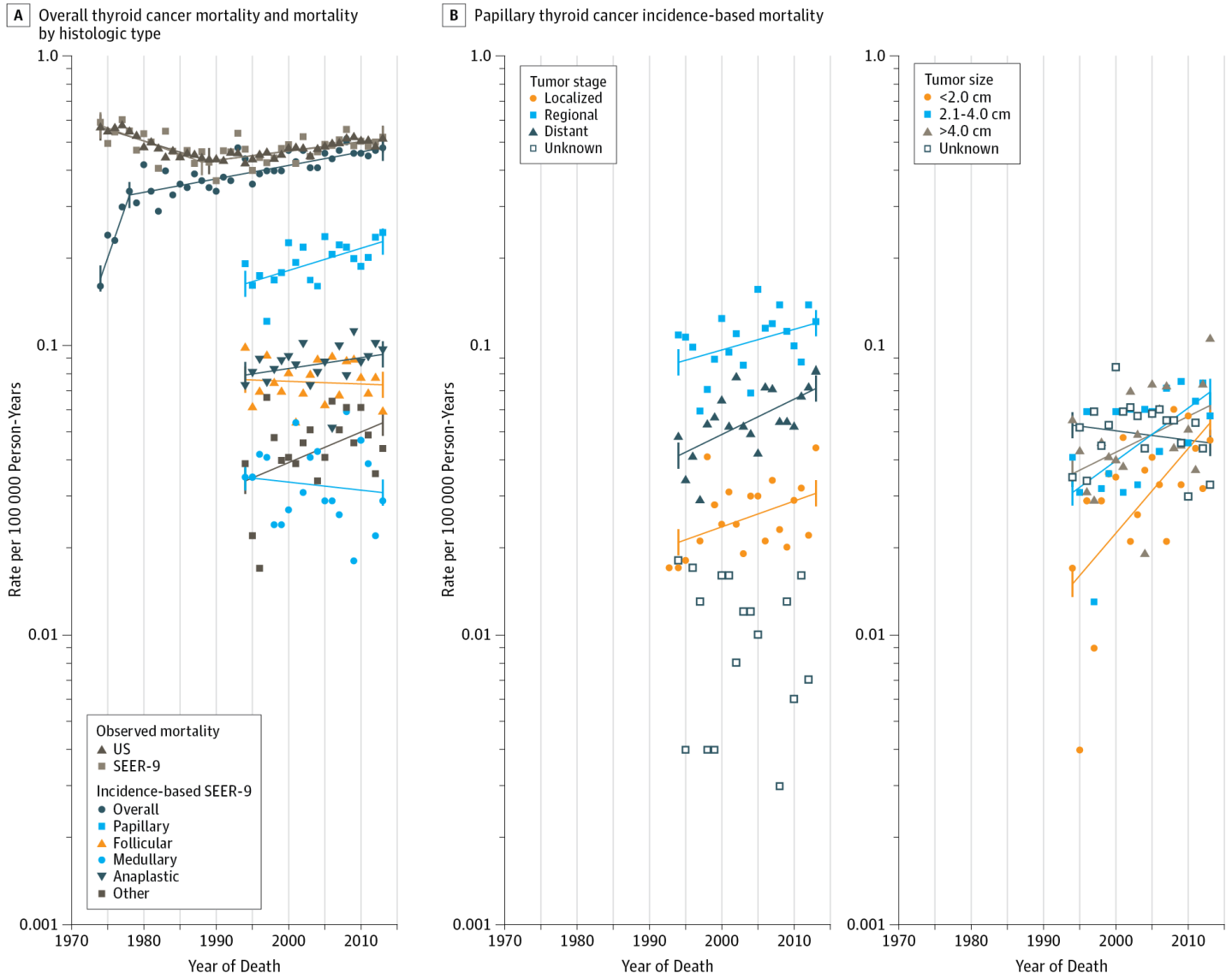


Lim H. *JAMA*. 2017



Lim H. *JAMA*. 2017

Evaluation of the thyroid nodule

- Ultrasonography is the gold standard assessment tool for the thyroid gland
- Portable devices allow for improved in-office access for patients
  - Same day FNA can be done

In Office Imaging

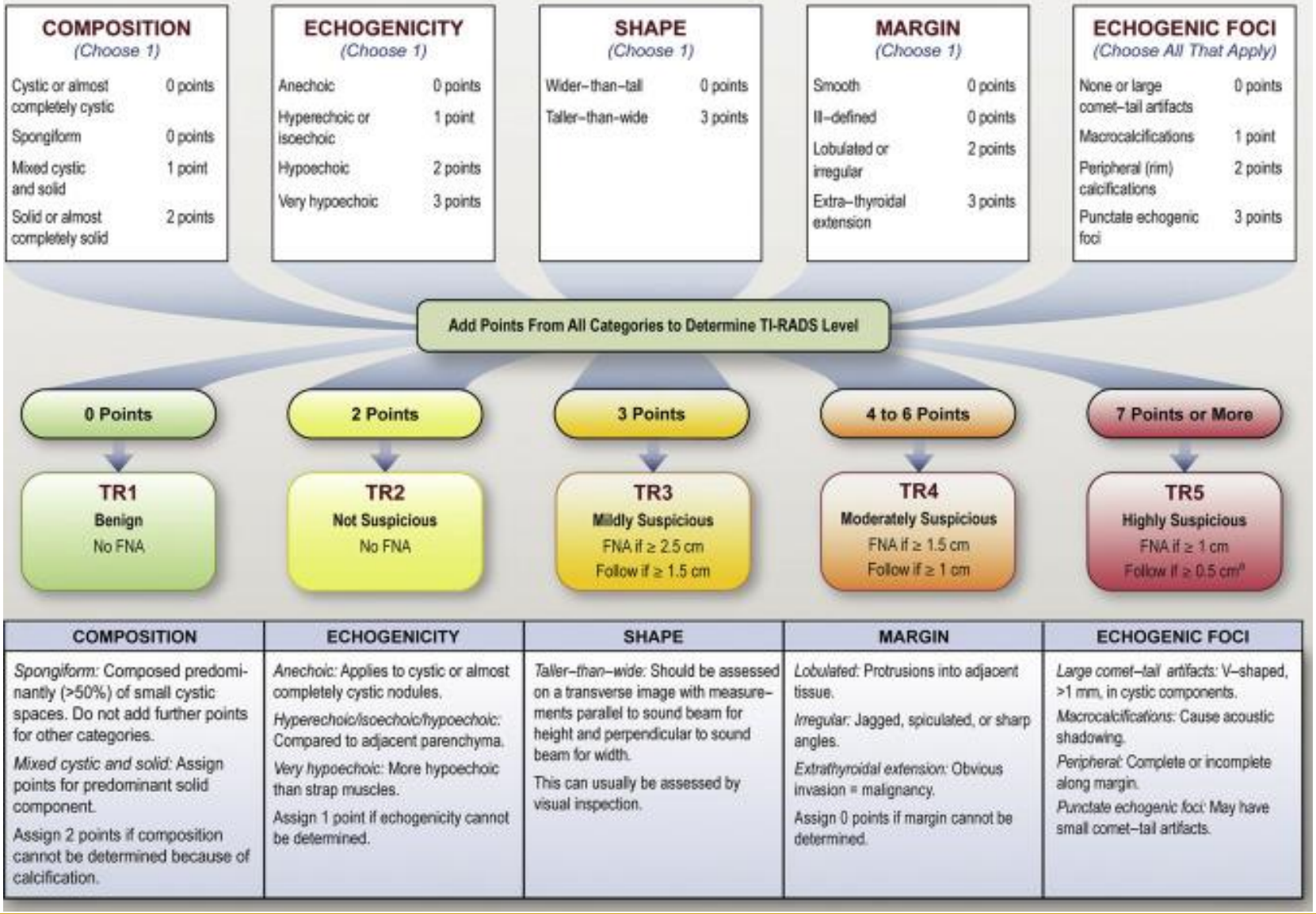
How do we approach patients with thyroid nodules?

- Clinical Guidelines
  - ATA 2015/NCCN
- Minimize harm and reduce over-testing/treatment in a low-risk disease
- Appropriately treat those patients with high-risk disease

Ultrasound characteristics of thyroid nodules

Benign	Malignant
1. Isoechoic/hyperechoic	1. Hypoechoic
2. Coarse calcifications	2. Microcalcifications
3. Thin, well-defined halo	3. Thick or absent halo
4. Regular margin	4. Irregular margin
5. Hypovascular	5. Increased vascularity

ACR TI-RADS



COMPOSITION	ECHOGENICITY	SHAPE	MARGIN	ECHOGENIC FOCI
Spongiform: Composed predominantly (>50%) of small cystic spaces. Do not add further points for other categories. *Mixed cystic and solid:* Assign points for predominant solid component. Assign 2 points if composition cannot be determined because of calcification.	*Anechoic:* Applies to cystic or almost completely cystic nodules. *Hyperechoic/isoechoic/hypoechoic:* Compared to adjacent parenchyma. *Very hypoechoic:* More hypoechoic than strap muscles. Assign 1 point if echogenicity cannot be determined.	*Taller–than–wide:* Should be assessed on a transverse image with measurements parallel to sound beam for height and perpendicular to sound beam for width. This can usually be assessed by visual inspection.	*Lobulated:* Protrusions into adjacent tissue. *Irregular:* Jagged, spiculated, or sharp angles. *Extrathyroidal extension:* Obvious invasion = malignancy. Assign 0 points if margin cannot be determined.	*Large comet–tail artifacts:* V–shaped, >1 mm, in cystic components. *Macrocalcifications:* Cause acoustic shadowing. *Peripheral:* Complete or incomplete along margin. *Punctate echogenic foci:* May have small comet–tail artifacts.

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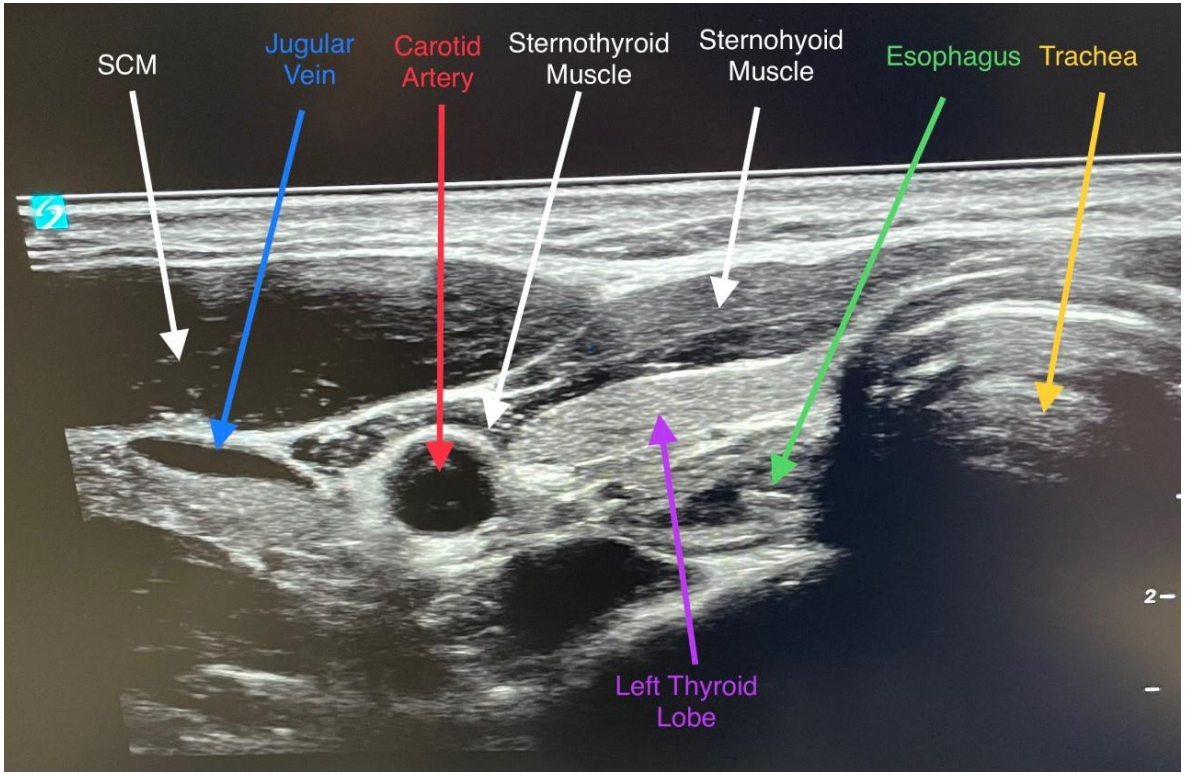
Malignancy from TIRADS Score

- TIRADS 1- 0
- TIRADS 2 – 1%
- TIRADS 3 – 3%
- TIRADS 4 – 40%
- TIRADS 5 – 86%

Mendes GF. *Br J Radiol*. 2018

Ultrasound appearance of normal neck



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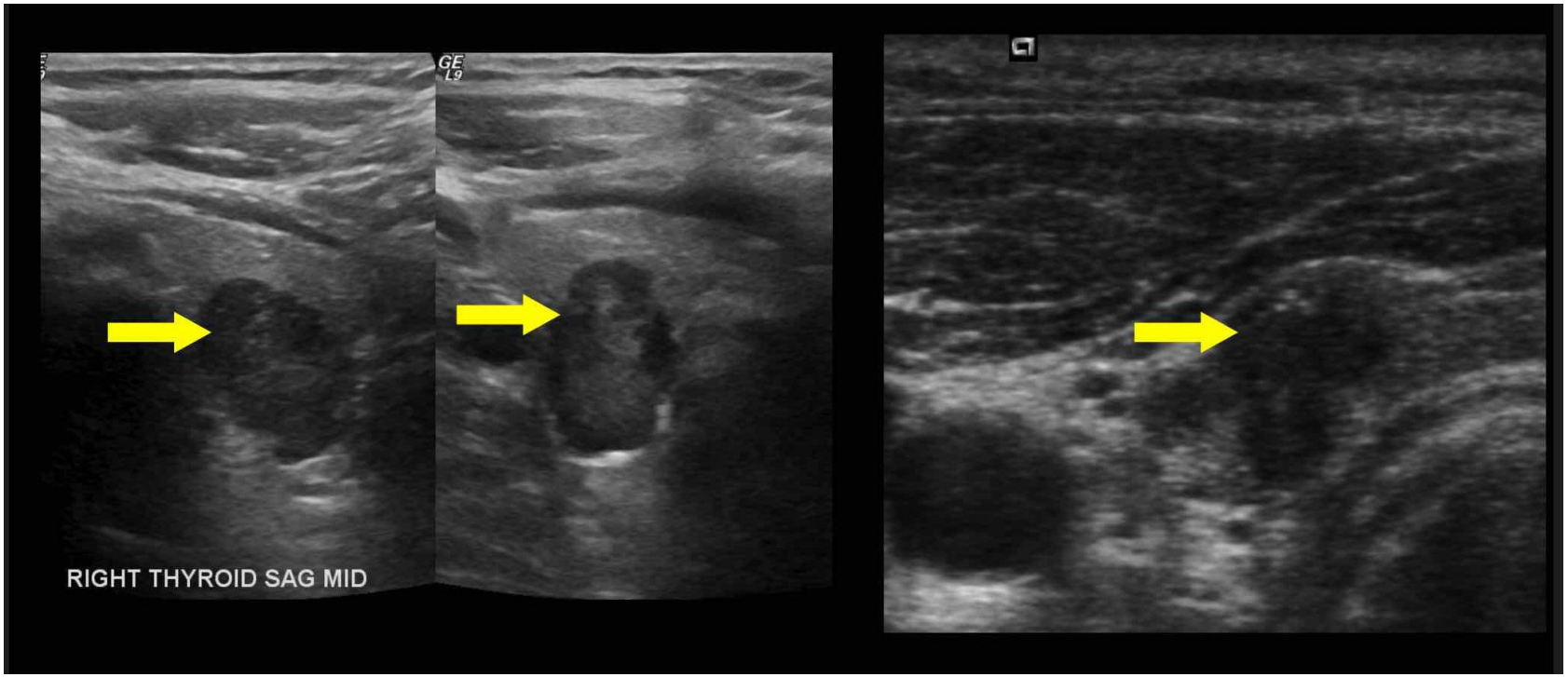
TIRADS atlas: taller > wide



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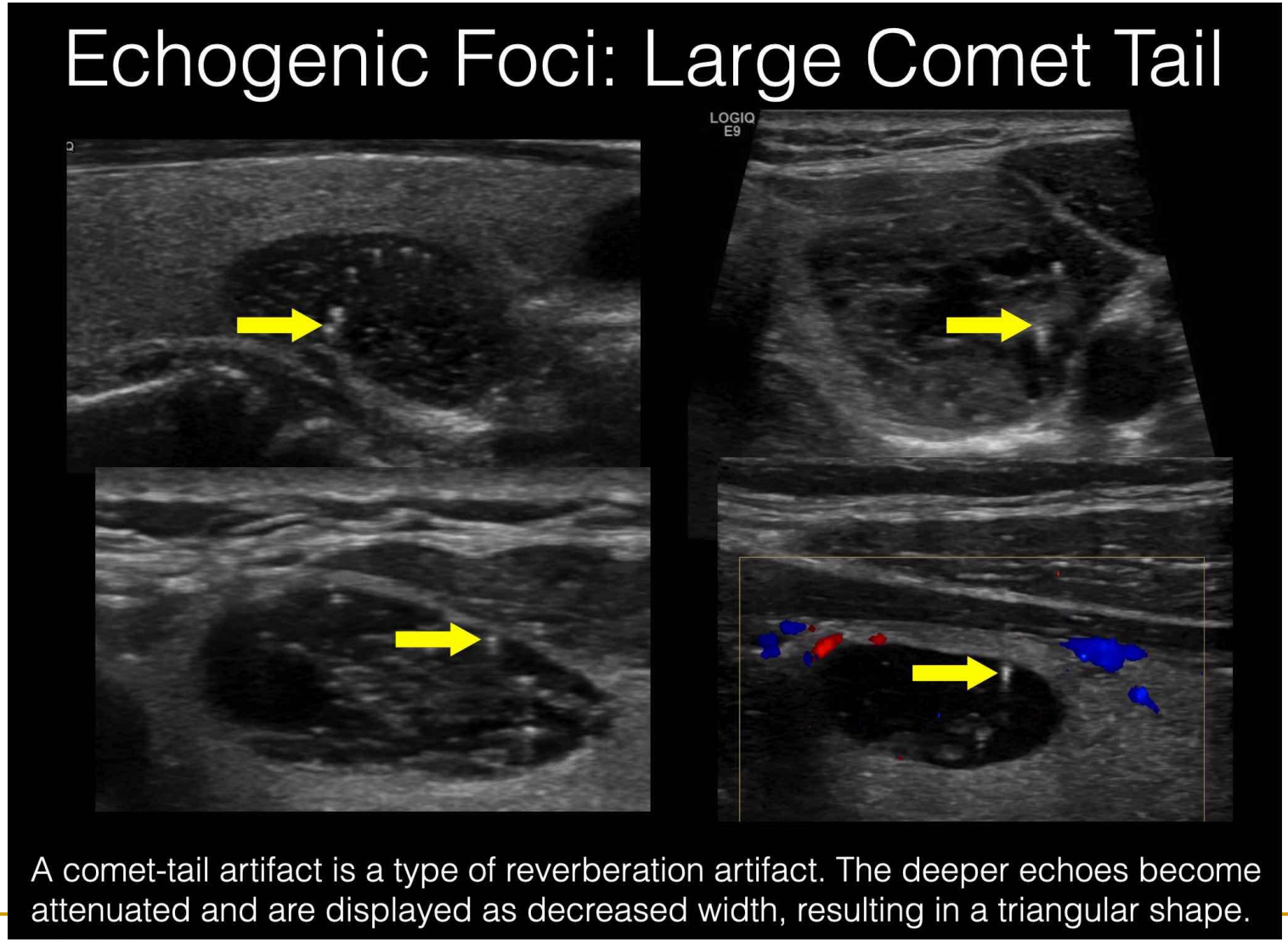
TiRADS atlas: Comet Tail



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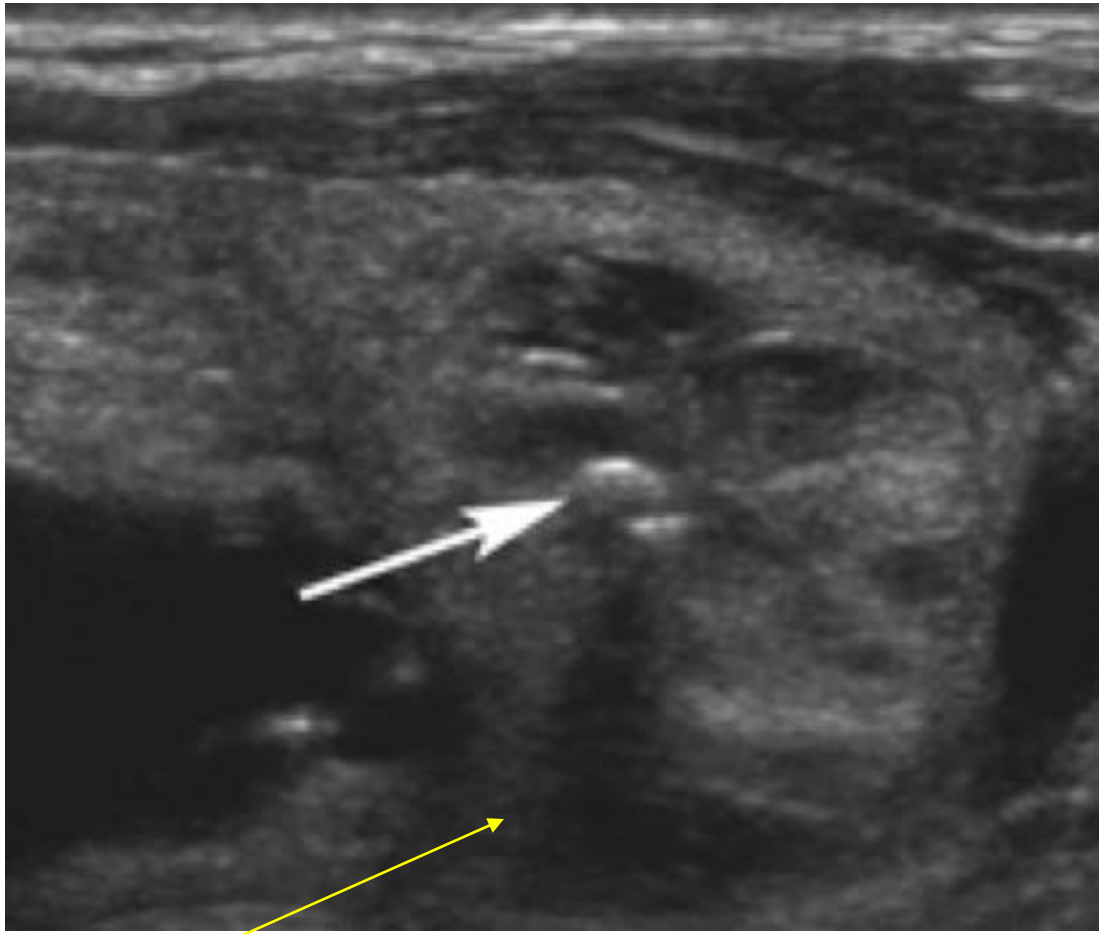
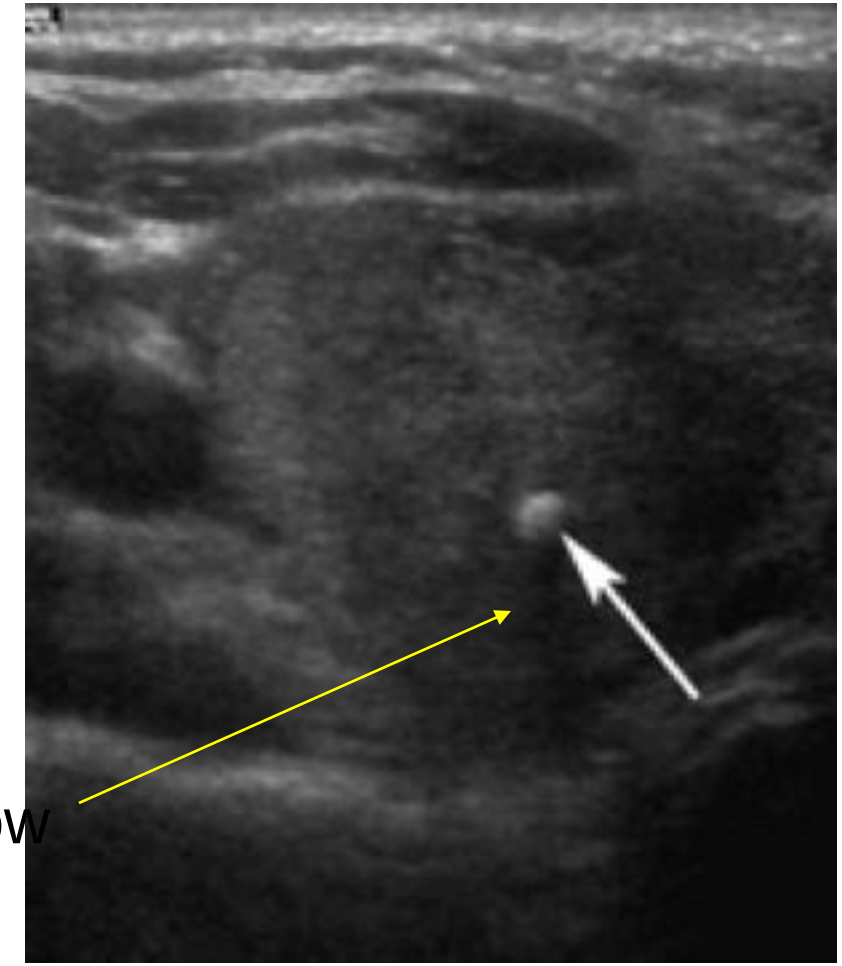
Macrocalcification (coarse)



Shadow

This one was benign…

Macrocalcification (coarse)



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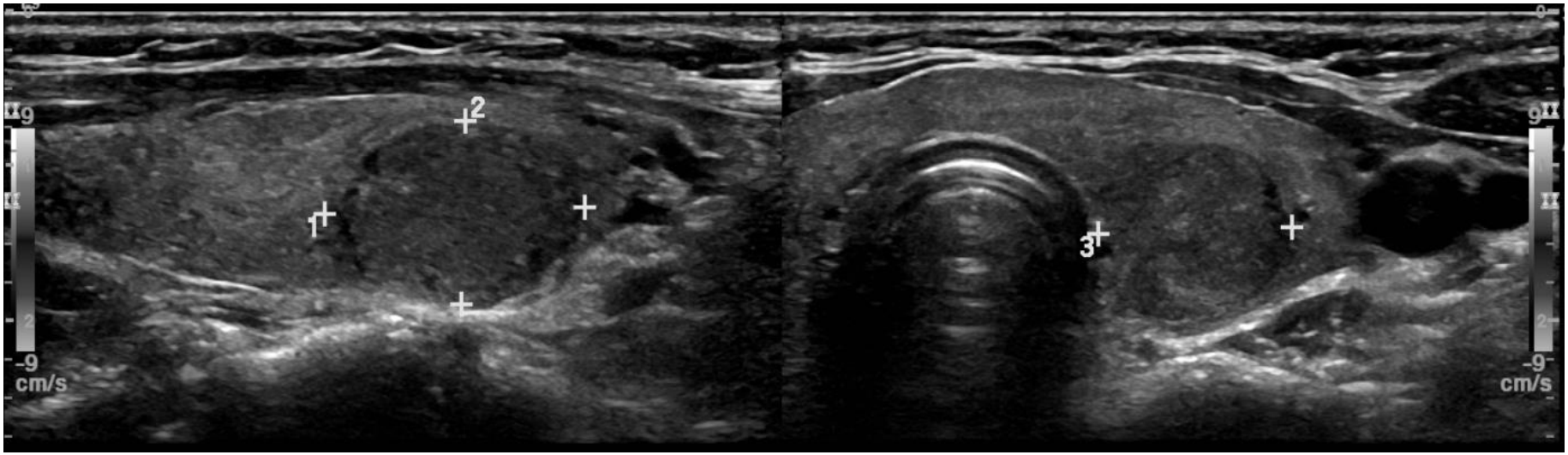
Hypoechoic, Microcalcified



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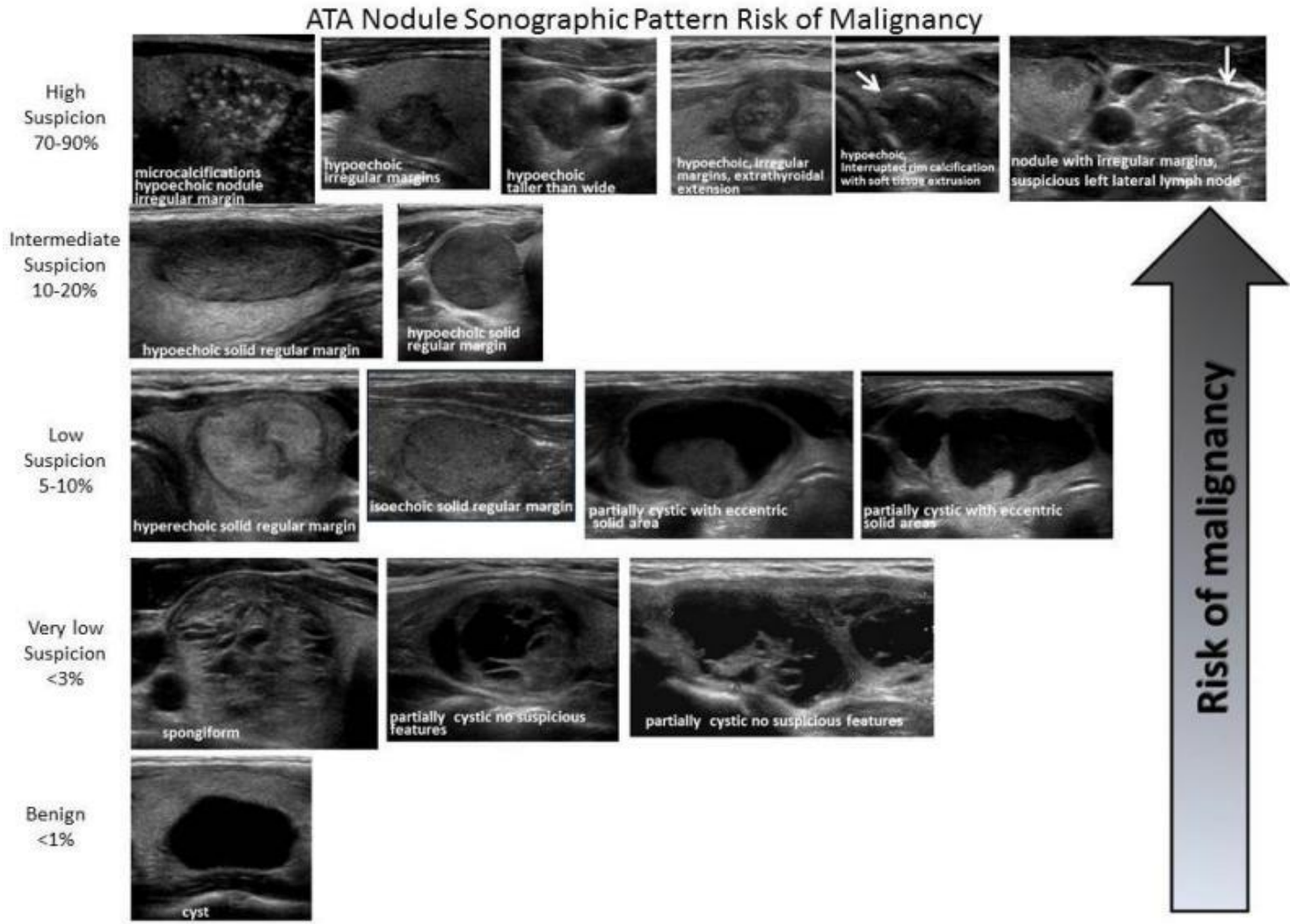

ATA Clinical Guidelines 2015

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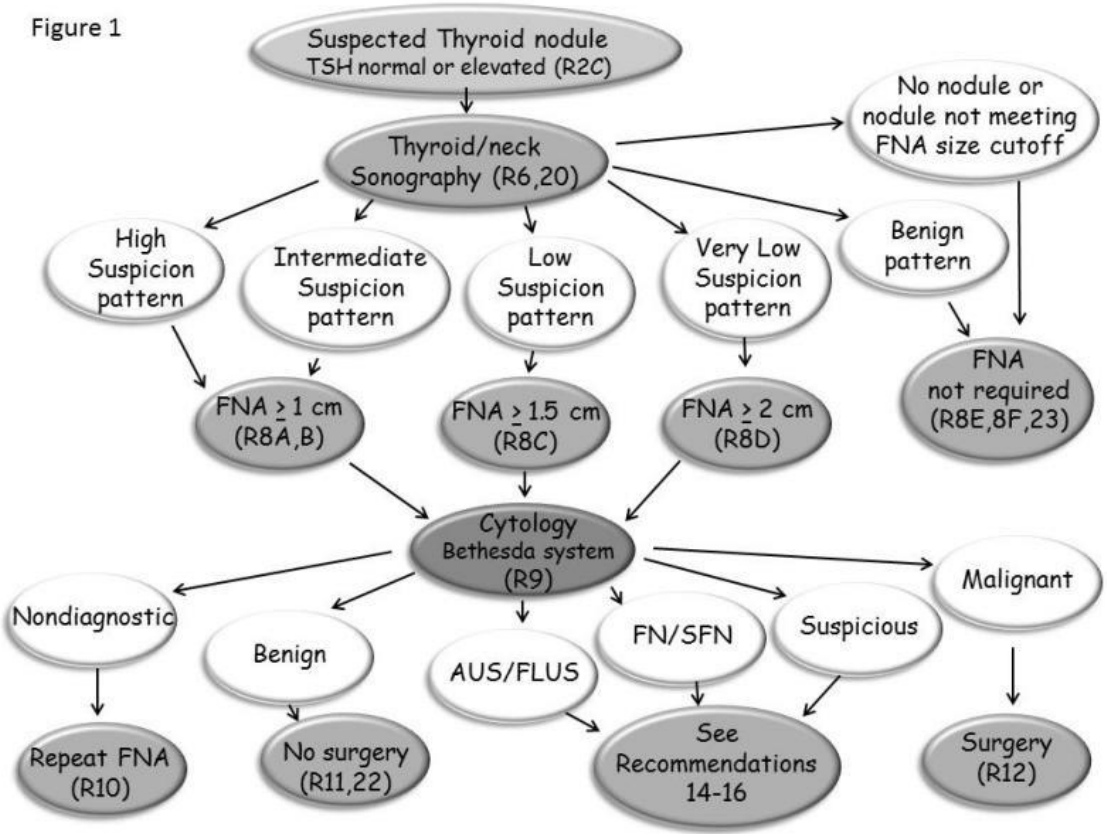
Who gets an FNA?

- Very Low- >2cm
- Low- >1.5cm
- Intermediate- > 1 cm
- High- >1 cm

ATA Clinical Guidelines 2015

Who gets an FNA?



ATA Clinical Guidelines 2015

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Setup

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FNA findings

FNA result	Bethesda Risk of Malignancy	Risk of Malignancy
Benign	0-3%	2.5%
Atypia of Undetermined Significance	5-15%	14%
Follicular Neoplasm	15-30%	25%
Suspicious for Malignancy	60-75%	70%
Malignancy	99%	99%

Bongiovanni. *Acta Cytol.* 2012

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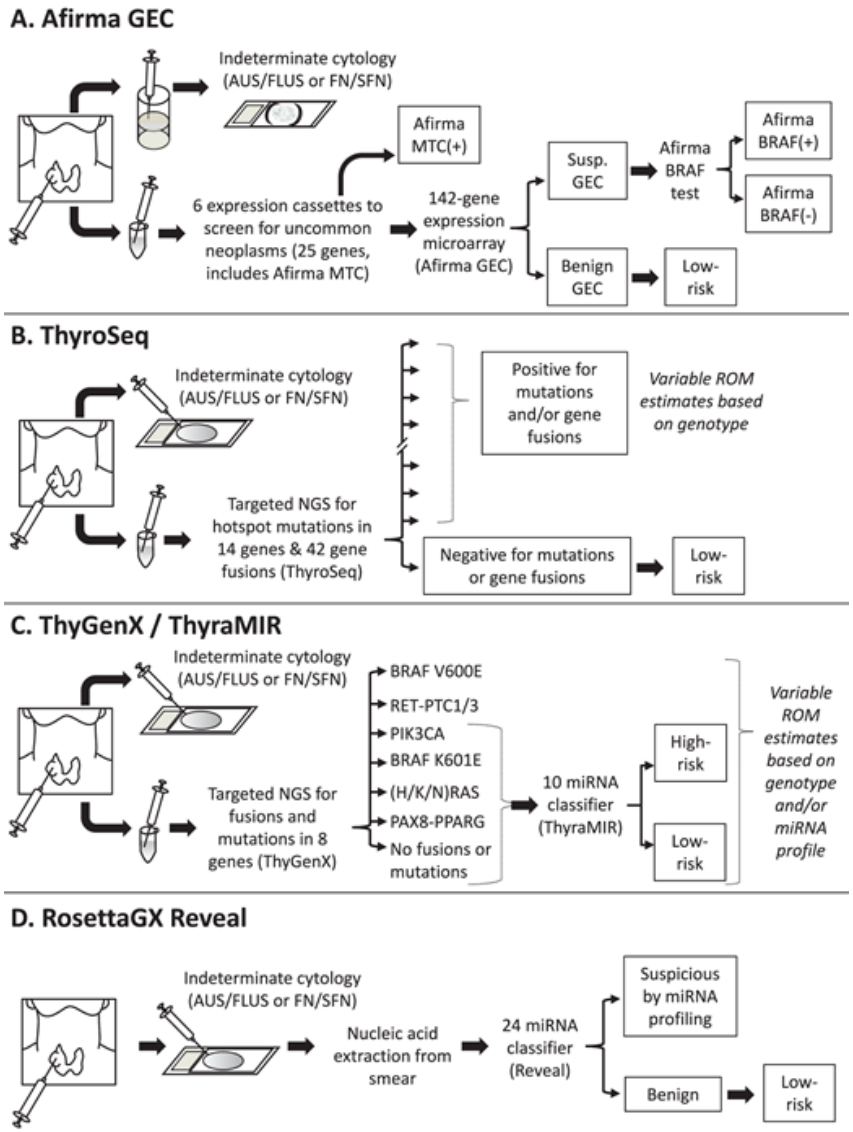

A. Afirma GEC
Indeterminate cytology (AUS/FLUS or FN/SFN)
Afirma MTC(+)
6 expression cassettes to screen for uncommon neoplasms (25 genes, includes Afirma MTC)
142-gene expression microarray (Afirma GEC)
Susp. GEC
Afirma BRAF test
Afirma BRAF(+)
Afirma BRAF(-)
Benign GEC
Low-risk
B. ThyroSeq
Indeterminate cytology (AUS/FLUS or FN/SFN)
Targeted NGS for hotspot mutations in 14 genes & 42 gene fusions (ThyroSeq)
Positive for mutations and/or gene fusions
Variable ROM estimates based on genotype
Negative for mutations or gene fusions
Low-risk
C. ThyGenX / ThyraMIR
Indeterminate cytology (AUS/FLUS or FN/SFN)
Targeted NGS for fusions and mutations in 8 genes (ThyGenX)
BRAF V600E
RET-PTC1/3
PIK3CA
BRAF K601E
(H/K/N)RAS
PAX8-PPARG
No fusions or mutations
10 miRNA classifier (ThyraMIR)
High-risk
Low-risk
Variable ROM estimates based on genotype and/or miRNA profile
D. RosettaGX Reveal
Indeterminate cytology (AUS/FLUS or FN/SFN)
Nucleic acid extraction from smear
24 miRNA classifier (Reveal)
Suspicious by miRNA profiling
Benign
Low-risk

Performance of GEC

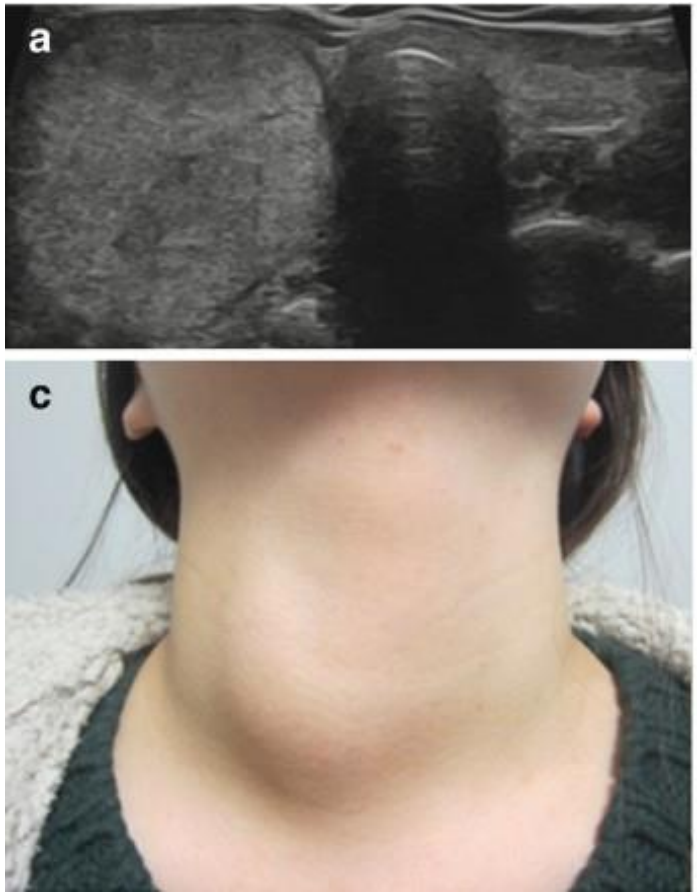
- Affirma (142 gene panel) (cost $6400/nodule)
  - NPV 96%
  - **PPV 47%**
- Thyroseq v3 (112 gene panel) (cost $3200/nodule)
  - NPV 97%
  - **PPV 66%**
- ThyGenX/ThyraMIR (8 gene panel/10 miRNA) (cost $4000/nodule)
  - NPV 94%
  - **PPV 74%**
- Rosetta GX (24 miRNA) (Cost $3700/nodule)
  - NPV 100%
  - **PPV 41%**

Patel KN *JAMA Surgery*. 2018
Steward DL. *JAMA Oncol*. 2018

Future

- Innovations in molecular signatures allowing for better delineation between histologies
  - Decision between active surveillance vs lobectomy vs total thyroidectomy
  - Unpublished data shows most positive molecular tests result in NIFTP

How do we approach the benign nodule with compressive symptoms?



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Radiofrequency Ablation

- Alternative to surgery
- Can address nodule without disrupting native thyroid tissue
- Avoids surgical risks!
- Avoids need for thyroid hormone replacement

Who is eligible?

- Benign thyroid nodule
  - 2 separate FNAs preferred
- Compressive symptoms
- Aesthetic concerns
- Relative Indications
  - Hyperfunctional nodule
  - Nodules >4 cm
  - Substernal extension

Korean J Radiol. 2018 Jul-Aug; 19(4): 632–655. PMCID: PMC6005940
Published online 2018 Jun 14. doi: 10.3348/kjr.2018.19.4.632 PMID: 29962870

2017 Thyroid Radiofrequency Ablation Guideline: Korean Society of Thyroid Radiology

GUIDELINES | JUNE 08 2020

2020 European Thyroid Association Clinical Practice Guideline for the Use of Image-Guided Ablation in Benign Thyroid Nodules Free

Radiofrequency ablation and related ultrasound-guided ablation technologies for treatment of benign and malignant thyroid disease: An international multidisciplinary consensus statement of the American Head and Neck Society Endocrine Surgery Section with the Asia Pacific Society of Thyroid Surgery, Associazione Medici Endocrinologi, British Association of Endocrine and Thyroid Surgeons, European Thyroid Association, Italian Society of Endocrine Surgery Units, Korean Society of Thyroid Radiology, Latin American Thyroid Society, and Thyroid Nodules Therapies Association

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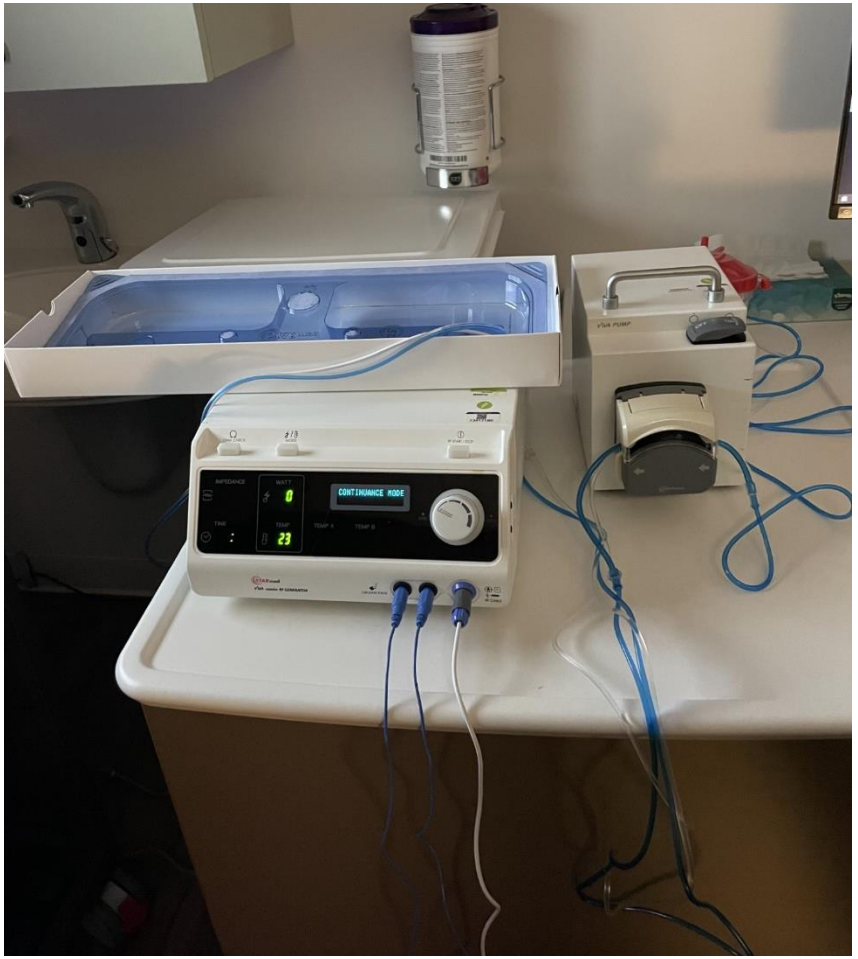
Setup



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COLLEGE OF MED. RUSH UNIVERSITY CHICAGO

Technique- transisthmic

Technique – moving shot

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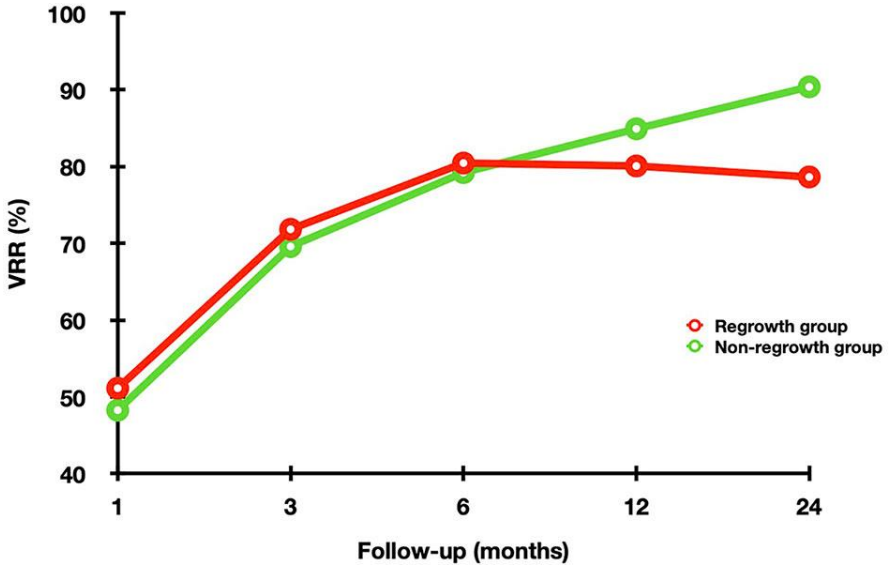
Results

- Size reduction plateaus at about 12 months
- Average 65-75% size reduction in nodule
- 5-20% regrowth rate



Orloff LA. Head Neck. 2022
Yan L. Front Endocrin. 2022

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Setting up an RFA practice

- Experience with US and US guided interventions
  - Attendance at certifications courses (AAO, ACS, ATA)
- Instrument and disposable costs
- PAYMENT!
  - Insurance
  - Out of pocket

Summary

- Thyroid nodules are quite common
- In-office US provides a safe, quick tool in evaluating thyroid nodules and allows for immediate biopsy
- Advancements in molecular testing allow for personalized treatment in indeterminate thyroid nodules
- Office based ablation procedures for benign nodules offers an intervention for patients desiring symptomatic relief without the risk of surgery

Acknowledgment

- Ashley Knies, PA-C

- Elyse Adkins, RN

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THANK YOU

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