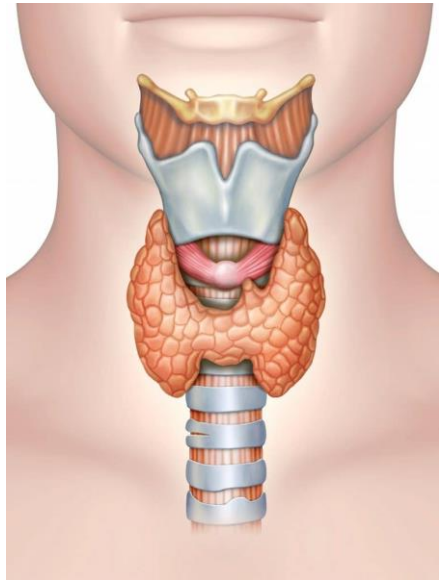
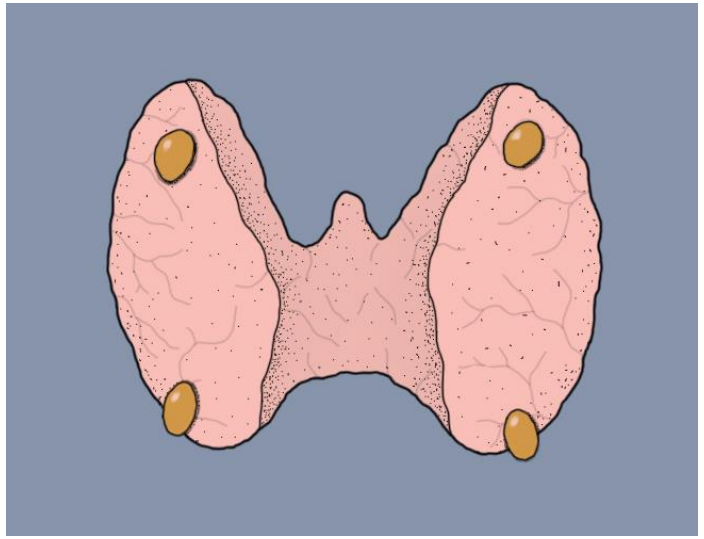
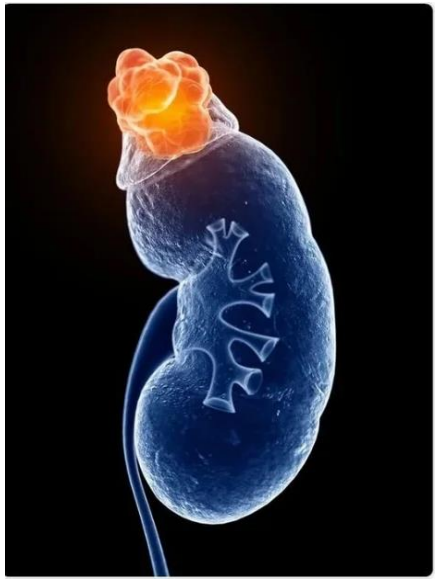






Endocrine Surgery for Primary Care Providers

Chris Barnes MD
Endocrine Surgery and General Surgery
The Doctors Clinic, Silverdale, WA

Disclosures

- None

Objectives

- **Thyroid Nodules and Goiter-** Evaluation and indications for referral
- **Primary Hyperparathyroidism-** Diagnosis, localization, and management
- **Adrenal nodules-** Biochemical workup and when to consider surgery

- Not comprehensive
- To give some background to inform your patients what is involved in next steps; to help answer their questions

Virginia Mason Franciscan Health™





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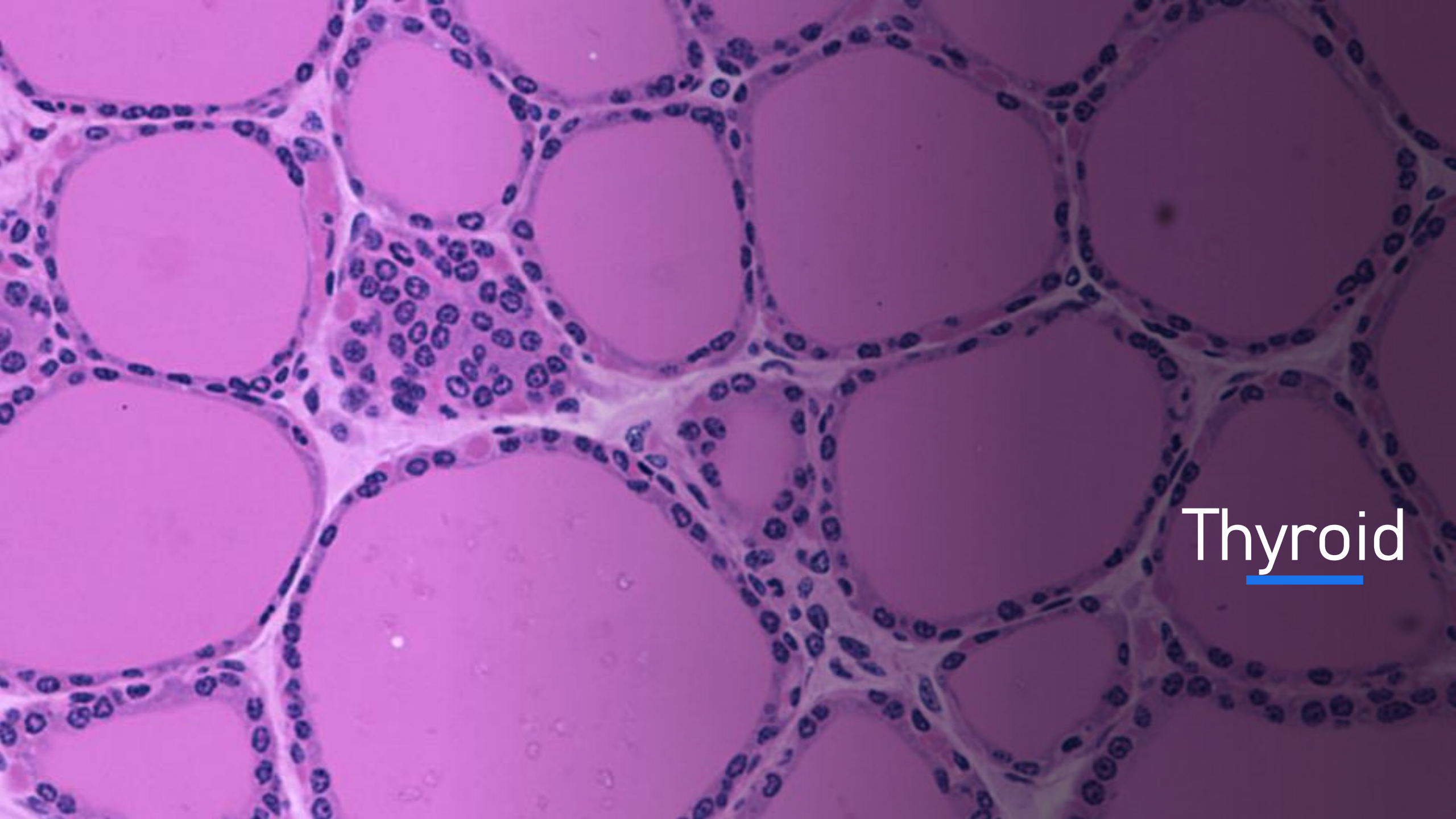


TDC

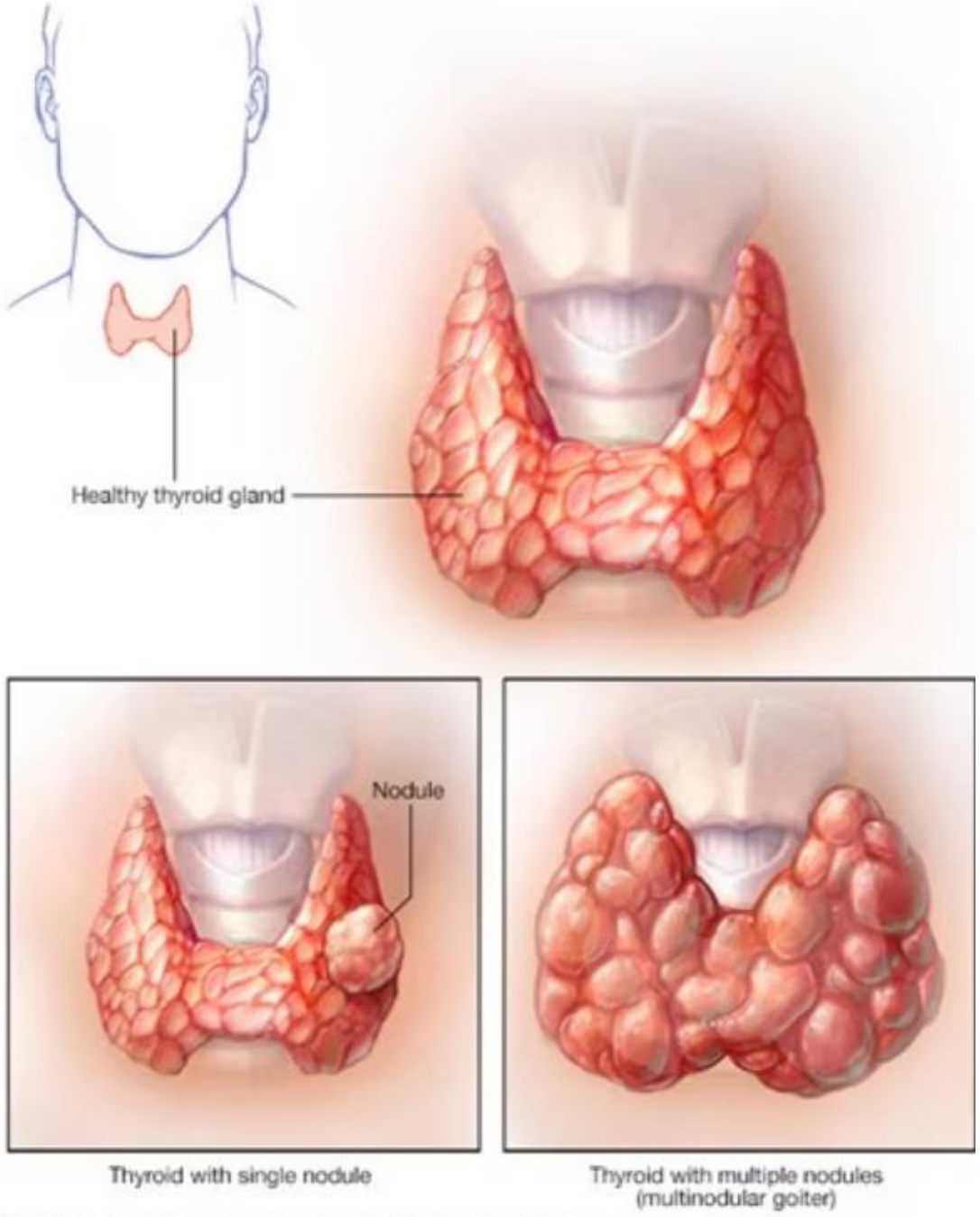
THE DOCTORS CLINIC

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Thyroid

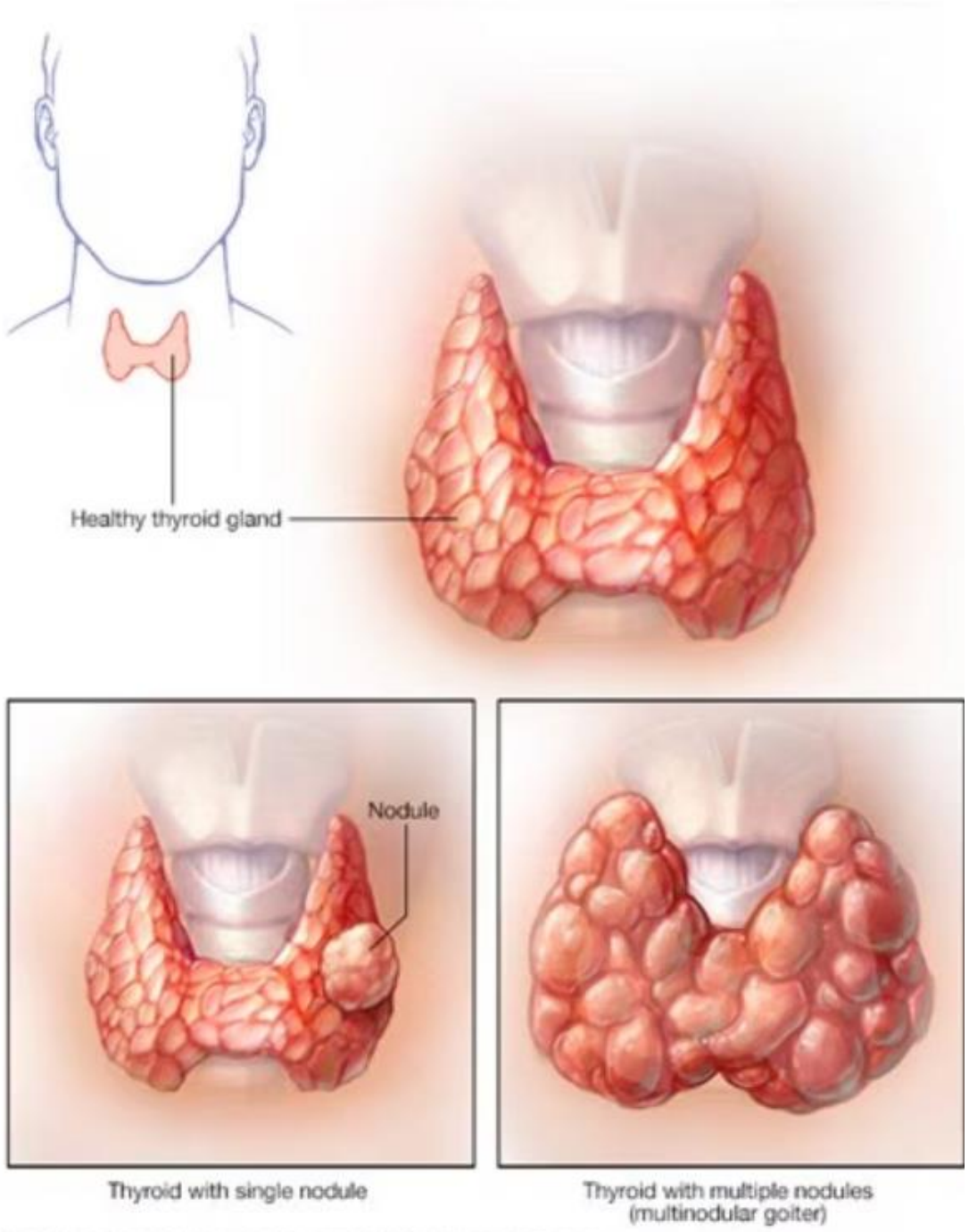


https://www.mayoclinic.org/diseases-conditions/thyroid-nodules/symptoms-causes/syc-20355262

Thyroid Nodules

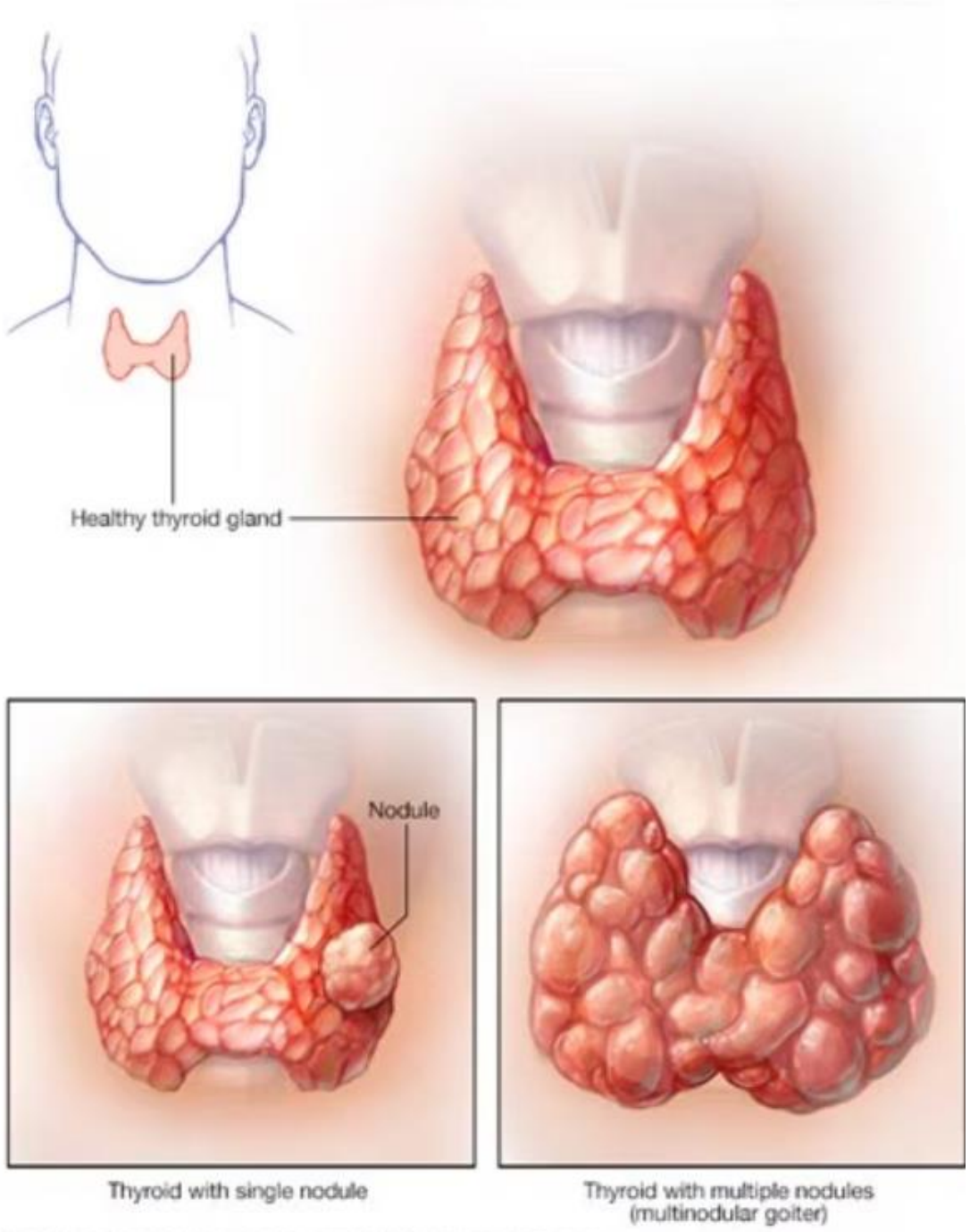
- Common; ~70% have ultrasound-detectable nodule
- Most asymptomatic, most stable
- Most don’t need intervention

Thyroid Nodules



https://www.mayoclinic.org/diseases-conditions/thyroid-nodules/symptoms-causes/syc-20355262

- Common; ~70% have ultrasound-detectable nodule
- Most asymptomatic, most stable
- Most don’t need intervention
- But some do



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Thyroid Nodules

- Common; ~70% have ultrasound-detectable nodule
- Most asymptomatic, most stable
- Most don’t need intervention
- But some do
- **The Challenge:** Determining which nodules need biopsy and intervention

Thyroid Nodules- What to Determine

Benign vs Malignant

- Ultrasound
  - TI-RADS score
- FNA biopsy

Symptomatic vs Asymptomatic

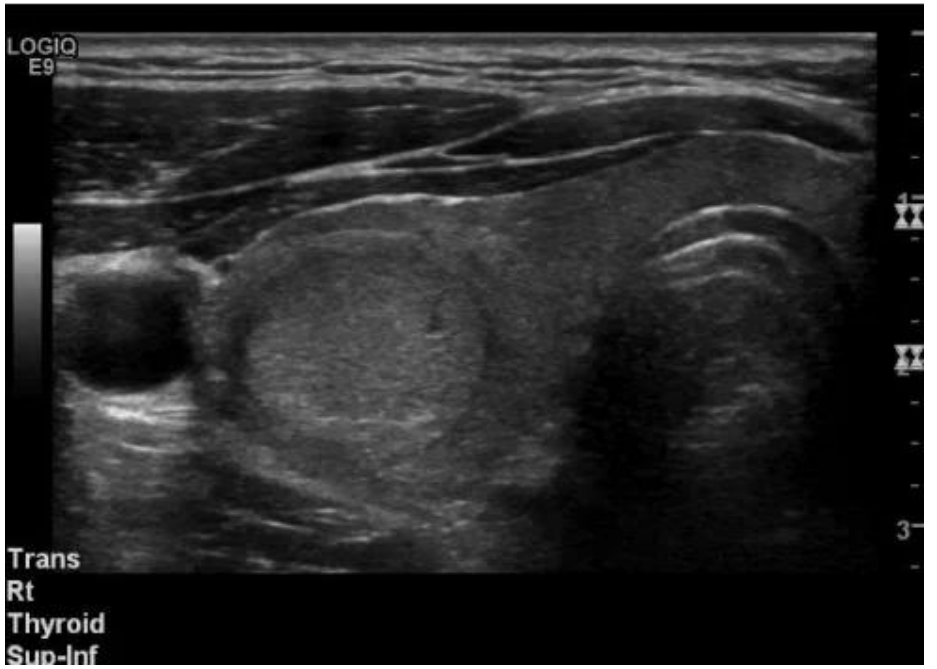
- Patient interview
- Exam

Functional vs Nonfunctional (toxic vs nontoxic)

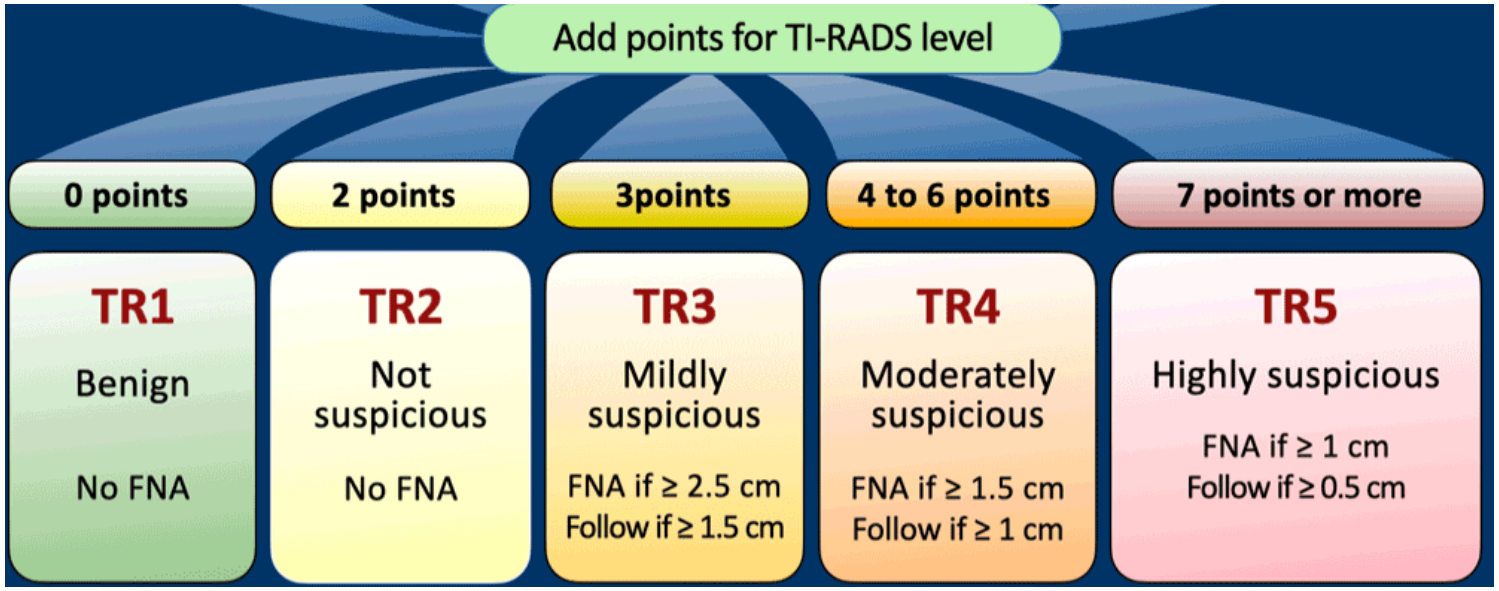
- TSH, T4
  - Thyroid scan if multinodular thyroid, may be just one hyperfunctioning nodule

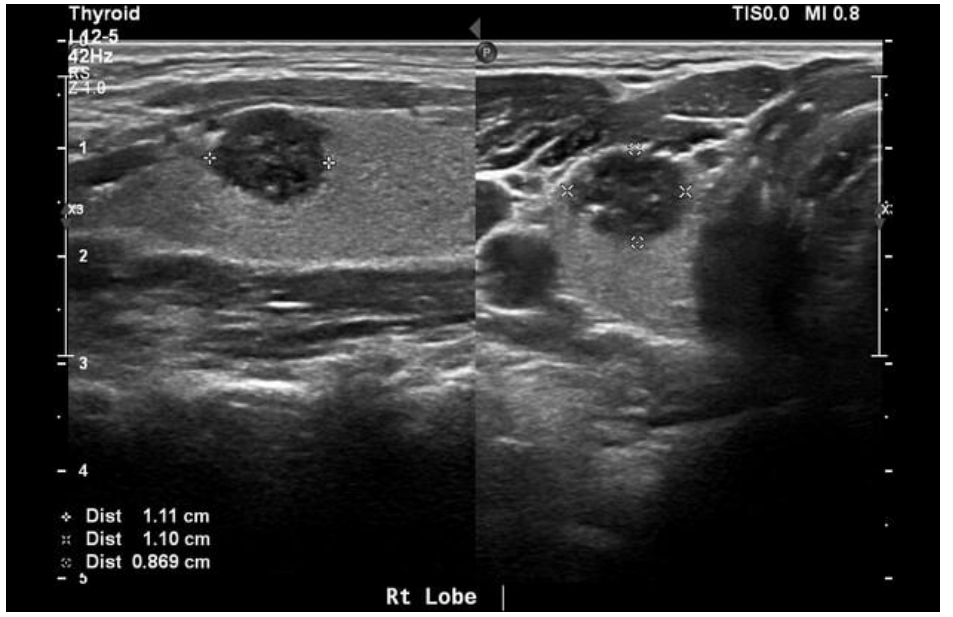
Thyroid Ultrasound

- First step with all thyroid nodules
- Risk-stratifies it
  - “Should it be biopsied?”
- TI-RADS Guidelines for next steps



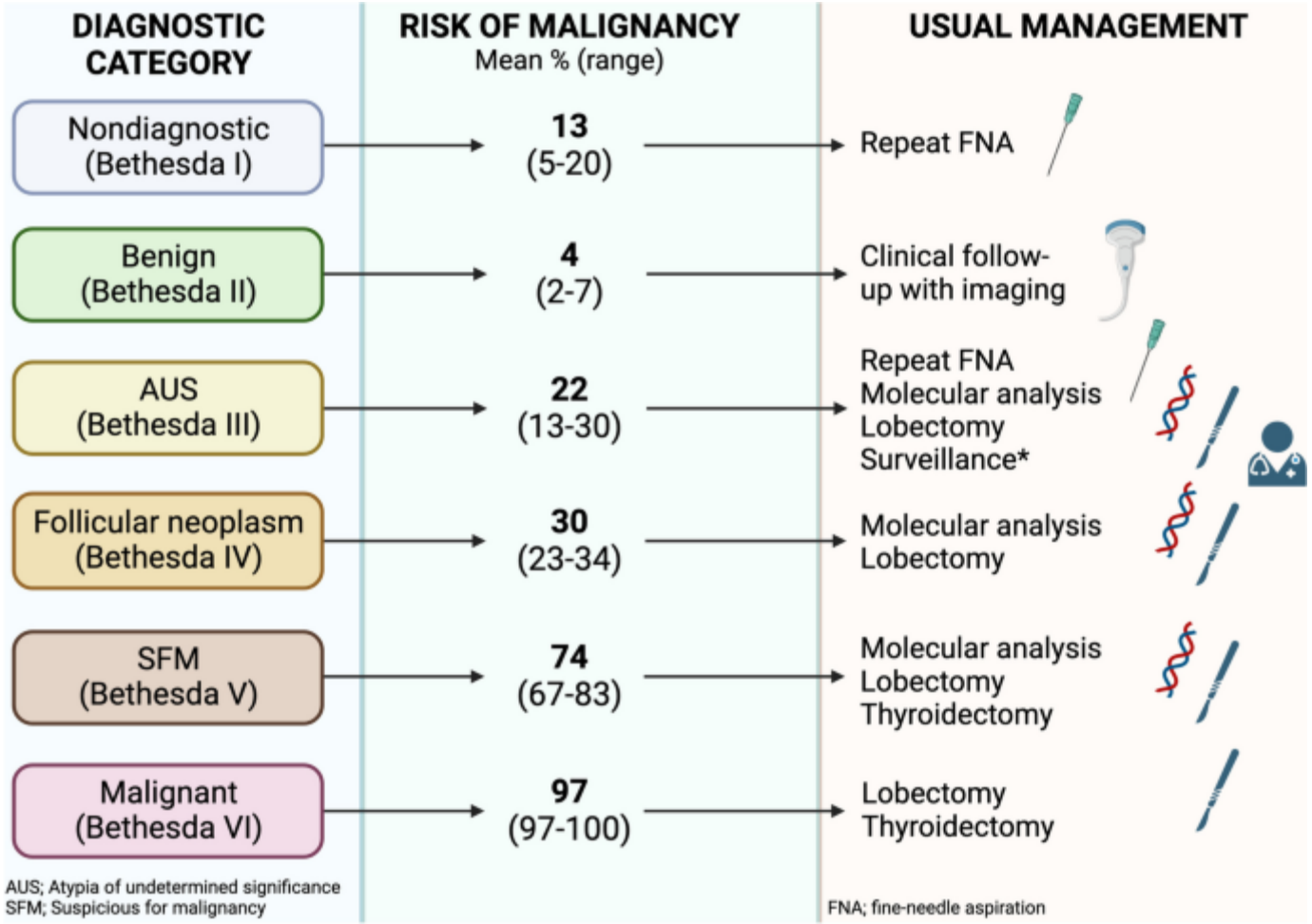
https://www.researchgate.net/figure/US-image-showing-a-benign-thyroid-nodule-Note-the-presence-of-peripheral-halo_fig2_51099148

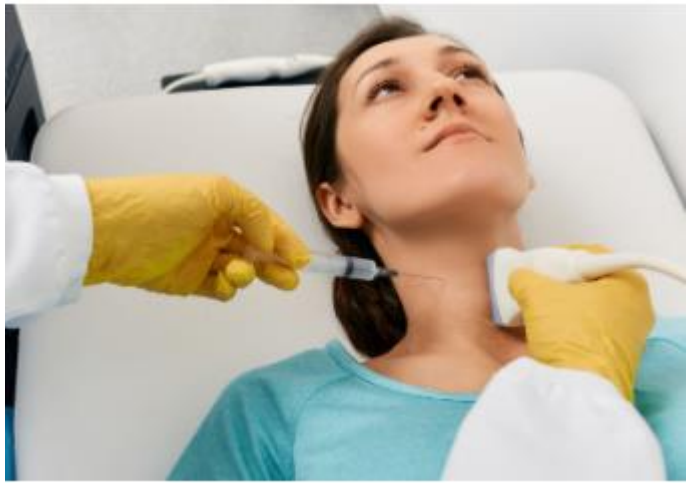




https://radiopaedia.org/articles/thyroid-cancer-overview

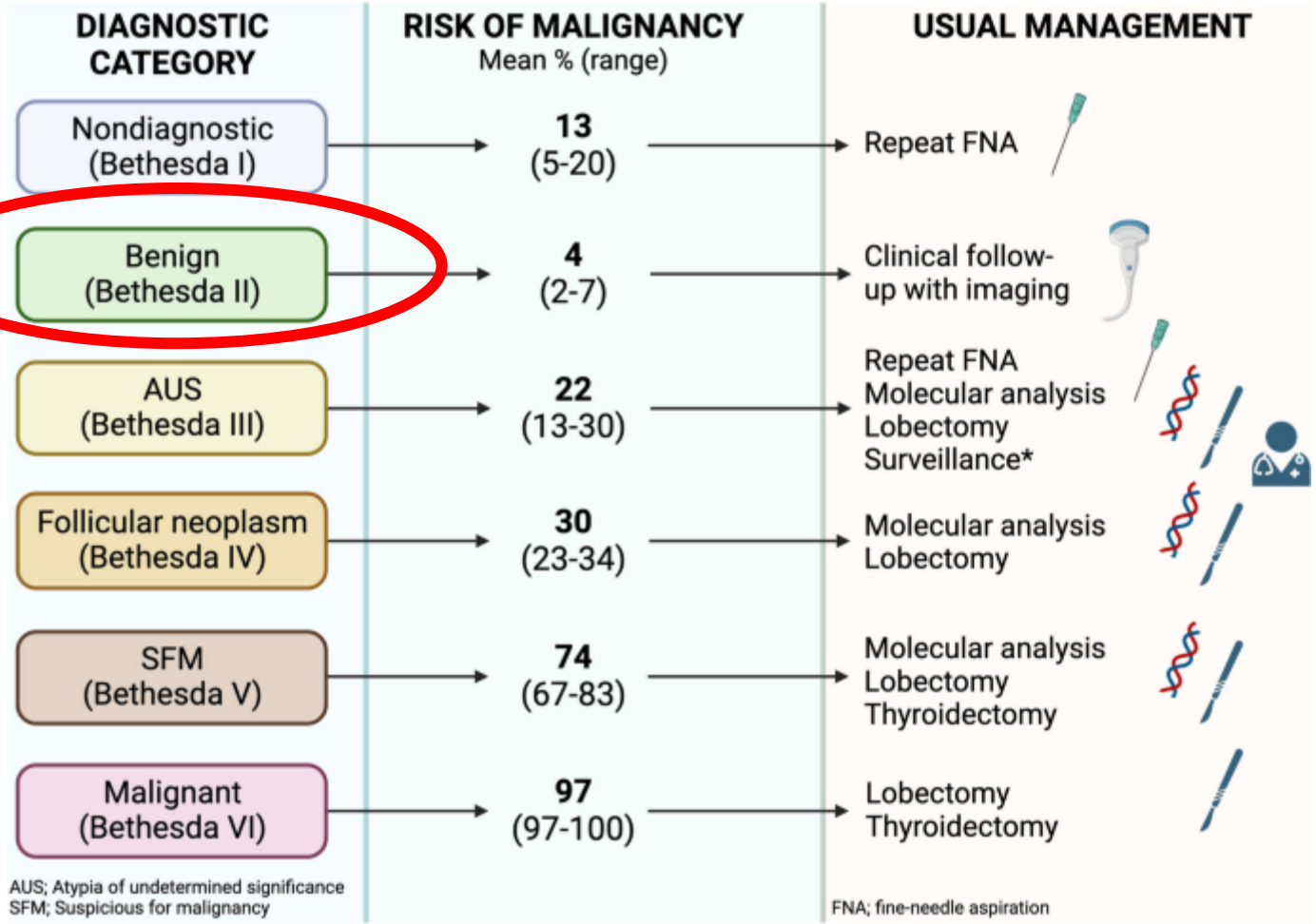
FNA Biopsy

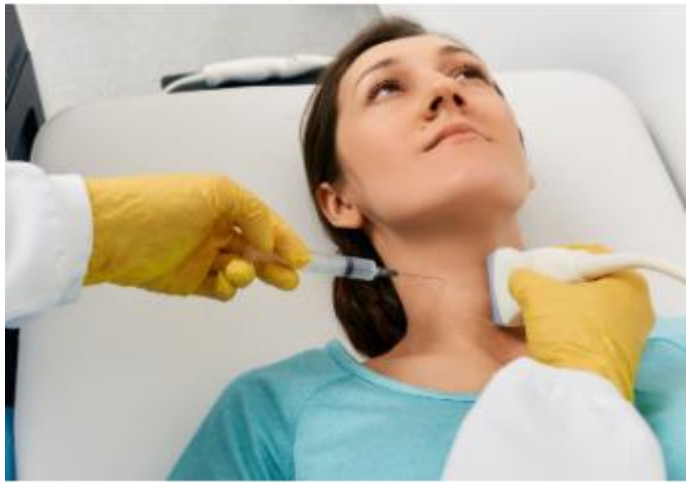




https://link.springer.com/article/10.1007/s12022-023-09795-9

FNA Biopsy





https://link.springer.com/article/10.1007/s12022-023-09795-9

Benign Nodules (Bethesda 2)

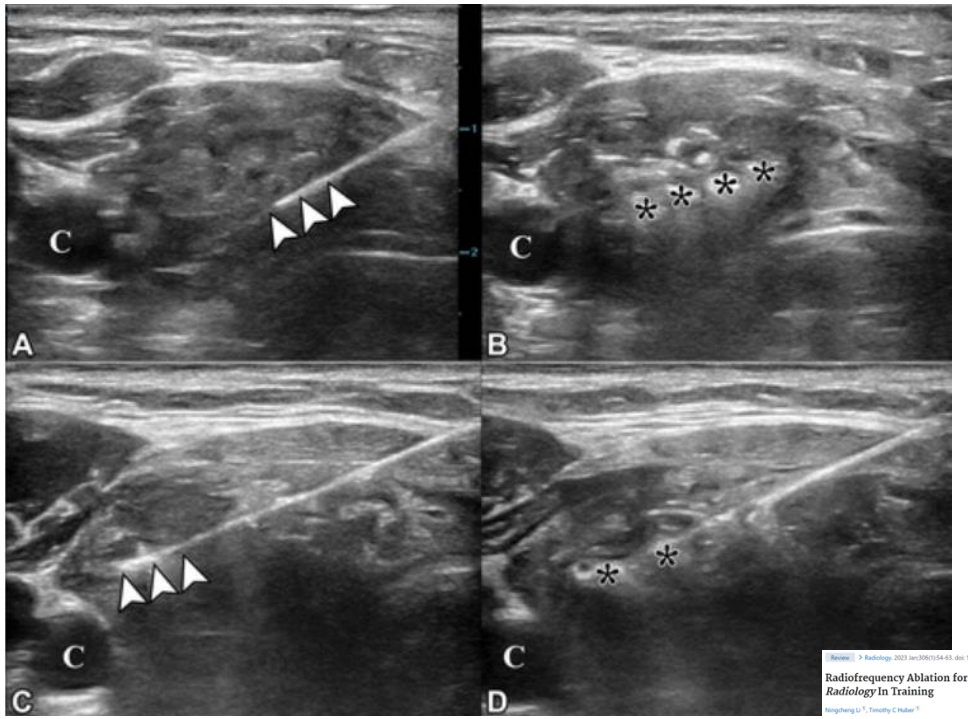
70% of all thyroid FNAs are benign (Bethesda 2)

- **Asymptomatic nodules**
  - Repeat ultrasound in ~1 year, then ~3 then ~5 years if stable
- **Symptomatic nodules**
  - Refer to discuss surgery or radiofrequency ablation (RFA)
  - Hemithyroidectomy is often sufficient
- **Large nodules (>4cm)**
  - Consider referral for surgical opinion vs close follow-up
- **If any uncertainty**
  - Happy to see patient and give an opinion!

Radiofrequency Ablation

- **~75% nodule size reduction** at 12 months
- Significant symptom and cosmetic improvement
- Two benign FNA biopsies needed
- Requires ongoing ultrasound surveillance





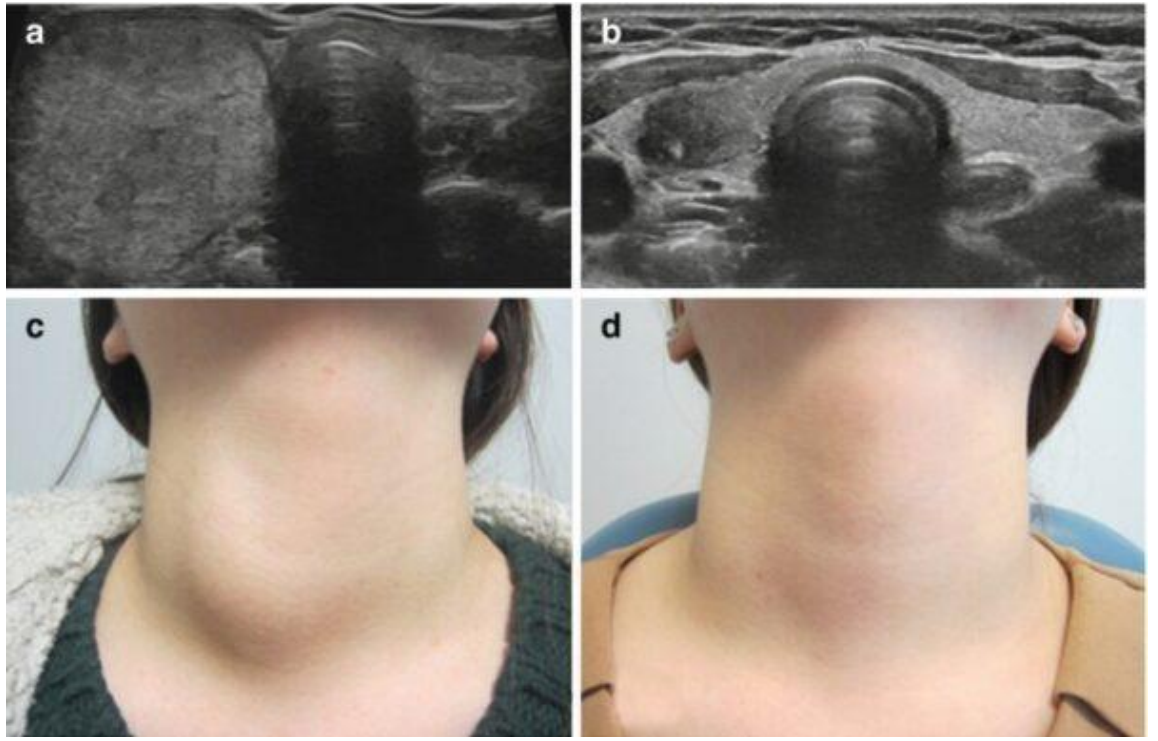
Valcavi, R. (2025). Radiofrequency Ablation (RA) of Benign Thyroid Nodules. In: Valcavi, R., Volpi, E., Dueñas, J.P., Randolph, G.W. (eds) Thyroid Ablation. Springer, Cham. https://doi.org/10.1007/978-3-031-88229-6_12

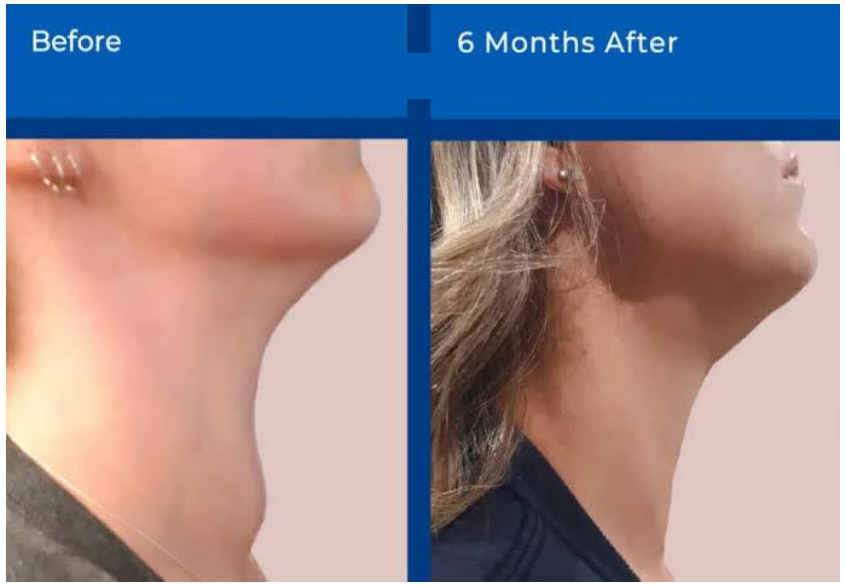


Radiofrequency Ablation

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- Significant symptom and cosmetic improvement
- Requires ongoing ultrasound surveillance







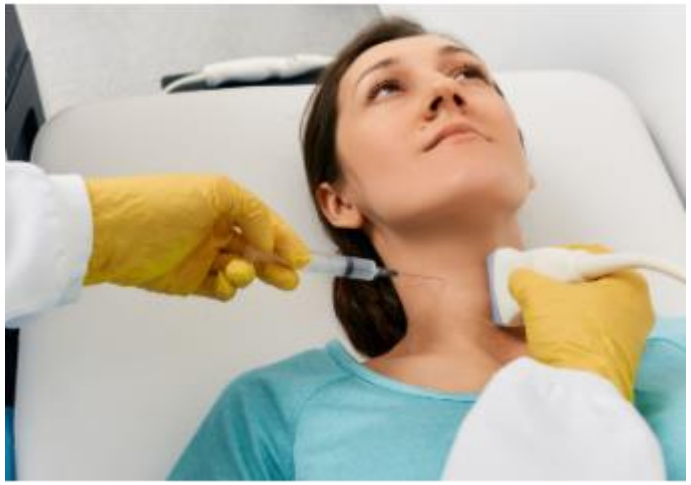
https://health.ucdavis.edu/news/headlines/nonsurgical-procedure-brings-relief-to-those-with-thyroid-nodules/2024/09

FNA Biopsy

DIAGNOSTIC CATEGORY	RISK OF MALIGNANCY Mean % (range)	USUAL MANAGEMENT
Nondiagnostic (Bethesda I)	13 (5-20)	Repeat FNA
Benign (Bethesda II)	4 (2-7)	Clinical follow-up with imaging
AUS (Bethesda III)	22 (13-30)	Repeat FNA Molecular analysis Lobectomy Surveillance*
Follicular neoplasm (Bethesda IV)	30 (23-34)	Molecular analysis Lobectomy
SFM (Bethesda V)	74 (67-83)	Molecular analysis Lobectomy Thyroidectomy
Malignant (Bethesda VI)	97 (97-100)	Lobectomy Thyroidectomy

AUS; Atypia of undetermined significance
SFM; Suspicious for malignancy

FNA; fine-needle aspiration



https://link.springer.com/article/10.1007/s12022-023-09795-9

Indeterminate Nodules (Bethesda 3)

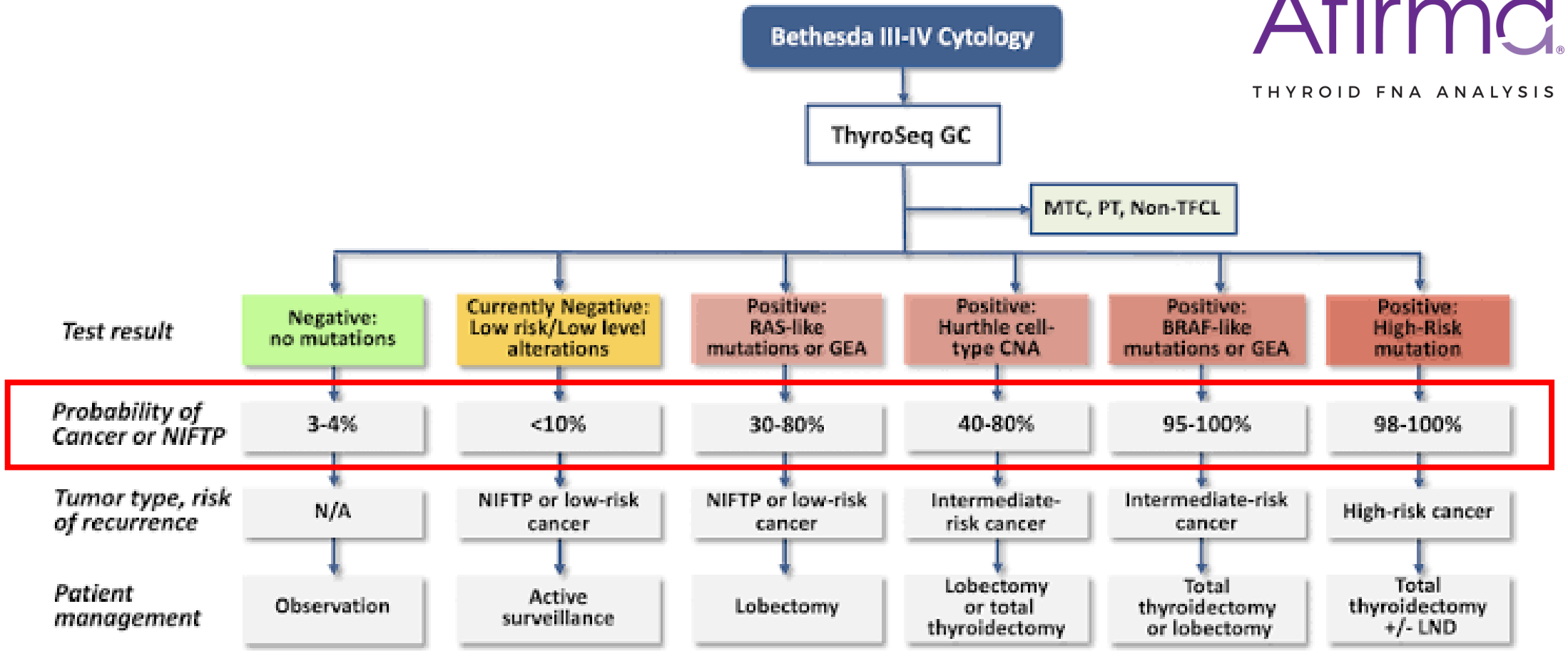
~10% of all thyroid FNAs are indeterminate (Bethesda 3)

- **Risk of malignancy 15-30%**
- Management: Repeat FNA
- If FNA intedeterminate/Bethesda 3 again:
  - Refer to discuss diagnostic hemithyroidectomy vs molecular testing

Molecular testing

ThyroSeq®
Thyroid Genomic Classifier

Afirma®
THYROID FNA ANALYSIS



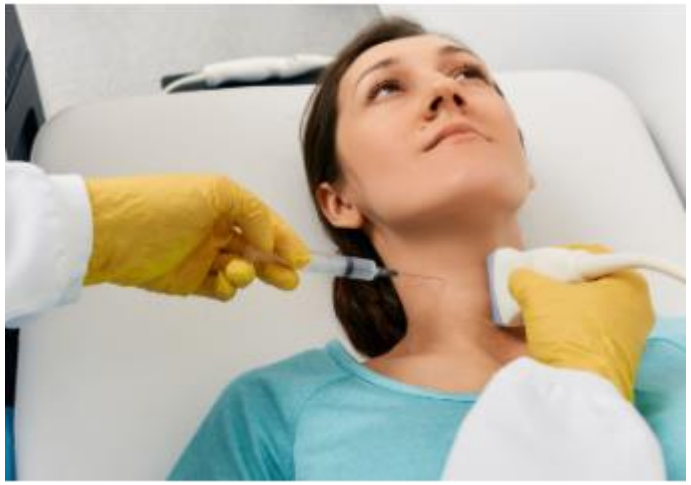
https://www.thyroseq.com/media/5752/thyroseq-negative-report-sonic-1.pdf

FNA Biopsy

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AUS; Atypia of undetermined significance
SFM; Suspicious for malignancy

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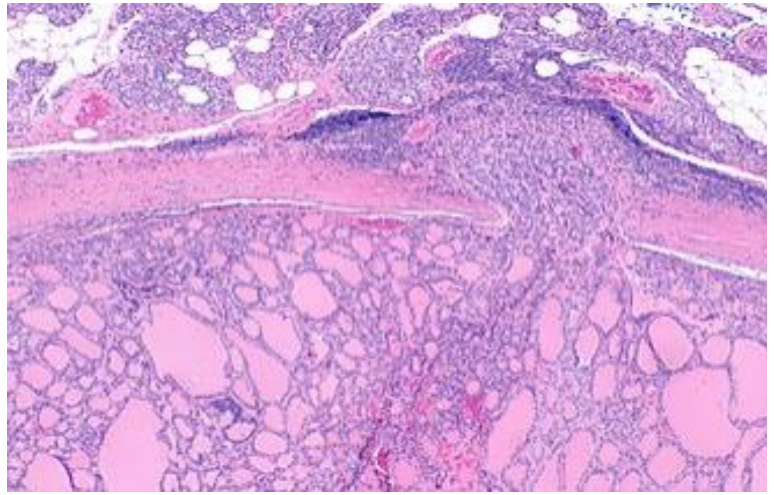


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Follicular Neoplasms (Bethesda 4)

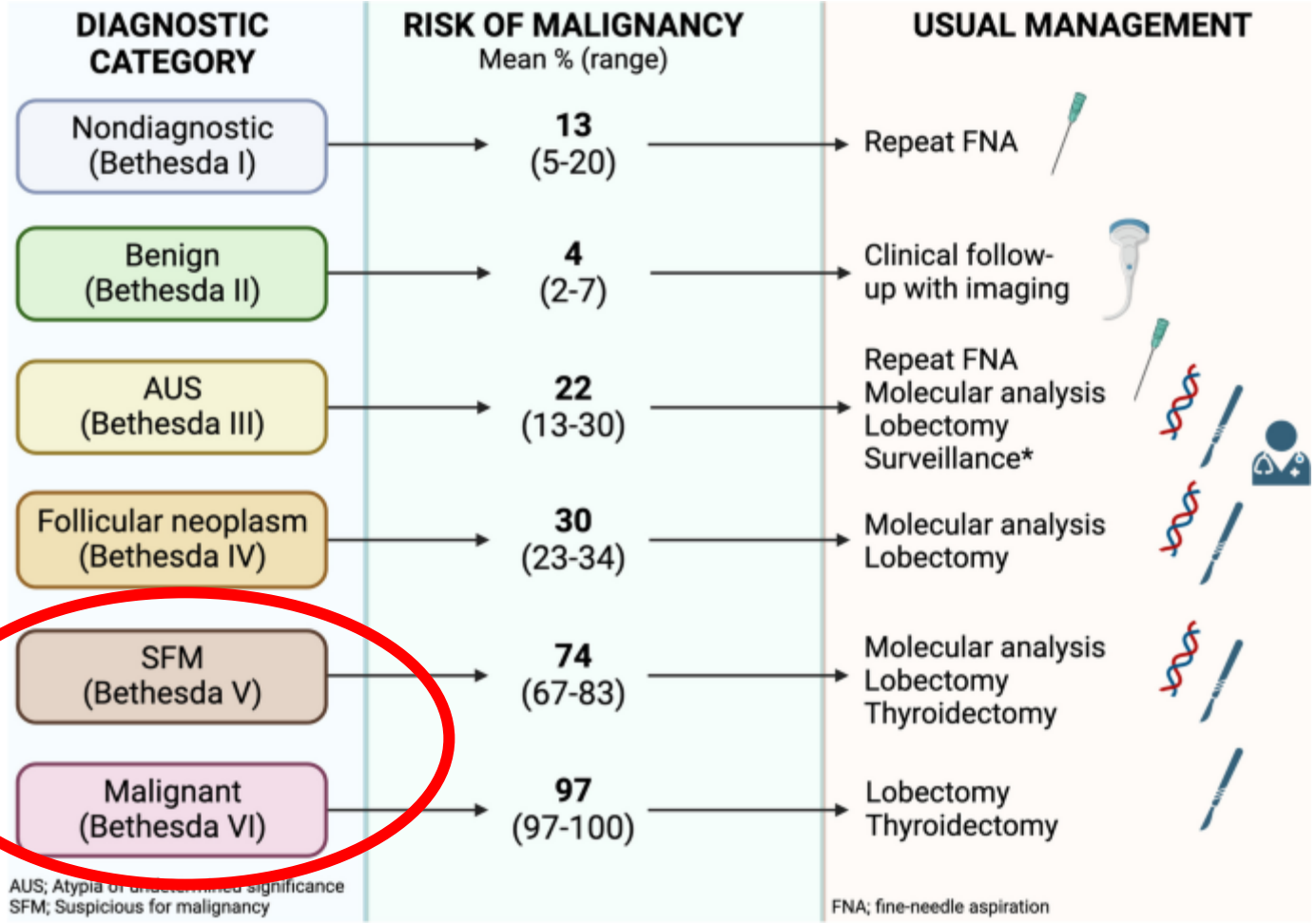
- **Risk of malignancy ~30%**
  - Cannot tell if follicular carcinoma without surgical resection or molecular testing
- **Management:** Surgery via hemithyroidectomy vs molecular testing
- If young patient (age <40): Surgery preferred, higher risk of malignancy

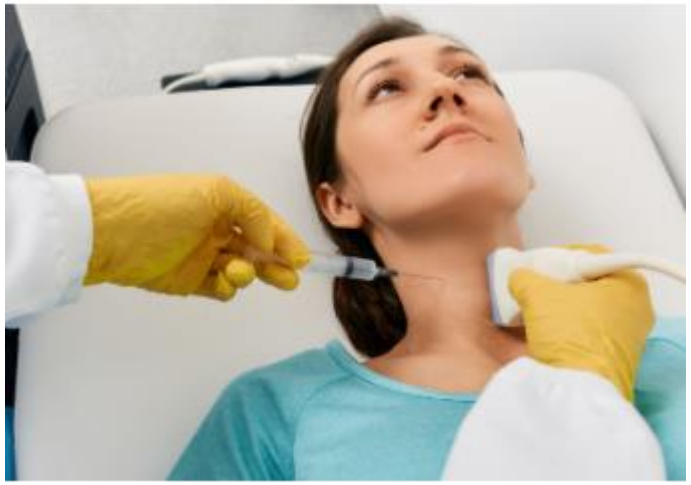
Follicular Neoplasms (Bethesda 4)



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FNA Biopsy





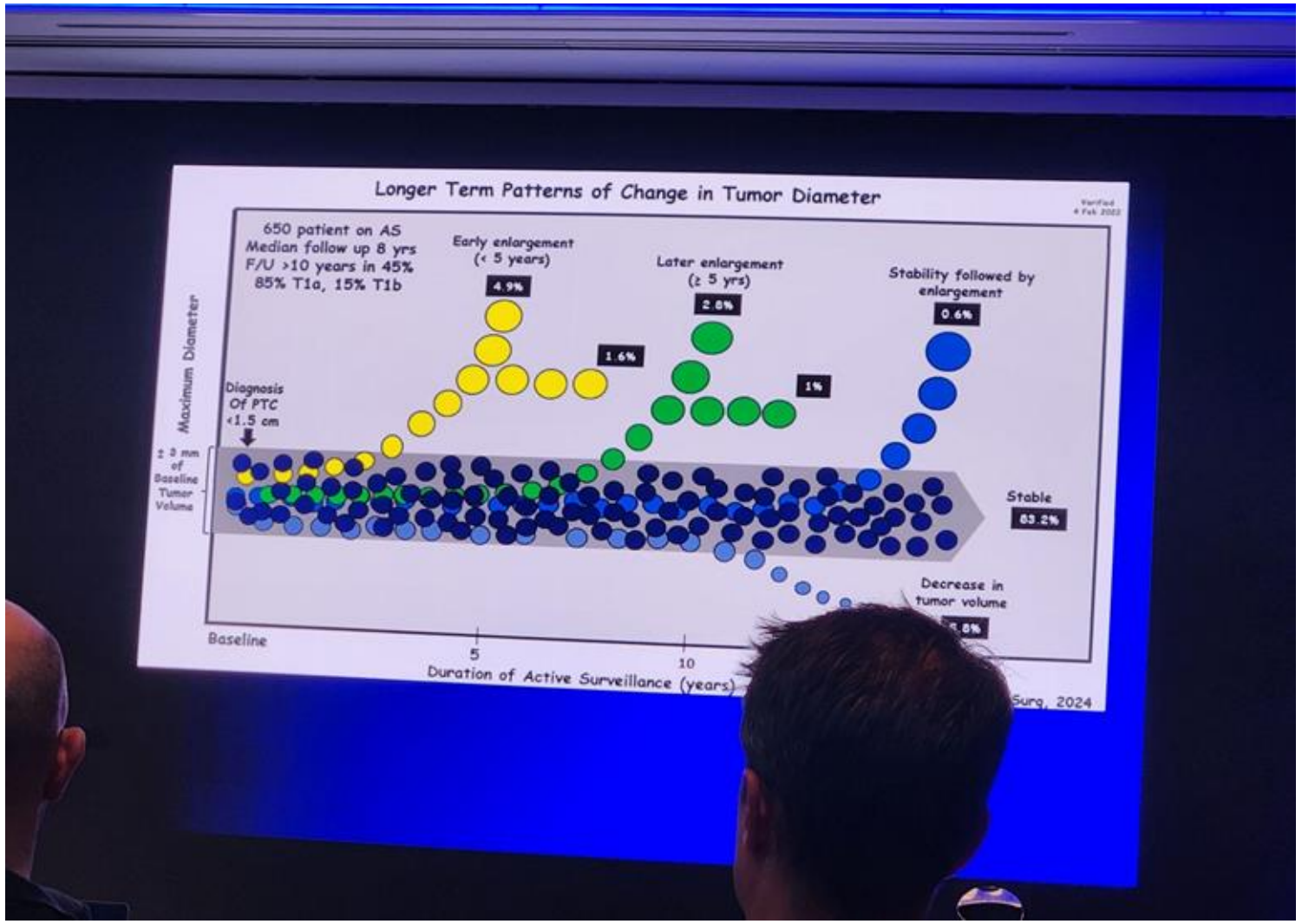
https://link.springer.com/article/10.1007/s12022-023-09795-9

Thyroid Cancer (Bethesda 5,6)

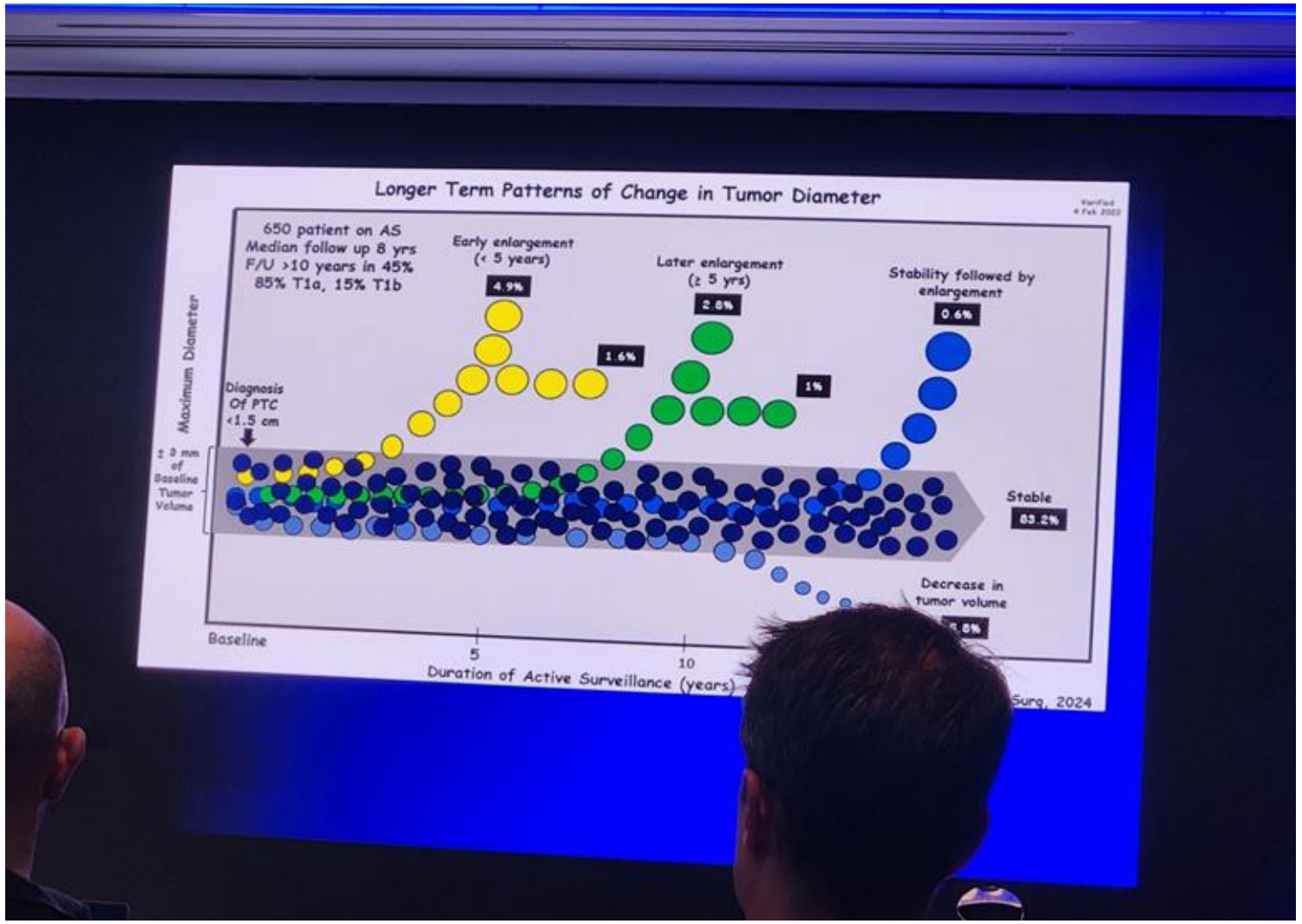
- **Risk of malignancy ~75-98%**
- Thyroid cancer is largely treatable, particularly papillary thyroid carcinoma
- 5-year survival rate 93-99% across all cancers, excluding anaplastic
- **Management:** Surgery
  - Hemithyroidectomy vs total thyroidectomy
  - Active surveillance an option for small tumors in favorable locations
- Multidisciplinary management with endocrinologist, PCP, and surgeon

https://www.cancer.org/cancer/types/thyroid-cancer/detection-diagnosis-staging/survival-rates.html

Papillary thyroid cancer <1.5cm: 83% do not grow or change after 15 years



Papillary thyroid cancer <1.5cm: 83% do not grow or change after 15 years



Nodules <1cm usually do not need biopsy

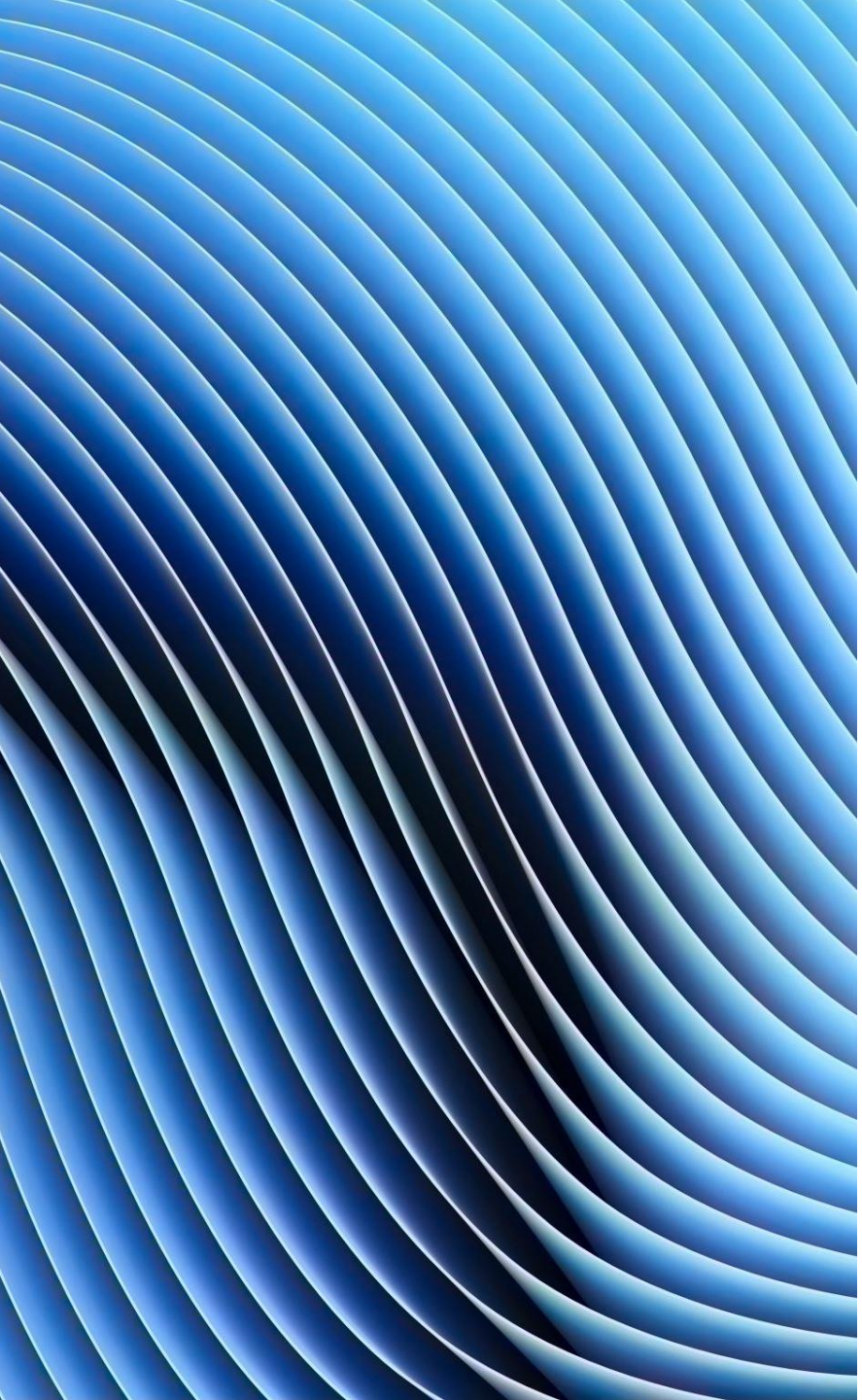
- Biopsy only if high-risk clinical features
  - Prior neck radiation, family history, enlarged lymph nodes

Papillary thyroid cancer <1.5cm: 83% do not grow or change after 15 years

- **RECOMMENDATION 11**

A. Active surveillance may be offered as an appropriate management option for some patients with cT1aN0M0 PTCs. Shared clinical decision-making between the patient and clinical team regarding risks and benefits of this approach is essential. ***(Conditional recommendation, Low certainty evidence)***

AMERICAN THYROID ASSOCIATION®



Post-op after thyroidectomy

Usually discharged home post-op day one, or same day of surgery

30% pts require long-term levothyroxine after hemithyroidectomy

- We will check post-op TSH/T4 at 6 weeks
  - We will titrate levothyroxine dose

Benign operation: Annual TSH/T4

Post-cancer operation: Annual thyroglobulin and ultrasound

- Usually surveilled by endocrinologist

Multidisciplinary discussion

- Discuss need for radioactive iodine, completion thyroidectomy
  - Historically, ~50% of pts got RAI. This is dropping, particularly in low-risk disease

Toxic Solitary Nodule



Goiter

- Indications for surgery: Compressive symptoms, size, cosmetic concerns
- Likely to continue growing
- CT neck/chest helpful to assess for retrosternal extension





Thyroiditis, etc

- Grave’s disease, Hashimoto’s, etc
- Nuanced decisions for surgery vs medical treatment
- Indications for surgery, made multidisciplinary with endocrinology, PCP

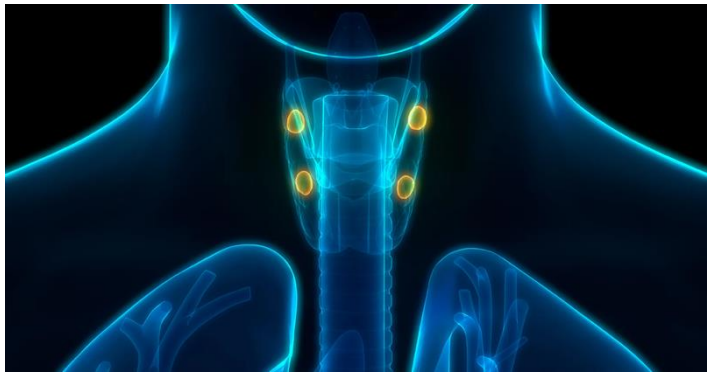
Thyroid- Long story short

- There are options for each thyroid nodule, and we're happy to have individualized patient-centered discussions
  - Observe
  - Radiofrequency ablation
  - Surgery
- Overall:
  - Ultrasound
  - Biopsy of most-suspicious nodule
  - TSH, T4



Parathyroid

Primary Hyperparathyroidism

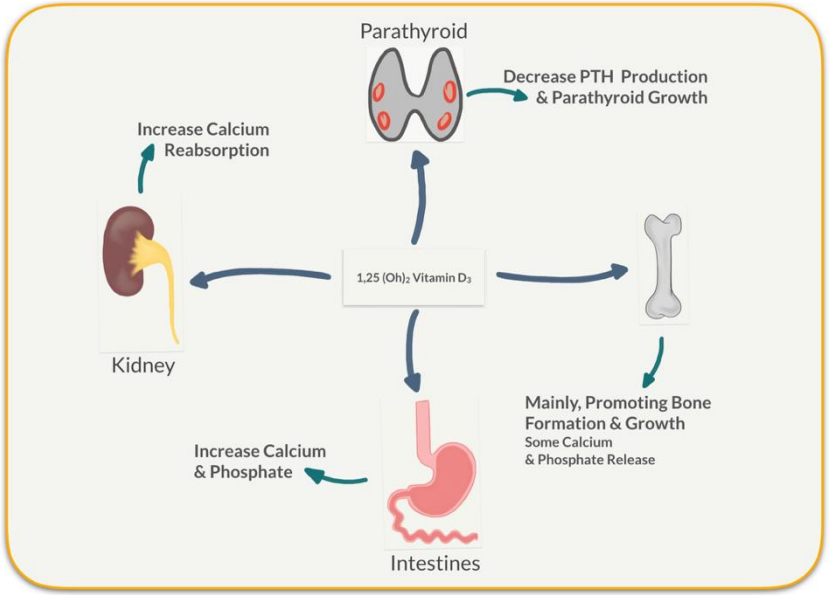


- Usually incidentally diagnosed
- Why it matters
  - Treatment can:
    - Improve bone mineral density
    - Reduce fracture risk
    - Improve renal stones
    - Neurocognitive/musculoskeletal symptomatic improvement
- Parathyroidectomy is only cure BUT need to discern if patient will indeed benefit

https://www.endocrine.org/patient-engagement/endocrine-library/primary-hyperparathyroidism

Next Steps

- Labs
  - Vitamin D levels
    - Especially if *normal calcium levels*
    - Sometimes PTH corrects with VitD supplementation
  - If hypercalcemic, add:
    - CMP, for creatinine and alkaline phosphatase
    - 24hr urine calcium/creatinine (testing for FHH)
- Parathyroid localization studies ordered
- Refer to surgeon or endocrinologist



https://www.hyperparathyroidmd.com/hyperparathyroidism-vitamin-d/

Normohormonal primary hyperparathyroidism

PTH	Calcium
Normal	High

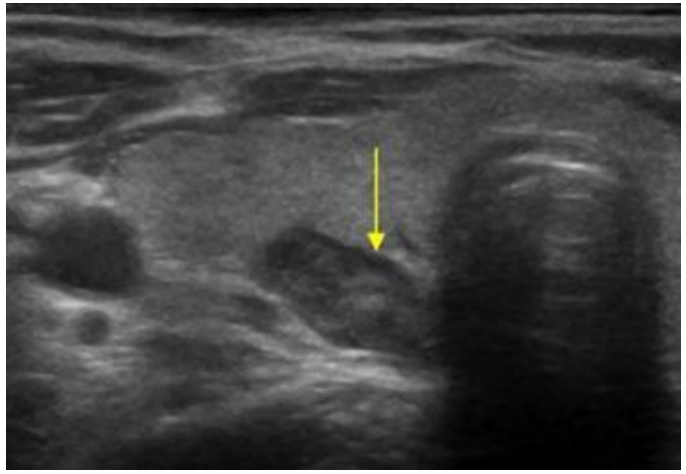
- “Normal” PTH level with hypercalcemia
  - Is actually “inappropriately nonsuppressed”
- Rule out other causes of hypercalcemia
  - **Familial hypocalciuric hypercalcemia (FHH)**
    - 24hr urine calcium/creatinine
  - **Medications**
    - Thiazide diuretics, lithium, calcium oversupplementation
  - **Malignancy**
    - Paraneoplastic effect (PTHrP); small cell lung cancer, etc
- Surgery highly effective to resolve hypercalcemia here

Normocalcemic primary hyperparathyroidism

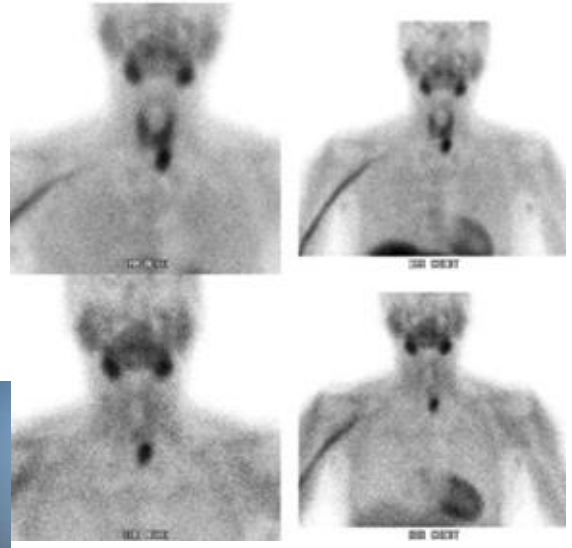
- Diagnosis of exclusion
- Often found on workup of osteoporosis, fragility fractures, renal stones
- Next steps:
  - **Must ensure Vitamin D-replete**
    - ~3 months Vitamin D supplementation then repeat labs
  - Ionized calcium
  - 24hr urine calcium/creatinine
- Later steps
  - DEXA
  - Renal ultrasound
- Referral to endocrinology; nuanced decisions for surgery in this population

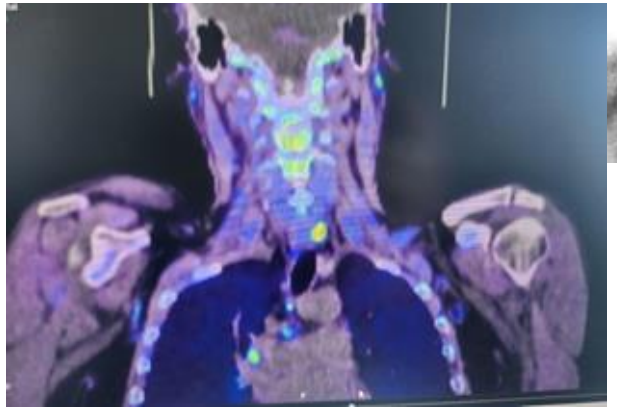
PTH	Calcium
High	Normal

Parathyroid Localization



- Begin localization
  - **Ultrasound**
  - **Sestamibii SPECT/CT**
    - Improved localization yield from typical Sestamibii
- Refer
  - If imaging negative/discordant:
    - 4DCT
    - F18 choline scan





After Referral

- Surgeon-performed ultrasound
- Further biochemical testing, if necessary
- Further localization, if necessary
  - 4DCT
  - F18 choline
- Parathyroidectomy is cure, BUT--

Our job as endocrine surgeon/endocrinologist

Will the patient benefit from surgery?

Clear benefit

- Symptomatic PHPT
- Significant hypercalcemia
- Skeletal/renal end-organ involvement
- Age <50 (likely to progress)

Potential benefit

- Isolated neurocognitive symptoms (unpredictable)
- Mild uncomplicated PHPT

Uncertain benefit

- Uncomplicated normocalcemic PHPT

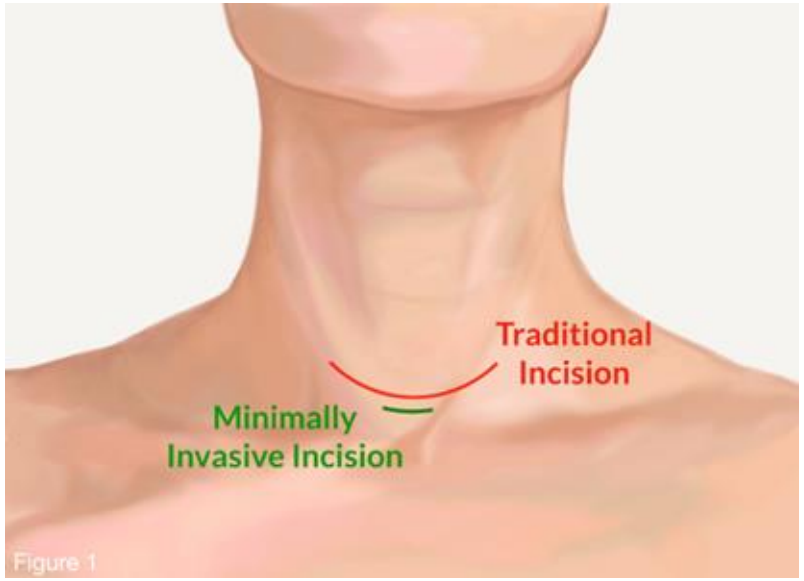
Mild Uncomplicated Primary Hyperparathyroidism

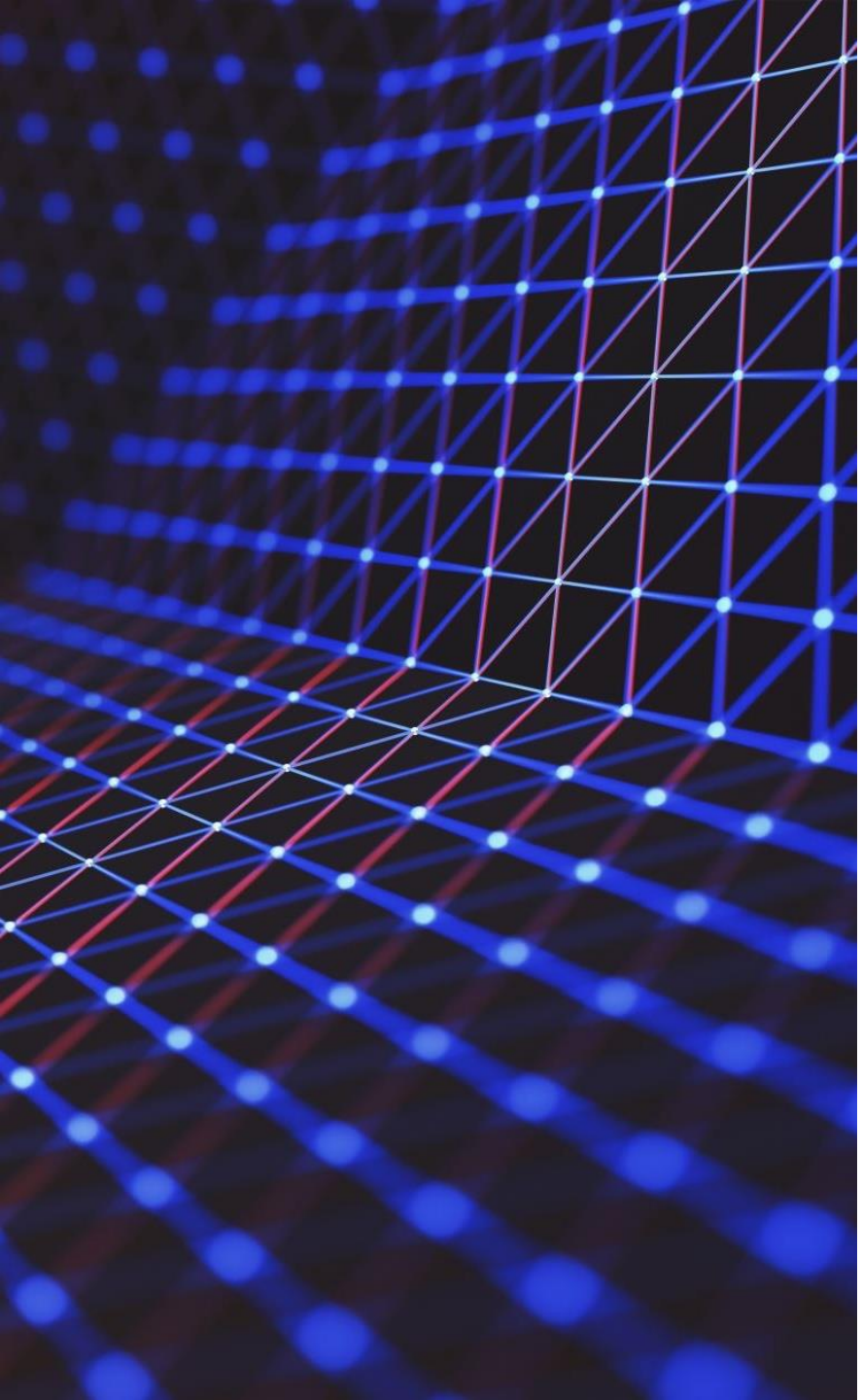
- Mild biochemical hypercalcemia
  - No attributable symptoms
  - No skeletal/renal complications
- Treatment?: Surveillance may be an option pending patient's age, end-organ complications)
  - 75% stable at 10 years
  - ~60% stable at 15 years
  - **~37% of conservatively-managed patients developed an indication for surgery within 15 years**
- Shared decision making on individualized basis with endocrinologist and surgeon
  - Ongoing monitoring annually

Rubin MR, Bilezikian JP, McMahon DJ, Jacobs T, Shane E, Siris E, Udesky J, Silverberg SJ. The natural history of primary hyperparathyroidism with or without parathyroid surgery after 15 years. J Clin Endocrinol Metab. 2008 Sep;93(9):3462-70. doi: 10.1210/jc.2007-1215. Epub 2008 Jun 10. PMID: 18544625; PMCID: PMC2567863.

Parathyroid Surgery

- Minimally-invasive parathyroidectomy
  - If good localization
- 4-gland exploration
  - If discordant/unclear imaging, older age
  - Multigland disease in 10-20% of patients
- Whichever option is safest
- “I thought I was just getting old!”





Post-op

Usually discharged home on post-op day one, or same day as surgery

Labs (we will manage)

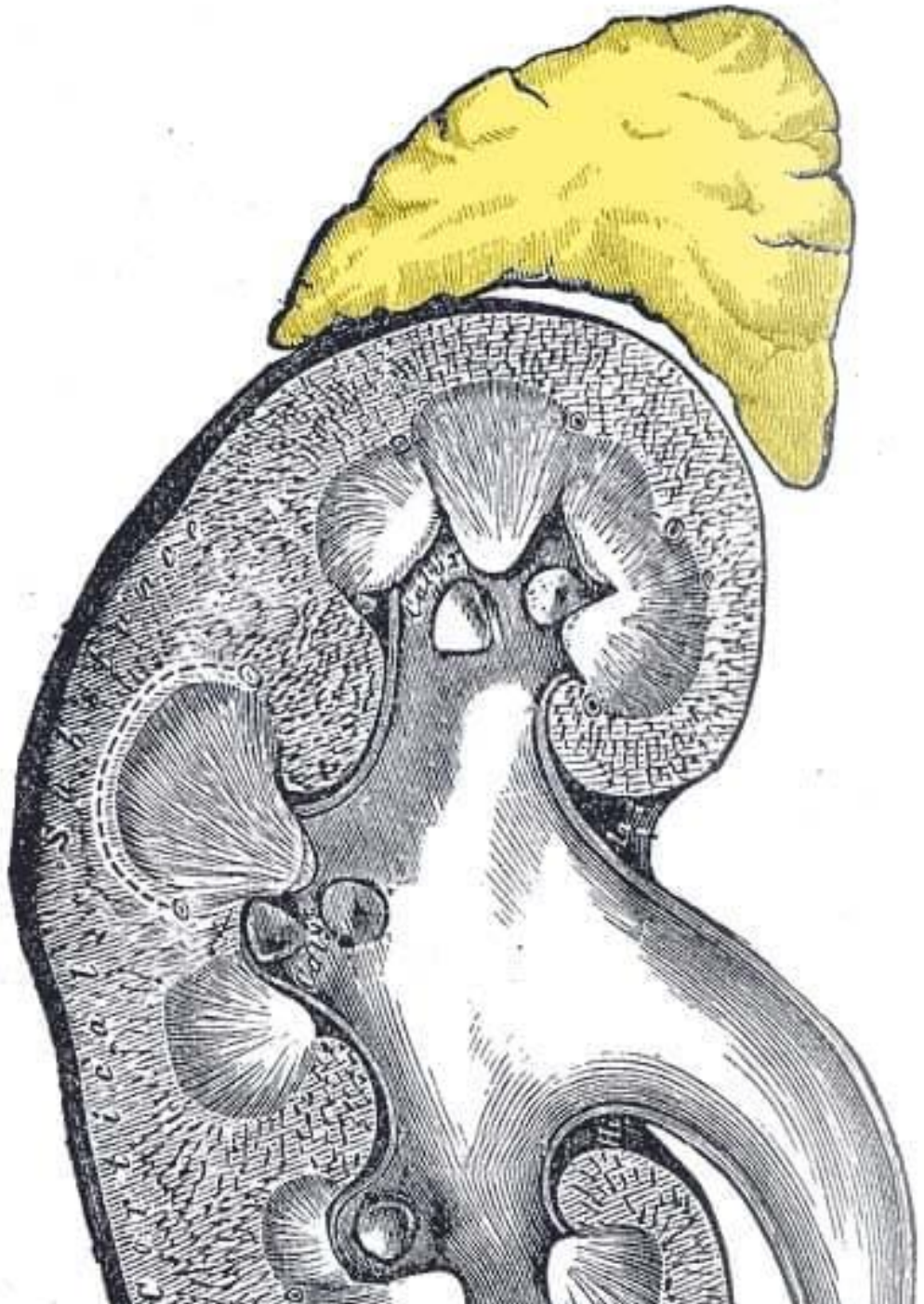
- **2 weeks post-op**: Calcium level
- **3 months**: PTH and calcium level
  - *PTH often rebounds back to high level post-op;*
    - *Calcium is main indicator of long-term success*
- Then annual calcium level

Sometimes we give daily calcium tabs post-op to prevent rebound hypocalcemia

- We will wean it over ~1-2 weeks post-op

Long story short

- If elevated PTH, obtain:
  - Vitamin D, replete if needed
  - Creatinine
  - 24hr urine calcium/creatinine (exclude FHH)
  - If normocalcemic:
    - Ionized calcium
    - Endocrinology referral
  - Parathyroid ultrasound and Sestamibi SPECT/CT
- Refer to surgeon/endocrinologist



Adrenal

Adrenal Nodules



- Incidentalomas
  - 4% of abdominal CT scans
  - Present in 10% of patients age >80
  - 75% of incidentalomas are benign and nonfunctional
- **Must** first determine if:
  1) Functional
  2) Malignancy risk
     - Via nodule *size* and *imaging characteristics*
     - **Don’t biopsy**

https://www.scientificanimations.com/adrenal-glands-functions-disorders/uncategorized/

Adrenal Nodules



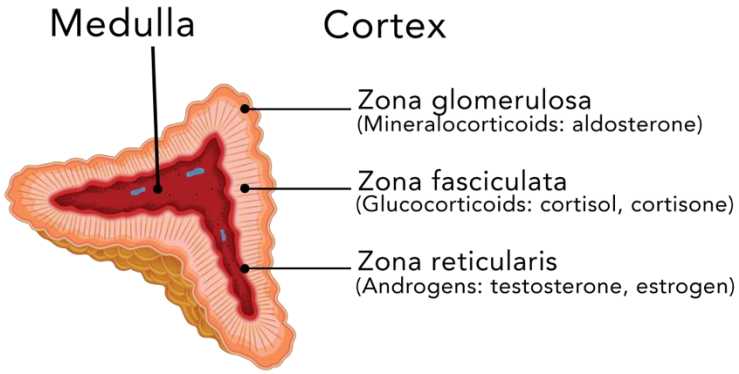
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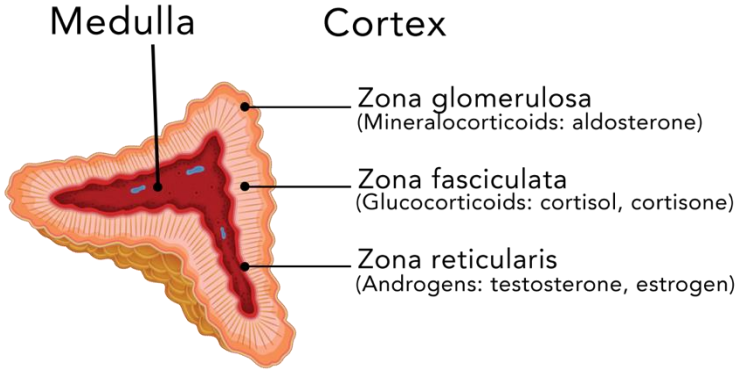
Is It Functioning?



- Biochemical workup:
  - **Low-dose dexamethasone suppression test (DST)**
  - **Aldosterone-renin ratio (ARR)**
  - **Plasma metanephrines** (or 24hr urine metanephrines)

https://www.adrenalinsufficiency.org/what-is-adrenal-insufficiency/anatomy-physiology/

Is It Functioning?



Hypercortisolism

Cushing's Syndrome

- **Low-dose dexamethasone suppression test (1mg)**
  - Mild autonomous cortisol secretion (MACS)
    - Asymptomatic, or mildly symptomatic
    - HTN, glucose intolerance, weight parameters, bone/vertebral fractures

Primary hyperaldosteronism

Conn Syndrome

- **Aldosterone-Renin ratio**
  - Beta blockers can cause false positive
  - Consider testing if patient with history of refractory hypertension and hypokalemia

Pheochromocytoma

- **Plasma metanephrines**

  -24hr urinary metanephrines

-Further confirmatory testing if needed via surgeon/endocrinologist

(24hr urine cortisol, midnight salivary cortisol, saline suppression test, adrenal venous sampling, clonidine suppression test, DOTATATE scan, among others)

https://www.adrenalinsufficiency.org/what-is-adrenal-insufficiency/anatomy-physiology/

Adrenal Imaging

- Historically: Adrenal protocol CT
  - Absolute washout, relative washout

Adrenal washout formulae for contrast CT

$$\text{Absolute washout: } 100 \times \frac{\text{Post HU - Delayed HU}}{\text{Post HU - Pre HU}}$$

$$\text{Relative washout: } 100 \times \frac{\text{Post HU – Delayed HU}}{\text{Post HU}}$$

https://radiogyan.com/adrenal-washout-calculator/

Adrenal Imaging



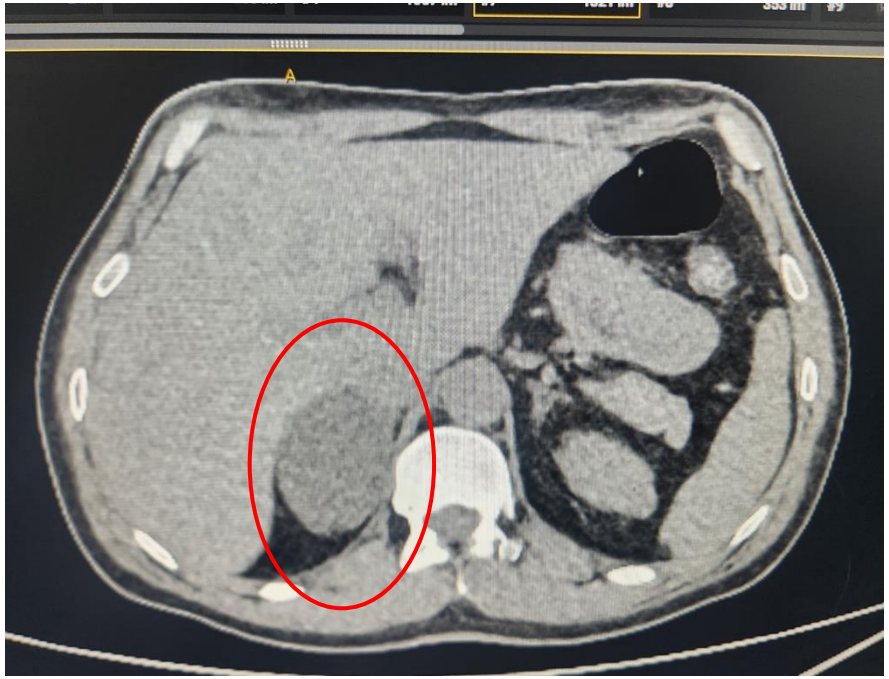
- Historically: Adrenal protocol CT
  - Absolute washout, relative washout
- Now: **noncontrast CT**
  - Sometimes already done during index/incidental CT with IV contrast
  - **If index CT was with contrast-only**:
    - Ok to hold on additional imaging
    - Surgeon/endocrinologist can arrange follow-up noncontrast CT as needed

https://www.researchgate.net/figure/Non-contrast-CT-image-of-a-57-year-old-female-adrenal-gland-showing-a-29-27-cm_fig5_6165223

Size

- Historically >4cm meant risk of malignancy
  - Now is more nuanced
- Adrenocortical carcinoma
  - <4cm: 0.5%
  - 4-6cm: 5%
  - >6cm: up to 35%

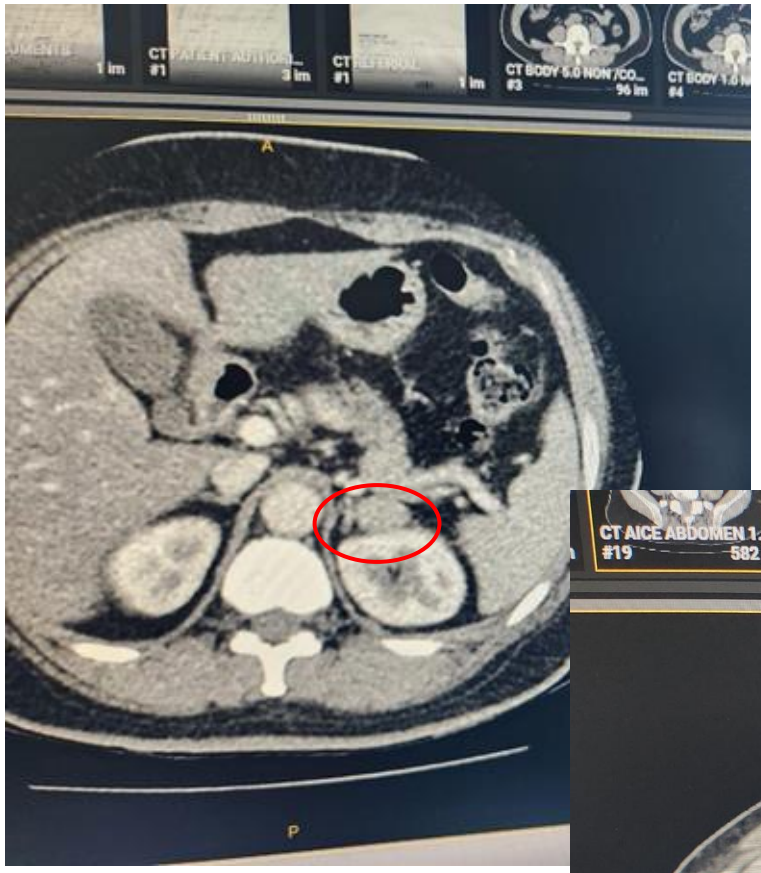


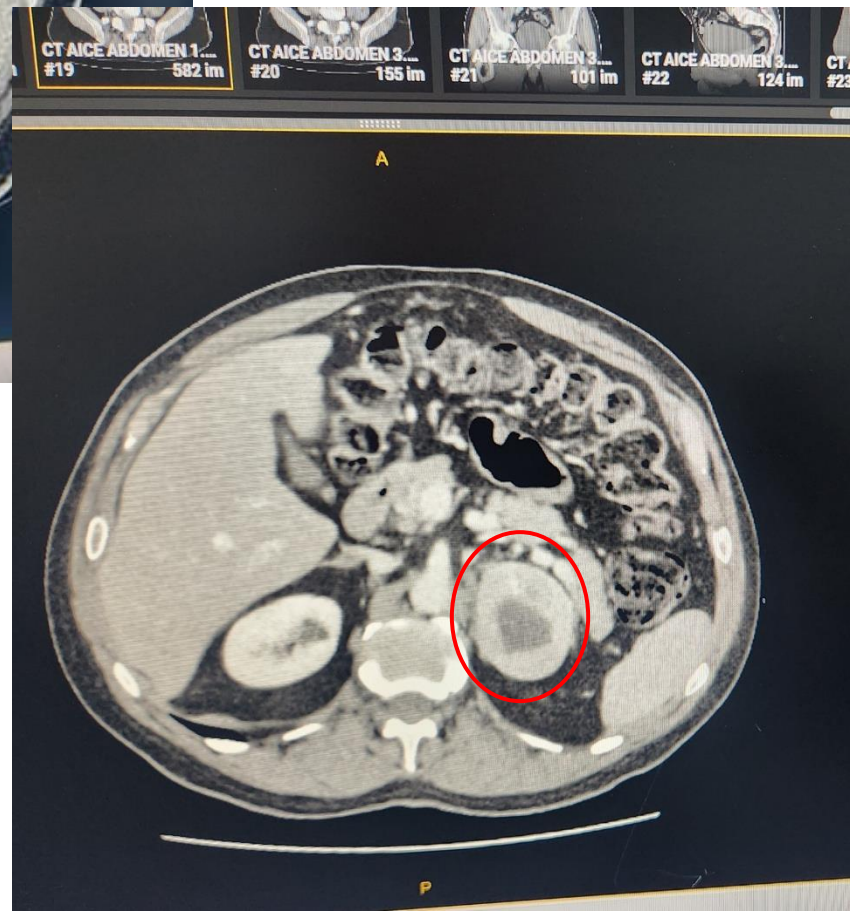


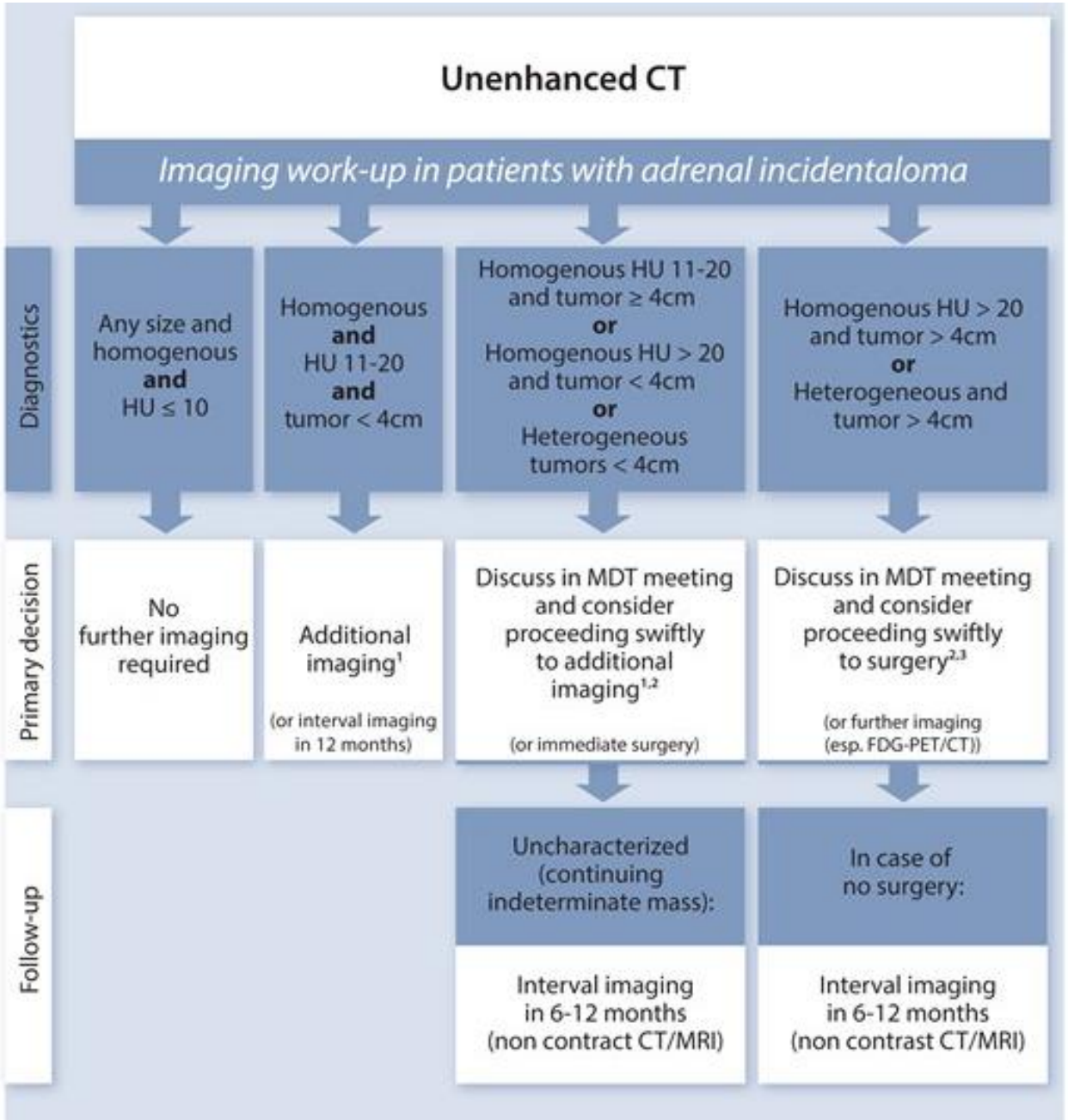
7cm, low-density

Density

- Nodule characteristics are what leads suspicion
  - Density (Houndsfield units; HU)
  - Homo/heterogeneous

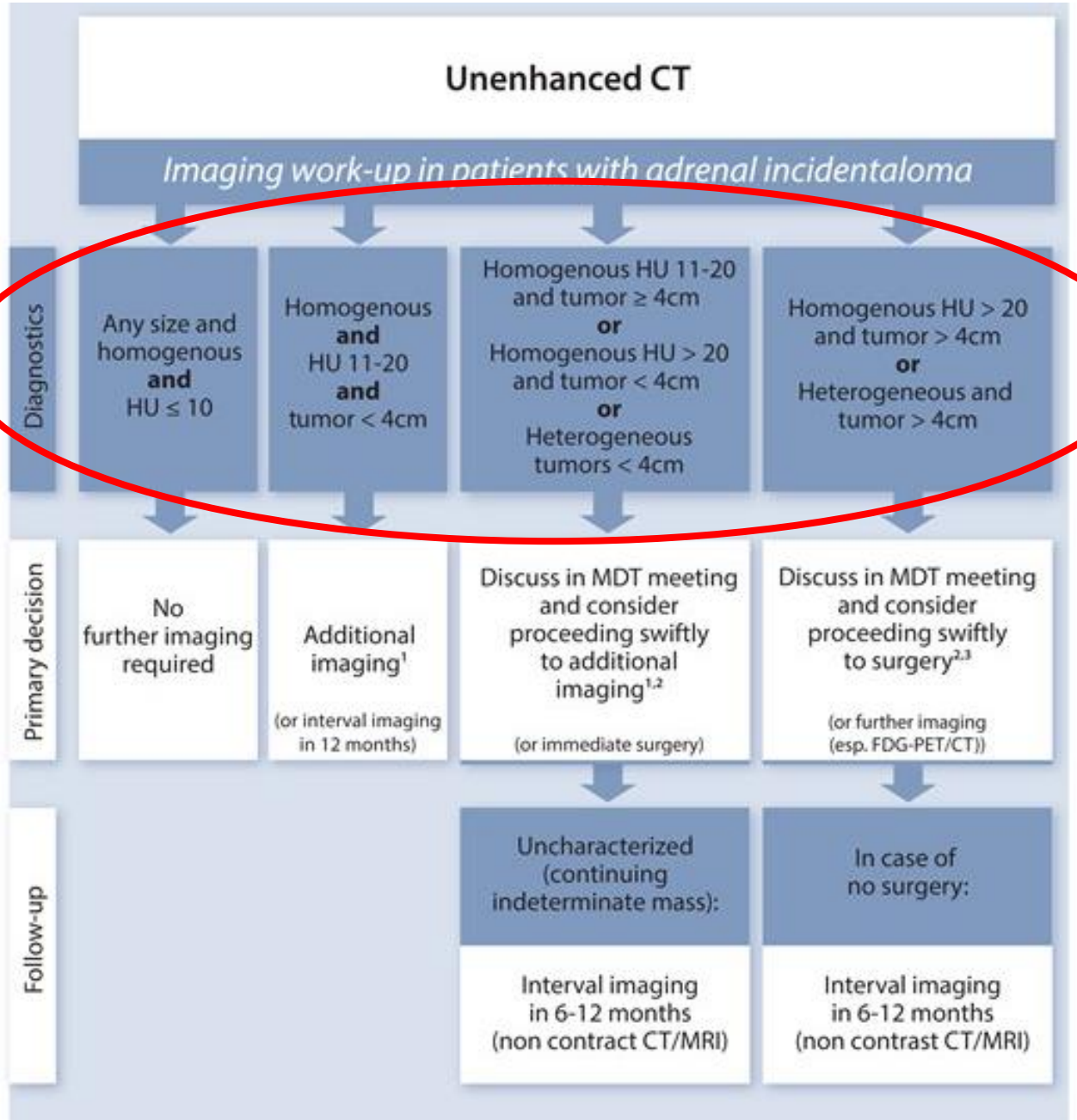






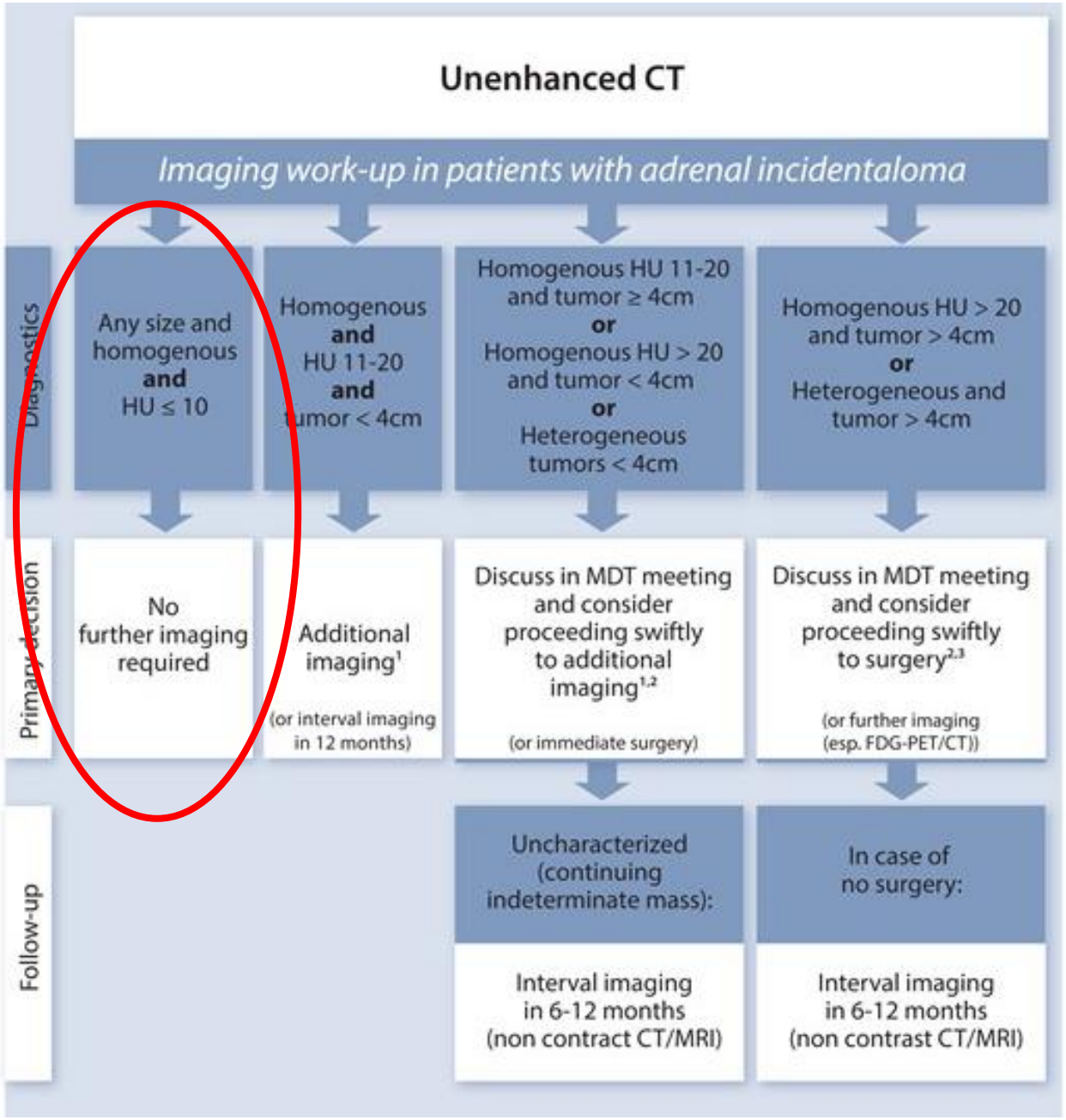
European Society of Endocrinology

Fassnacht M, Tsagarakis S, Terzolo M, Tabarin A, Sahdev A, Newell-Price J, Pelsma I, Marina L, Lorenz K, Bancos I, Arlt W, Dekkers OM. European Society of Endocrinology clinical practice guidelines on the management of adrenal incidentalomas, in collaboration with the European Network for the Study of Adrenal Tumors. Eur J Endocrinol. 2023 Jul 20;189(1):G1-G42. doi: 10.1093/ejendo/lvad066. PMID: 37318239.



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American Association of Endocrine Surgeons
Dedicated to advancing the science and art of endocrine surgery

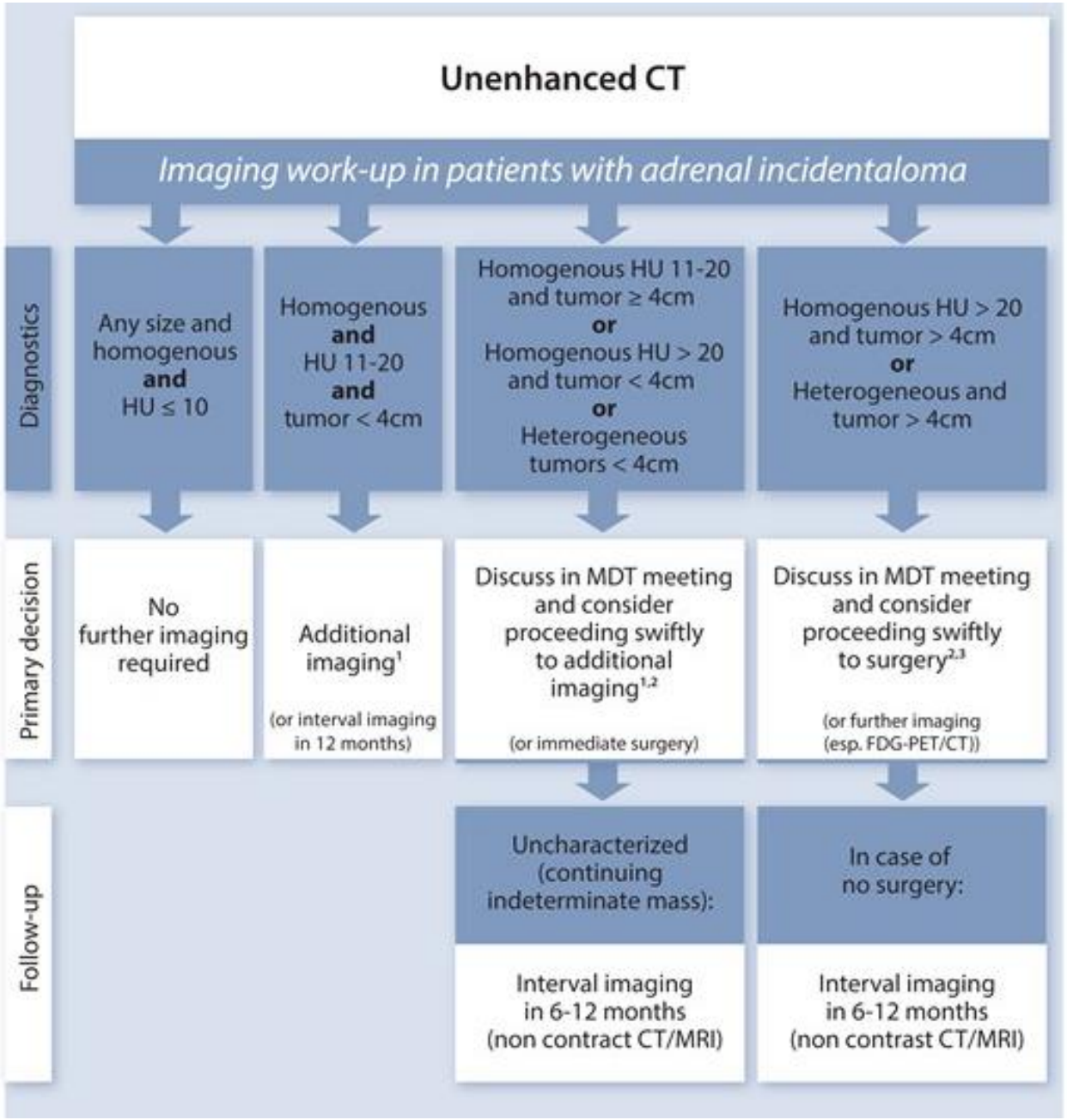
JAMA Surg. 2022 Oct 1;157(10):870-877. doi: 10.1001/jamasurg.2022.3544.

American Association of Endocrine Surgeons Guidelines for Adrenalectomy: Executive Summary

Linwah Yip [1], Quan-Yang Duh [2], Heather Wachtel [3], Camilo Jimenez [4], Cord Sturgeon [5], Cortney Lee [6], David Velázquez-Fernández [7], Eren Berber [8], Gary D Hammer [9 10 11], Irina Bancos [12], James A Lee [13], Jamie Marko [14], Lilah F Morris-Wiseman [15], Marybeth S Hughes [16], Masha J Livhits [17], Mi-Ah Han [18], Philip W Smith [19], Scott Wilhelm [20], Sylvia L Asa [21], Thomas J Fahey 3rd [22], Travis J McKenzie [23], Vivian E Strong [24], Nancy D Perrier [25]

Recommendation 1.4. We do not recommend routine scheduled follow-up of a nonfunctional adrenal nodule (size <4 cm) with benign imaging characteristics and noncontrast HU less than 10 because the risk of developing malignancy is very low.

Fassnacht M, Tsagarakis S, Terzolo M, Tabarin A, Sahdev A, Newell-Price J, Pelsma I, Marina L, Lorenz K, Bancos I, Arlt W, Dekkers OM. European Society of Endocrinology clinical practice guidelines on the management of adrenal incidentalomas, in collaboration with the European Network for the Study of Adrenal Tumors. Eur J Endocrinol. 2023 Jul 20;189(1):G1-G42. doi: 10.1093/ejendo/lvad066. PMID: 37318239.



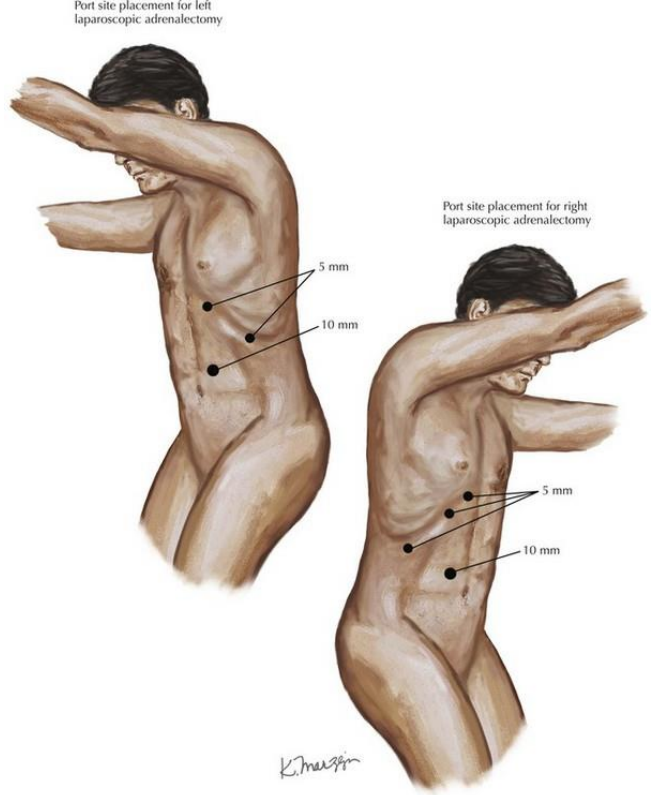
If any concern or question, we are happy to see!

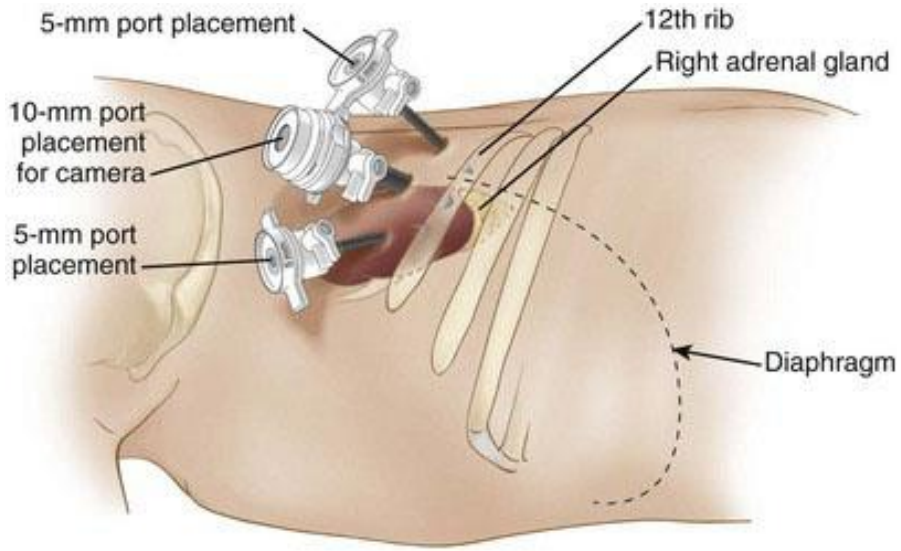
We can make surveillance plan on patient-specific basis

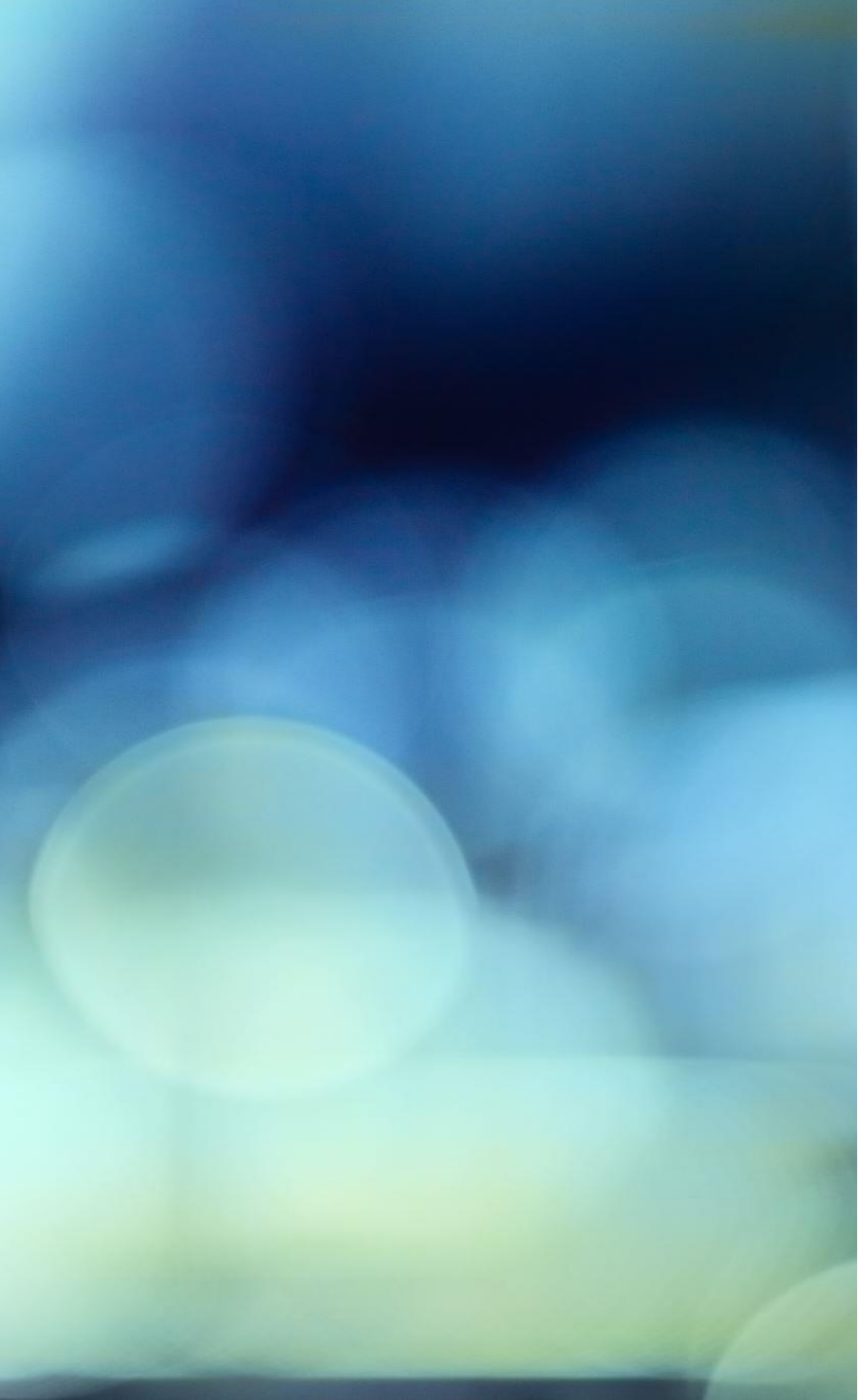
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Adrenalectomy

- Laparoscopic/Robotic
- Posterior retroperitoneoscopic
- Open
  - For possible adrenocortical carcinomas or large nodules (>4-6cm)







Post-Op After Adrenalectomy

Post-op day one

- **Am cortisol level**, if cortisol-producing tumor
- Surgeon and endocrinologist will guide any need for steroid replacement
  - Will wean regimen as outpatient

Usually discharge home post-op day one

Surgeon/endocrinologist will follow labs/imaging as needed

- Aldosteronoma: BP and K monitoring, Aldosterone-renin ratio repeat at 6 months
- Pheochromocytoma: Catecholamines, repeat annually

Adrenal- Long story short

- **All nodules should get biochemical workup**
  - *If functional*→ Refer to endocrinologist and surgeon; likely will benefit from surgery
  - *If nonfunctional*→ Imaging characteristics guide next steps
- **Noncontrast CT abdomen/pelvis**
  - If index CT was with contrast, ok to not get another scan prior to referral
- **If HU >10**→ Recommend referral to surgeon/endocrinologist
- **If >4cm**→ Recommend referral to surgeon/endocrinology
- If any question or uncertainty→ We are happy to discuss and see patient!

Summary

- We’re here to help
- There is nuance in most of endocrine pathology
- Some benefit from surgery, some won’t
  - We’re happy to help discuss this with each patient
- Ultrasound, labs, imaging helpful to have
  - But we’re happy to arrange it on our end as well

Contact me anytime!

Chris Barnes MD

Endocrine Surgery and General Surgery

The Doctors Clinic- Silverdale, WA

720-281-4408 (cell)

Christopher.barnes@commonspirit.org

TDC

THE DOCTORS CLINIC

A part of Franciscan Medical Group



Thank You

Mild Autonomous Cortisol Secretion (MACS)

- Excess cortisol secretion from adrenal nodule without classic overt Cushing's features
  - Most asymptomatic/mildly symptomatic
- Still can contribute to cardiovascular, musculoskeletal risk

- Adrenalectomy often results in improved glucose control, hypertensive medication burden, and fracture risk

  - *Subclinical does not mean insignificant*