

**In The Name Of God**

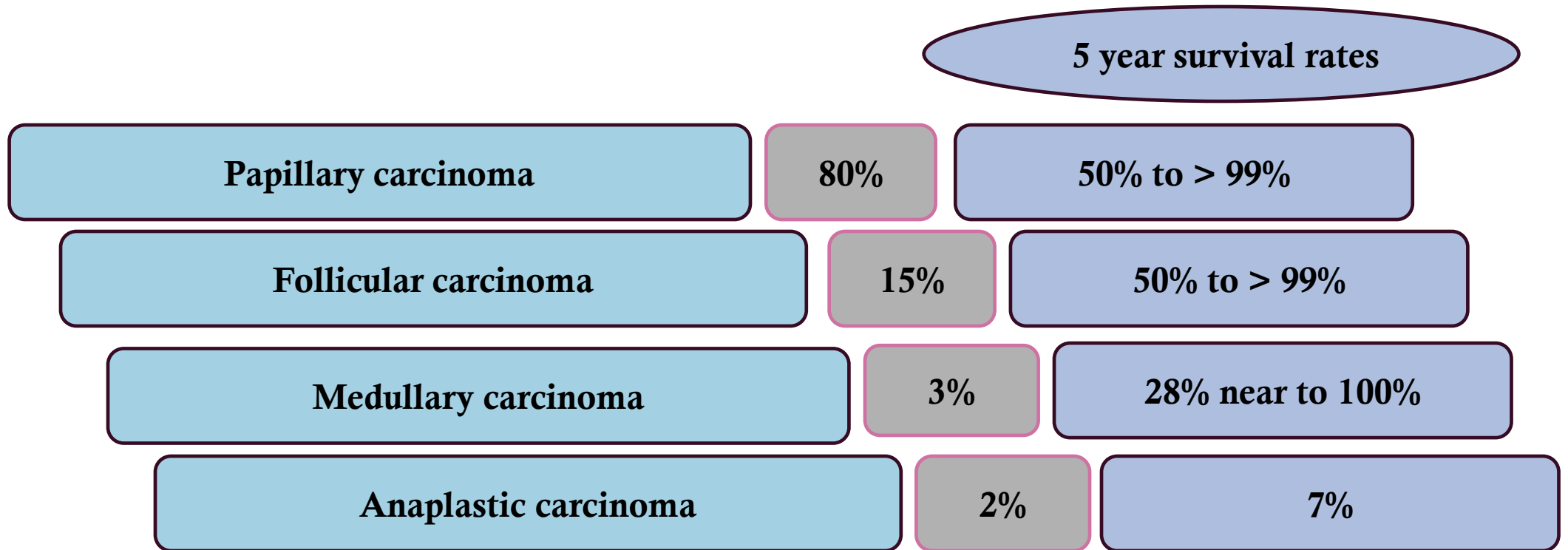
***Role of Sonography After  
Thyroidectomy for Thyroid Cancer***

**Elahe Salehi.MD**

**Arak University of Medical Sciences**

# Background:

- **Thyroid cancer is the most common endocrine cancer.**
- **Outcomes: Thyroid cancer is treatable; however, outcome is dependent on stage (I-IV)**



# *Treatment:*

**surgery**



**RAI ablation**



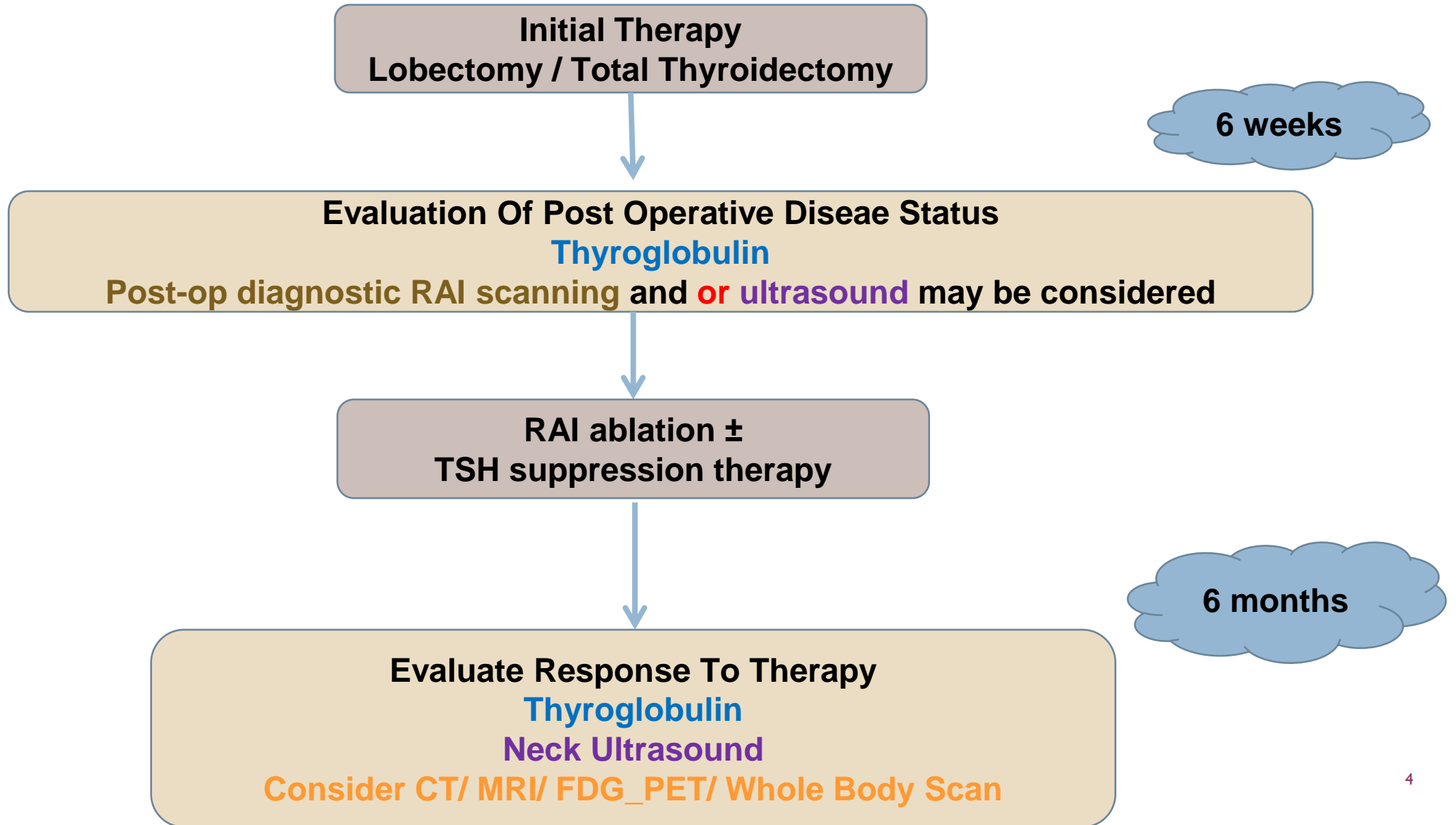
**TSH SUPPRESSION  
THERAPY**

size < 1 cm: active surveillance  
1 cm < size < 4 cm : lobectomy or near total thyroidectomy  
4 cm < size / metastases / extrathyroidal invasion: near total thyroidectomy

Not routinely recommended.

In higher risk patients :

larger tumors, more aggressive variants of papillary cancer, tumor vascular invasion, extrathyroidal invasion, presence of large-volume lymph node metastases.



# *Follow-up of differentiated thyroid cancer:*

The histotype  
The initial treatment  
The initial risk of recurrence  
The response to treatment

- Thyroglobulin
- Thyroglobulin antibody
- TSH
- Neck ultrasound
- Iodine 131 whole body scan
- CT/MRI/PET

# *Excellent response:*

Definition (2015 American Thyroid Association guidelines) <sup>21</sup>	Risk of recurrence (%)	Proposed definition for patients treated with total thyroidectomy without radioiodine remnant ablation <sup>a</sup> (REF. <sup>62</sup> )	Proposed definition for patients treated with thyroid lobectomy <sup>a</sup> (REF. <sup>62</sup> )
<ul style="list-style-type: none"><li>• No abnormal finding on imaging and basal thyroglobulin &lt;0.2 ng/ml or stimulated thyroglobulin &lt;1 ng/ml</li><li>• And no thyroglobulin antibodies</li></ul>	<1-4	<ul style="list-style-type: none"><li>• No abnormal finding on imaging</li><li>• And basal thyroglobulin &lt;0.2 ng/ml or stimulated thyroglobulin &lt;2 ng/ml</li><li>• And no thyroglobulin antibodies</li></ul>	<ul style="list-style-type: none"><li>• No abnormal finding on imaging</li><li>• And basal thyroglobulin &lt;30 ng/ml<sup>b</sup> stable over time</li><li>• And no thyroglobulin antibodies</li></ul>

- 
- ✓ These thresholds still need wider validation for clinical practice.
  - ✓ In patients treated with total thyroidectomy without radioiodine remnant ablation or lobectomy alone, **a single thyroglobulin value is not a reliable indicator**, and the thyroglobulin trend over time should be evaluated.
  - ✓ **Rapid (<12 months) thyroglobulin doubling times have been associated with recurrence and poor prognosis.**
  - ✓ Rising thyroglobulin antibody titres have been associated with an increased risk of recurrence.
  - ✓ If **antibodies are positive, Tg levels are falsely decreased.**

# Why Ultrasound?

- More cost effective
  - Quicker, non-invasive
  - No radiation
  - Localization of disease
  - **Independent of the degree of tumor differentiation** unlike FDG PET or 131I whole-body scanning.
  - **Higher sensitivity** than whole-body 131I scanning and serum Tg
- Interference from **Tg antibodies that cause a falsely low or undetectable serum Tg level** can mask the presence of disease.
- **Tg testing is less useful** in patients who have **not undergone RAI remnant ablation**

## Sensitivity

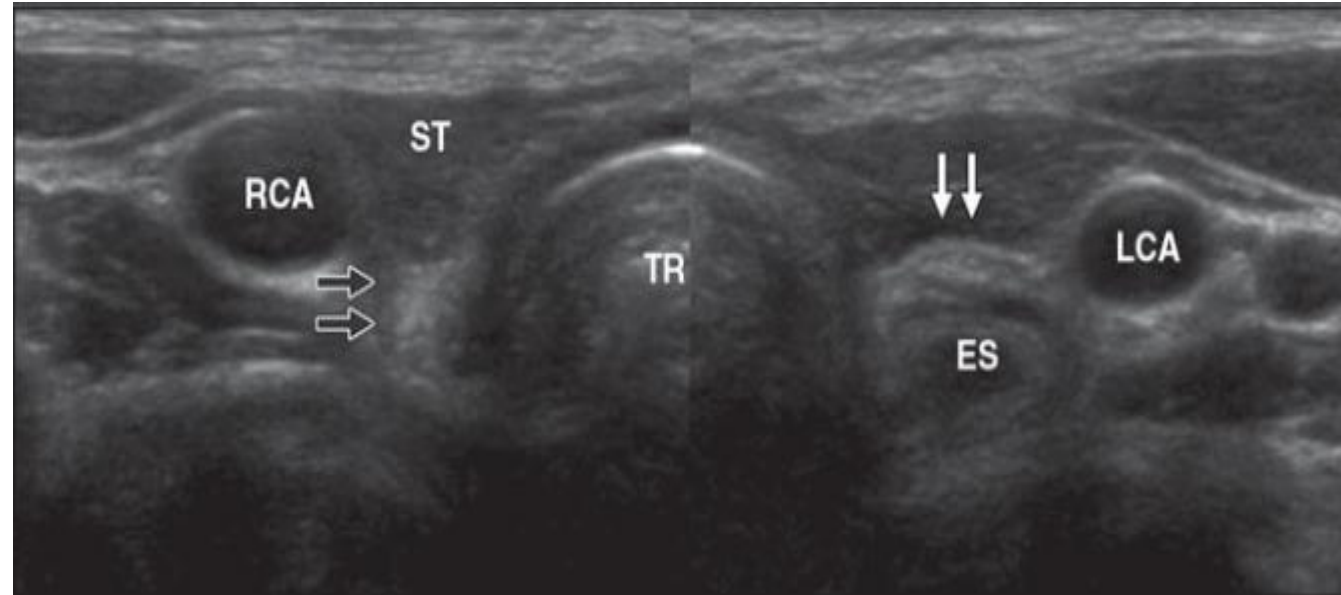
Serum Tg $\geq$ 2ng/ml	56.8%
131I WBS	45.1%
Ultrasound	94%



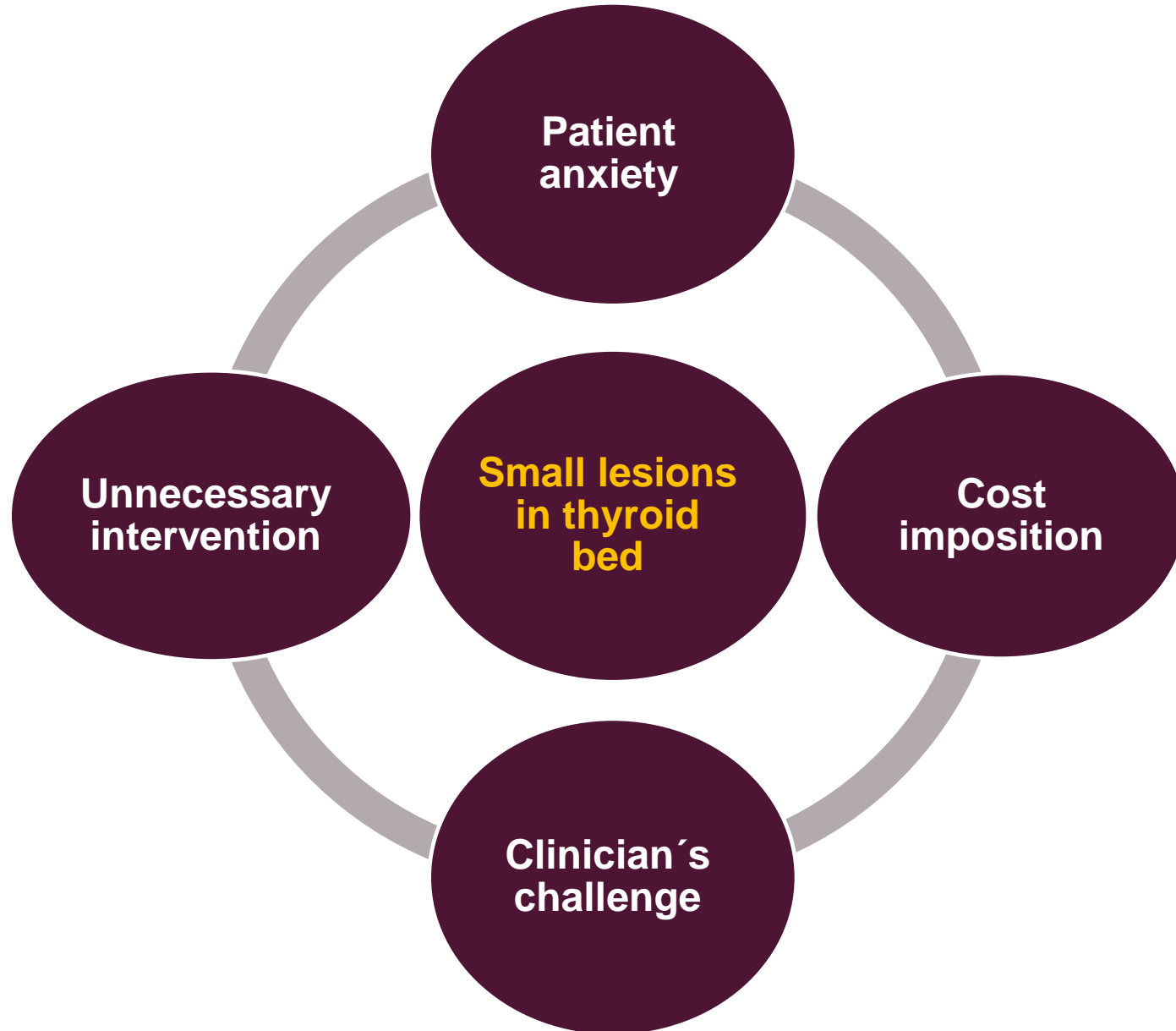
# *Recurrence Rates*

- ❖ For well differentiated thyroid cancer, there is a 9-30% recurrence rate within the **first decade after diagnosis**
- ❖ Most recurrences (up to 76% ) occur in the **thyroid bed and cervical lymph nodes**

## ***Normal thyroid bed after total thyroidectomy***



On transverse sonogram, inverted triangular hyperechoic fibrofatty tissue (*black arrows*) is well depicted between carotid artery and proximal trachea in right thyroid bed. In left thyroid bed, hyperechoic fibrofatty tissue (*white arrows*) is flattened by posteriorly located cervical esophagus.



ORIGINAL ARTICLE

### Predictive factors related to the recurrence at US-guided fine needle aspiration in postoperative patients with differentiated thyroid cancer

Soo Yeon Hahn\*, †, Jung Hee Shin\*, Boo-Kyung Han\*, Eun Young Ko\*, Seok Seon Kang\*, Jae Hoon Chung‡, Jung Han Kim§, Young Lyun Oh¶ and Young-Ik Son\*\*

Ultrasonographic findings of a newly detected nodule on the thyroid bed in postoperative patients for thyroid carcinoma: correlation with the results of ultrasonography-guided fine-needle aspiration biopsy

Jeong Hyun Lee<sup>a,\*</sup>, Ho Kyu Lee<sup>b</sup>, Deok Hee Lee<sup>a</sup>, Choong Gon Choi<sup>a</sup>, Gyungyub Gong<sup>c</sup>, Young Kee Shong<sup>d</sup>, Sang Joon Kim<sup>a</sup>



### Recurrence in the Thyroidectomy Bed: Sonographic Findings

Aya Kamaya<sup>1</sup>  
Megan Gross<sup>1</sup>  
Haruko Akatsu<sup>2</sup>  
R. Brooke Jeffrey<sup>1</sup>

**OBJECTIVE.** The purpose of this article is to characterize sonographic features of differentiated thyroid cancer recurrence in the thyroidectomy bed.  
**MATERIALS AND METHODS.** Patients referred for biopsy of thyroidectomy bed lesions between February 2006 and December 2009 were identified. Patient data and gray-scale and color Doppler features were recorded.

### Sonographic Findings in the Surgical Bed After Thyroidectomy

Comparison of Recurrent Tumors and Nonrecurrent Lesions

Jung Hee Shin, MD, Boo-Kyung Han, MD, Eun Young Ko, MD, Seok Seon Kang, MD

**Objective.** The purpose of this study was to assess the sonographic findings of recurrent lesions mimicking recurrent tumors in the surgical bed after thyroidectomy. **Methods.** Fifty-eight patients who underwent sonography and sonographic needle aspiration for evaluation of abnormal lesions in the surgical bed after thyroidectomy were included in this retrospective study. We compared the sonographic findings of recurrent

ORIGINAL ARTICLE

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### Malignant thyroid bed mass after total thyroidectomy

Do Sung Park, Jin Seong Cho, Min Ho Park, Young Jae Ryu, Min Jung Hwang, Sun Hyung Shin, Hee Kyung Kim<sup>1</sup>, Hyo Soon Lim<sup>2</sup>, Ji Shin Lee<sup>3</sup>, Jung Han Yoon

Departments of Surgery, <sup>1</sup>Internal Medicine, <sup>2</sup>Radiology, and <sup>3</sup>Pathology, Chonnam National University Medical School, Gwangju, Korea

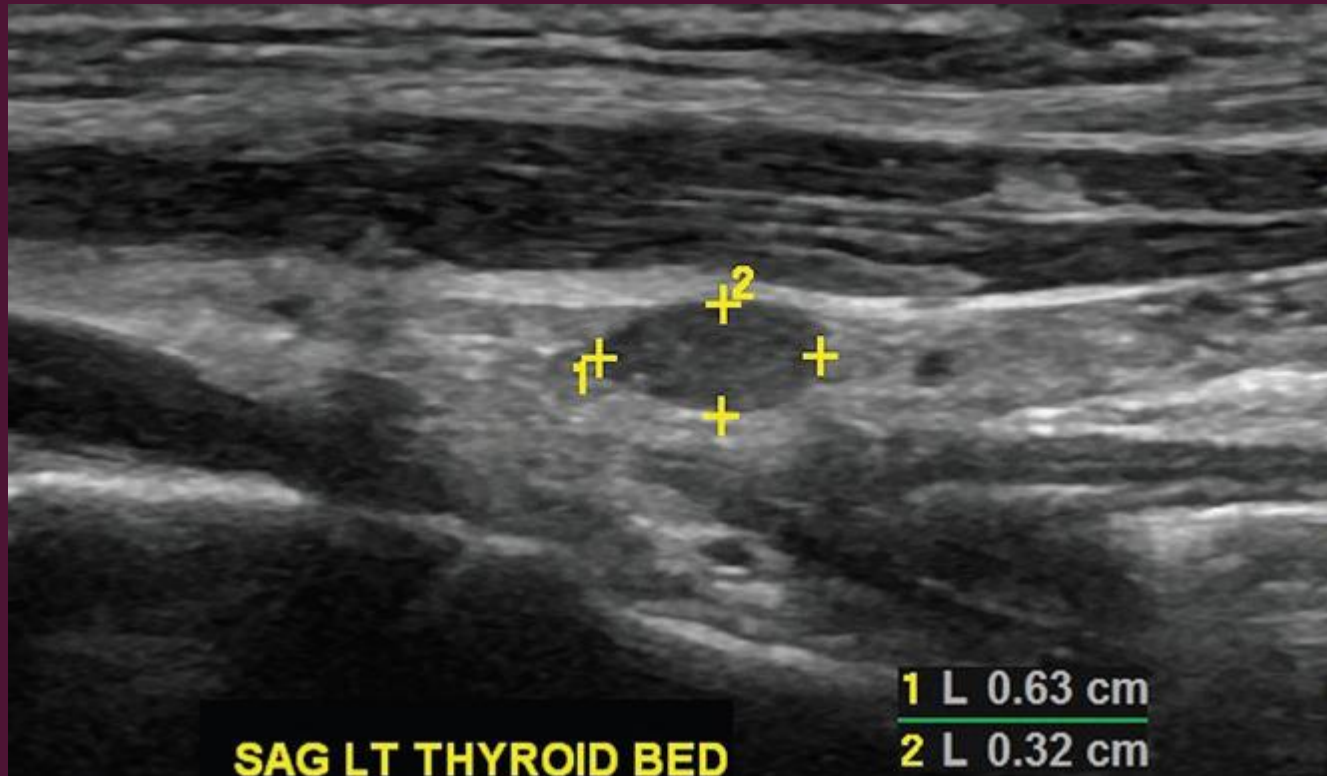
- Shape
- Echogenicity
- Cystic component
- Size
- Abnormal vascularity
- Marginal irregularity
- Microcalcification

## Role of Sonographic Characteristics of Thyroid Bed Lesions

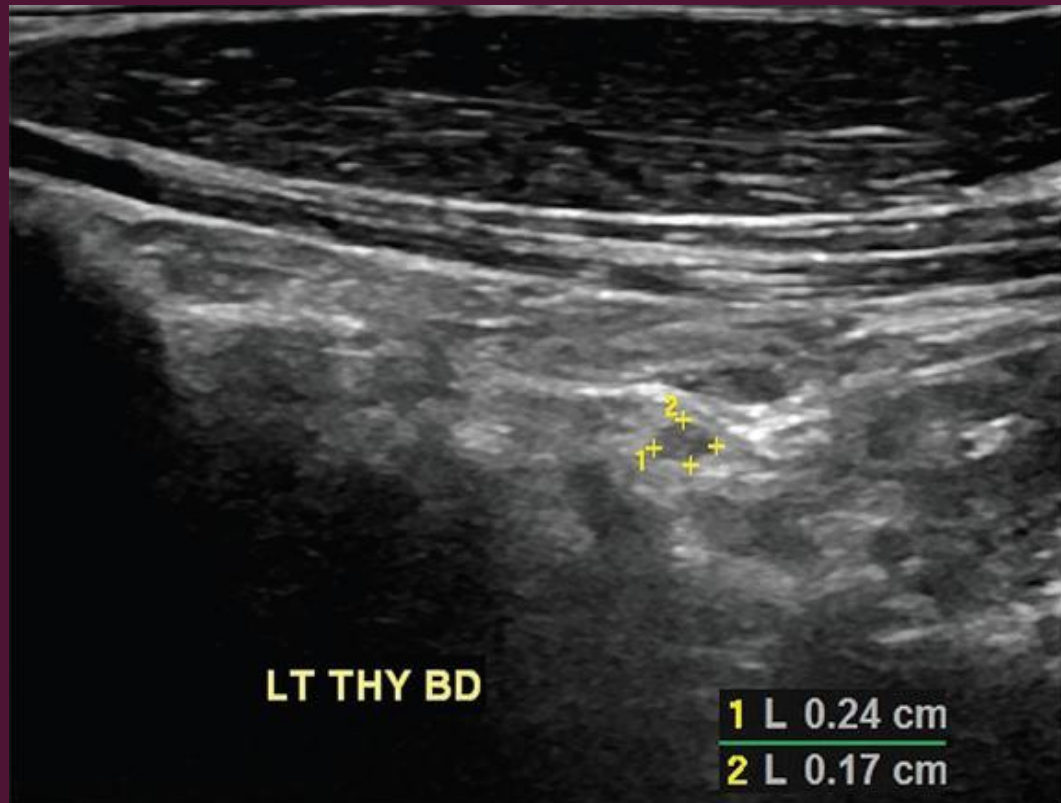
### Identified Following Thyroidectomy in the Diagnosis or Exclusion of Recurrent Cancer

- **Forty percent** of US examinations (**2313 of 5732**) showed thyroid bed lesions after thyroidectomy.
- Lesions in the thyroid bed that contained **punctate echogenicities** had a high association with cancer recurrence (28 of 61 malignant lesions [45.9%; 95% CI: 33, 58]; three of 33 benign lesions [9%; 95% CI: 0, 18.9]; 12 of 50 nondiagnostic lesions [24%; 95% CI: 12, 36];  $P < .001$ ).
- **Only 0.2%** of lesions (two of 1303) in the thyroid bed smaller than **6 mm** in maximum diameter were found to be malignant.

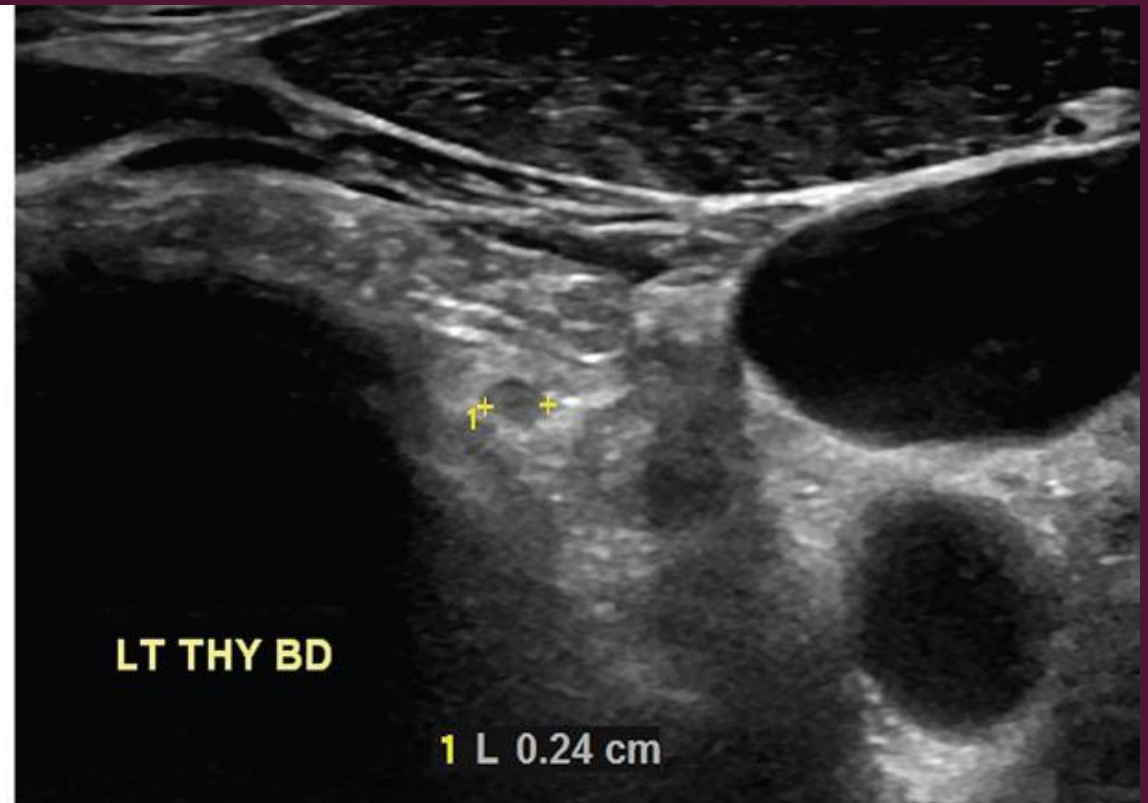
- ✓ we suggest that thyroid bed lesions measuring 5 mm or greater should be reported and that lesions smaller than 5mm do not need to be individually reported.
- ✓ Sampling should be considered for lesions **6 mm or larger** with worrisome characteristics.



Sagittal US scan of the left bed (SAG LT) in a 38-year-old woman with history of classic papillary thyroid cancer. Scan shows a solid hypoechoic mass measuring **6.3-mm \* 3.2-mm** with **no internal echogenicities**. Results of fine needle aspiration were positive for malignancy.

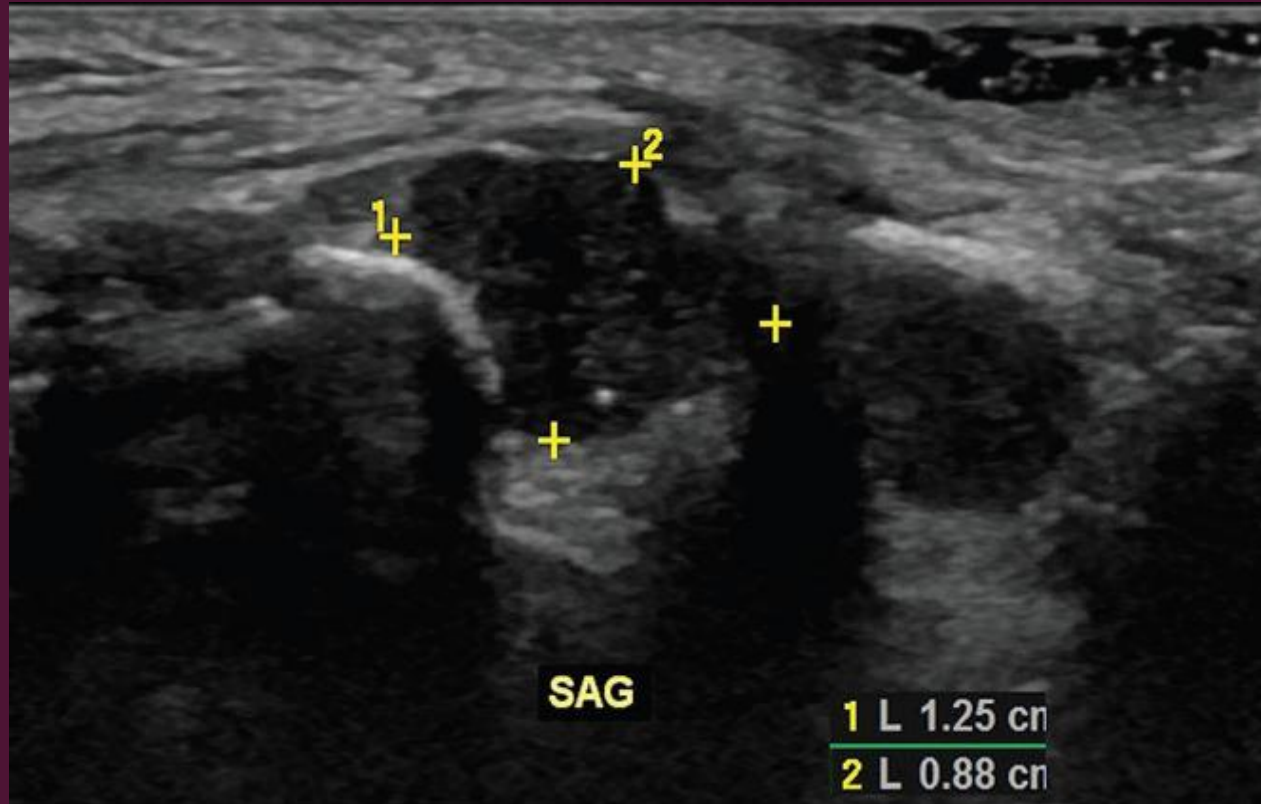


a.



b.

US scans of the left thyroid bed (LT THY BD) in a 57-year-old man with history of tall cell variant of papillary thyroid cancer. **(a)** Sagittal scan shows a **2.4-mm \* 1.7-mm** solid mass. **(b)** Transverse scan of the same mass measuring 2.4 mm. This lesion was too small to sample with fine needle aspiration biopsy but was stable for 5 years and presumed benign.



Sagittal (SAG) US scan in a 59-year-old man with history of classic papillary cancer. Scan shows a solid hypoechoic mass measuring 12.5-mm \* 8.8-mm with a single punctate echogenicity. Results of fine-needle aspiration were positive for malignancy.



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# *Benign Conditions Mimicking Local Tumor Recurrence*

Suture granulomata

Parathyroid adenoma

Thyroid remnant

Cartilage

Cervical spine

Cervical thymus

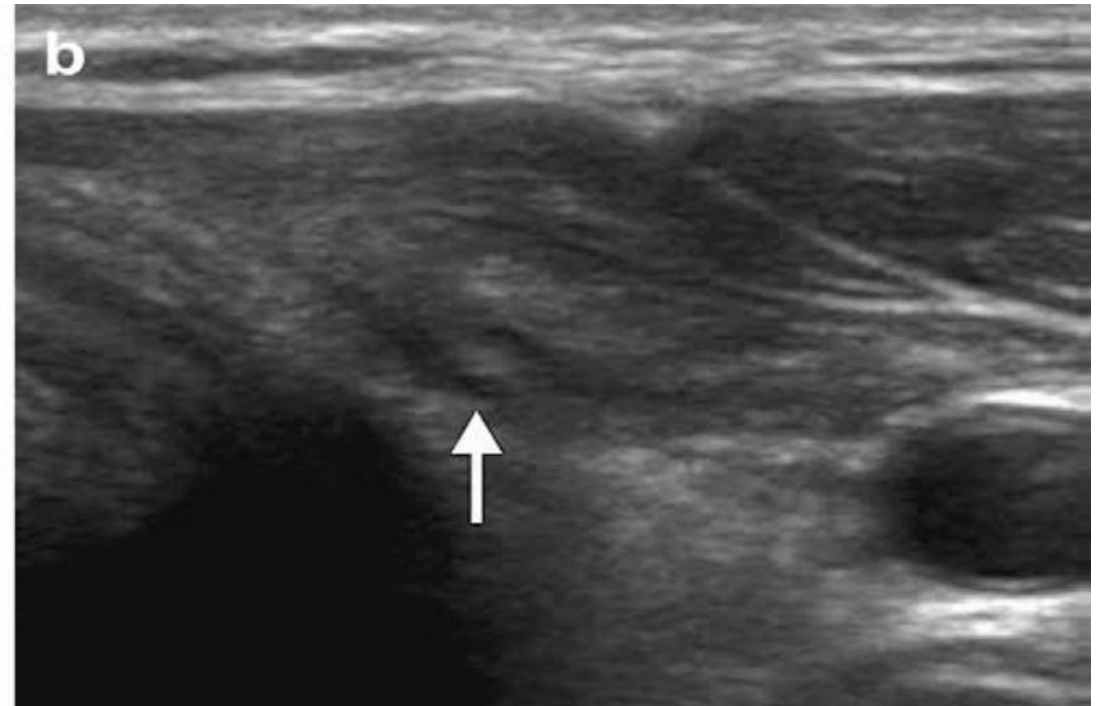
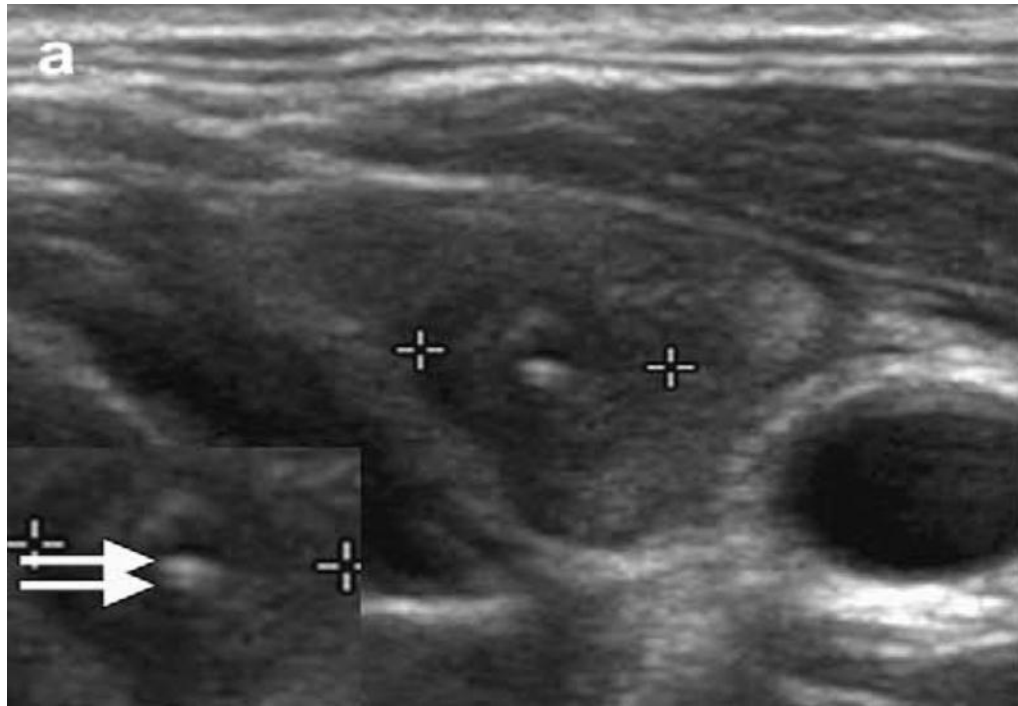
Sympathetic ganglion

Esophageal diverticulum

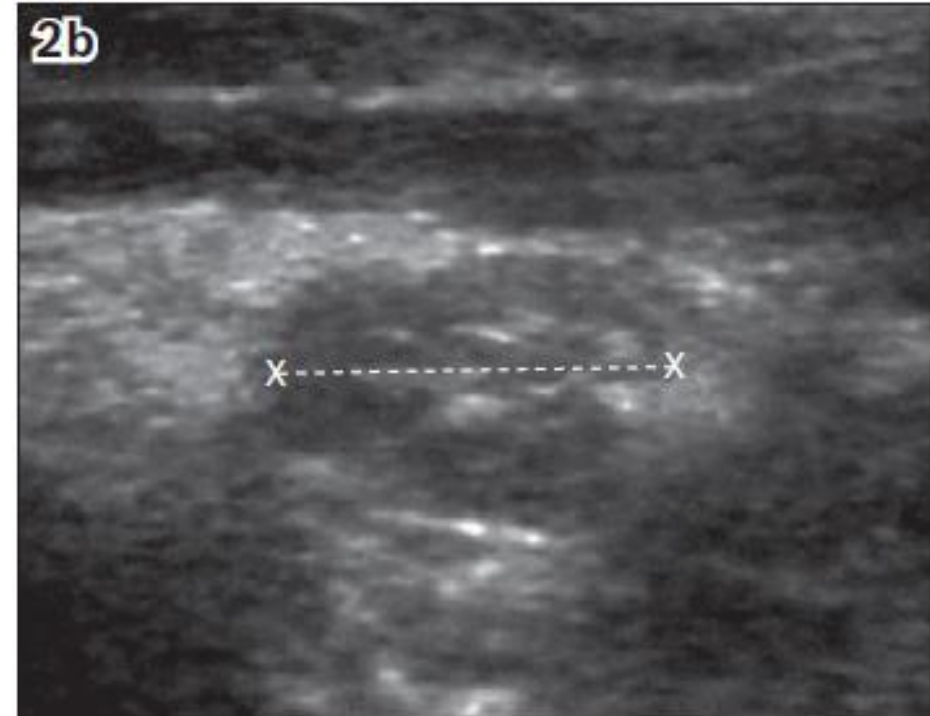
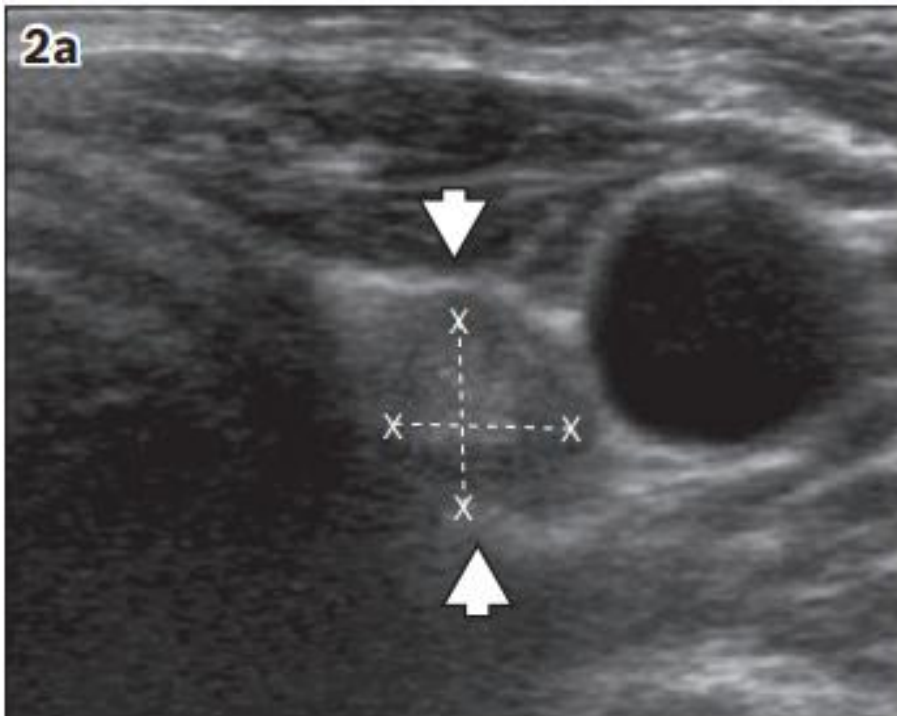
Thoracic duct

## SUTURE GRANULOMA

- Echogenic foci – mimic microca++
- Paired appearance
- Clustered centrally or paracentrally
- >1 mm in diameter, no color flow



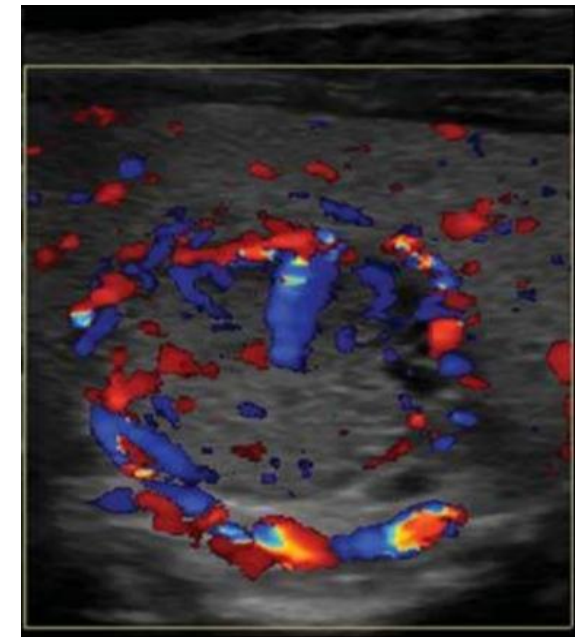
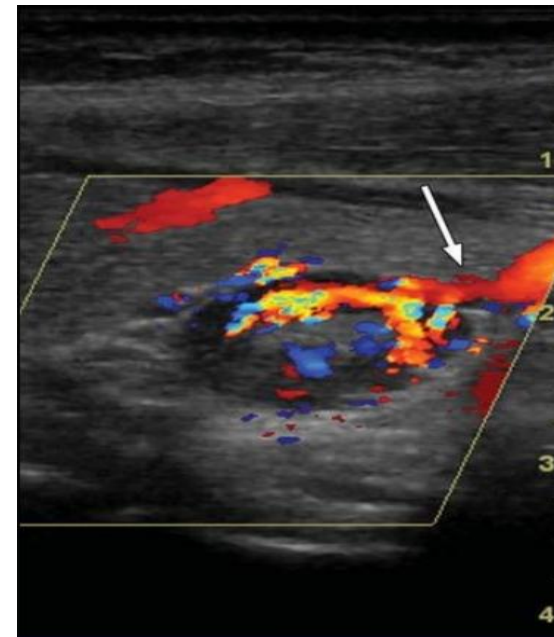
## SUTURE GRANULOMA



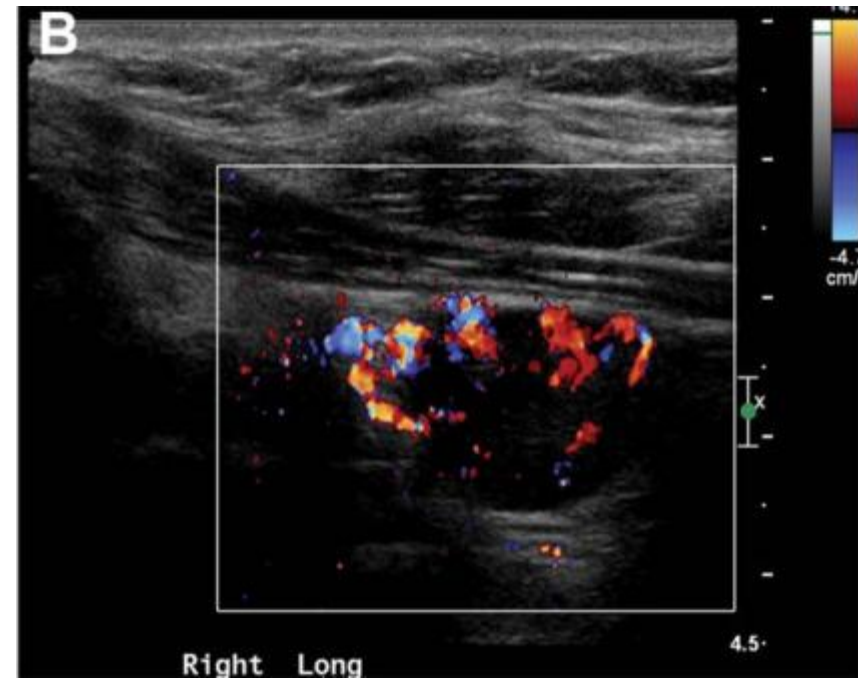
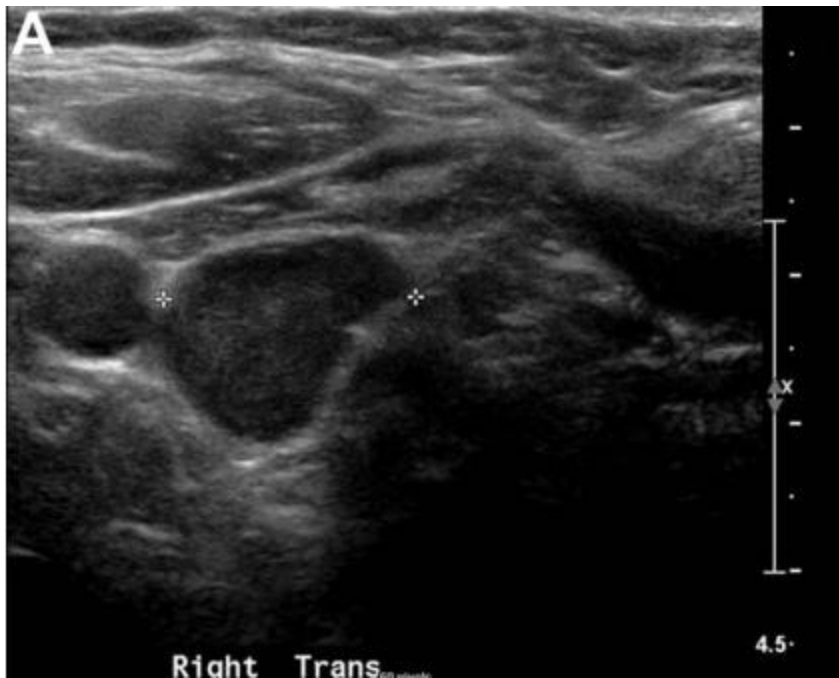
Benign thyroid bed nodule. US images show (a) a benign thyroid bed nodule (arrowheads) the nodule was assumed to be benign, as the patient's thyroglobulin level had been 0.2 UG/L for at least 6 years; and (b) a nodule that contains **linear internal echoes that are parallel** to the surrounding tissue plane on longitudinal section. 19

# PARATHYROID ADENOMA

- **“Polar” feeding artery and peripheral “rim” or “arc” vascularity**, in contrast to the central branching flow seen with lymph nodes.
  - **Calcifications** and **cystic changes** are relatively **uncommon in parathyroid adenomas**.
  - **Clinical findings** of hyperparathyroidism
- Importantly, in cases in which parathyroid adenoma is a differential consideration, the fine-needle aspirate should be sent for **both parathyroid hormone** and **tg testing**.



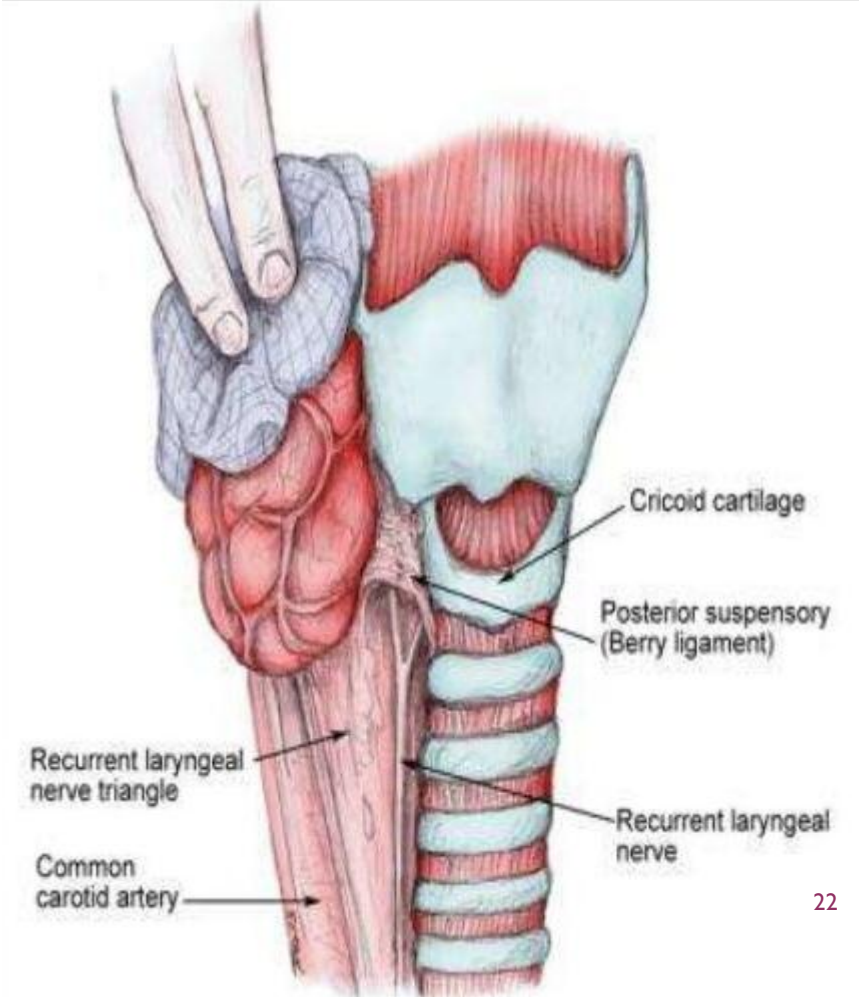
# PARATHYROID ADENOMA



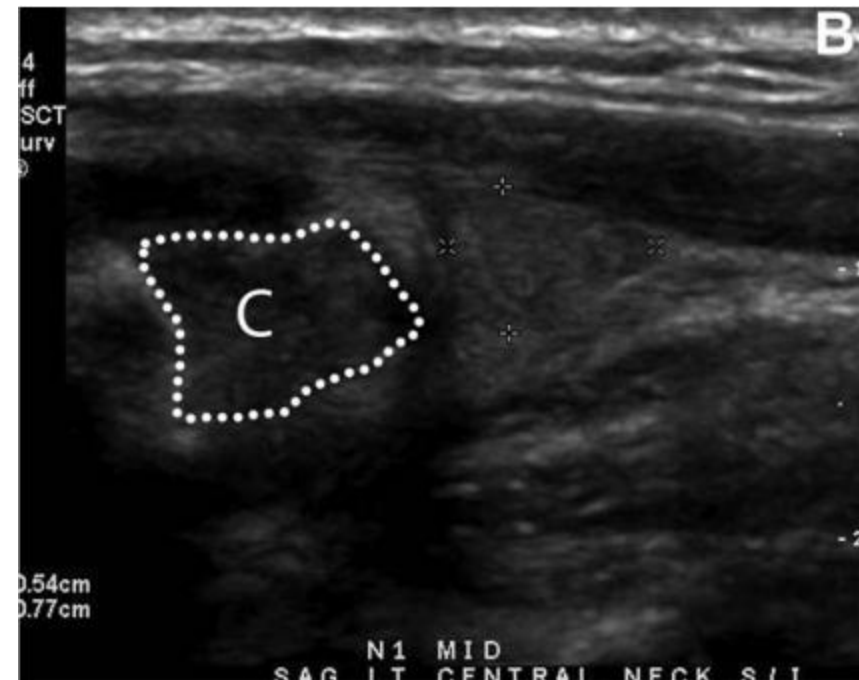
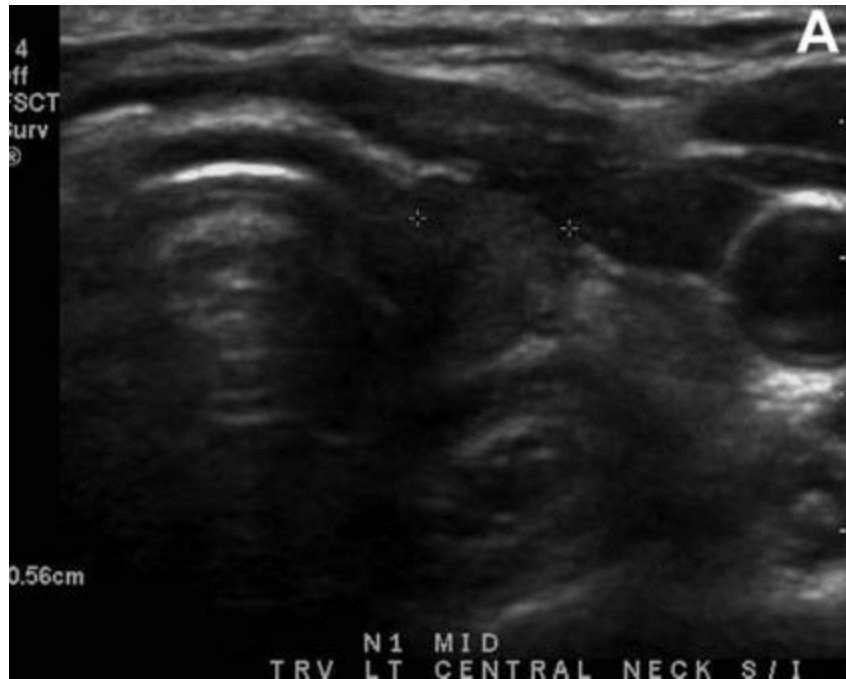
Parathyroid adenoma mistaken as thyroid bed recurrence in a patient who underwent thyroidectomy for papillary thyroid carcinoma 18 years previously. A and B, Transverse grayscale (A) and sagittal color Doppler (B) images show a hypoechoic hypervascular mass (calipers), which was thought to potentially reflect a nodal metastasis. Ultrasound guided FNA was interpreted as “follicular neoplasm present.” Subsequent excision revealed a “hypercellular parathyroid, consistent with a parathyroid adenoma, no carcinoma seen.”

# RESIDUAL THYROID OR REGROWTH OF A THYROID REMNANT

- Thyroid remnants were isoechoic or hypoechoic and were mostly oval or triangular.
- It is very **uncommon** to visualize a thyroid remnant in patients **treated with radioiodine ablation.**

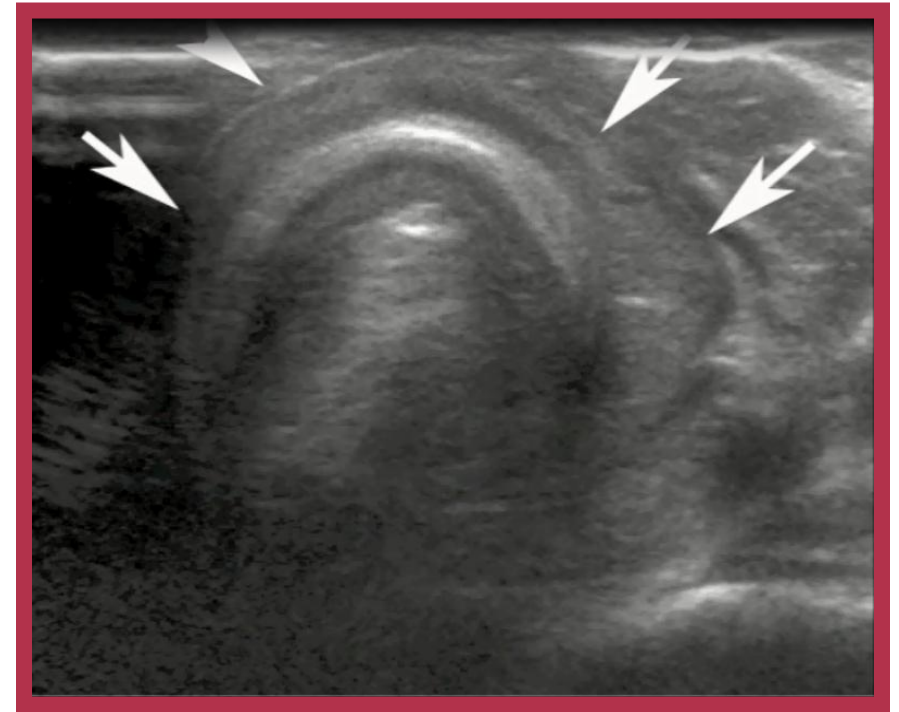
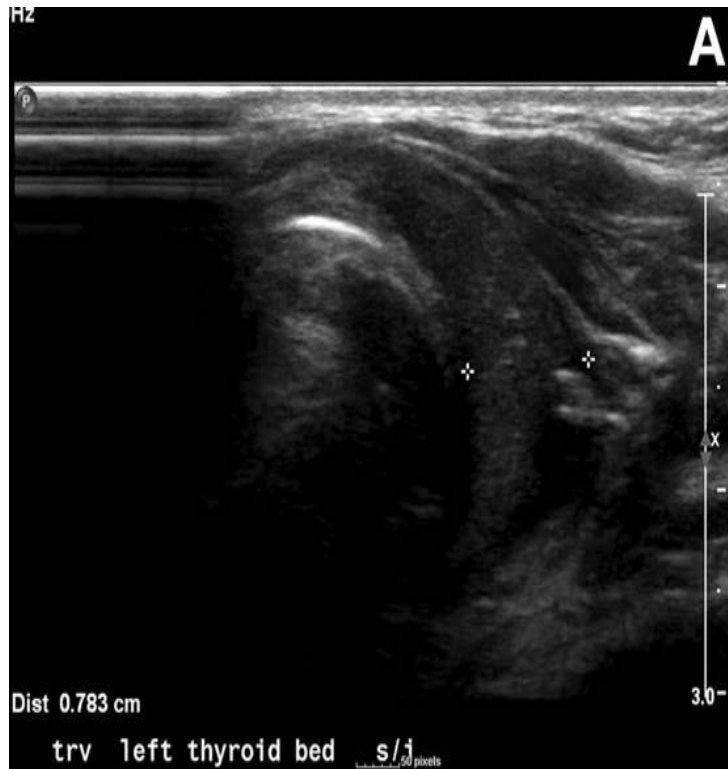


# THYROID REMNANT



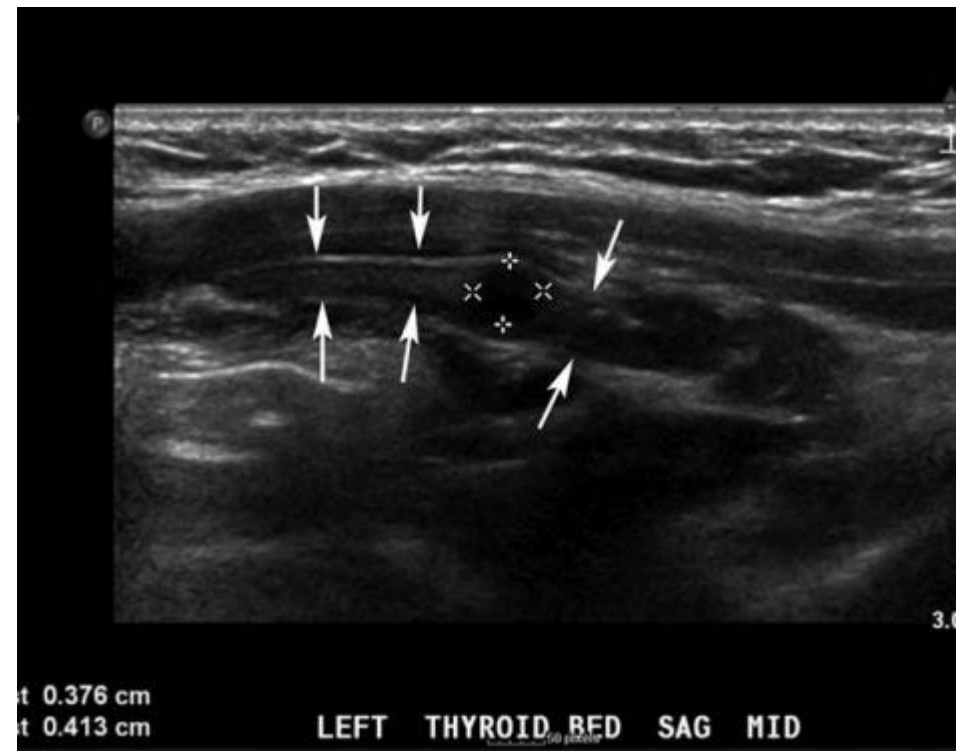
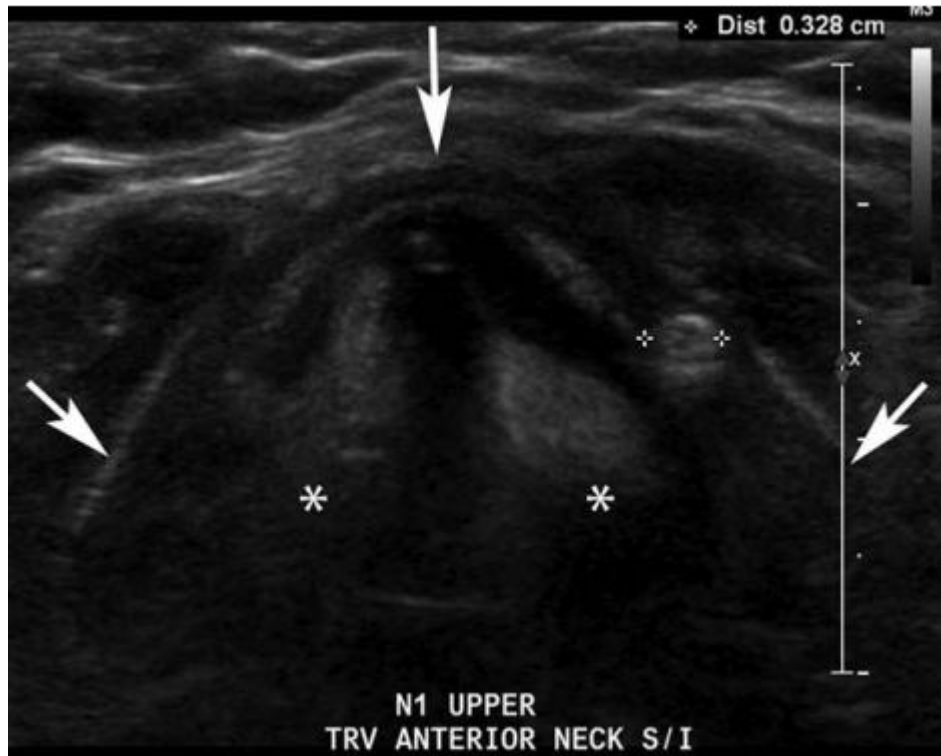
Thyroid remnant in a patient 4 years after subtotal thyroidectomy for a goiter, with pathologic review noting an incidental papillary microcarcinoma. The patient had no history of radioiodine therapy. Transverse (A) and sagittal (B)

# THYROID AND CRICOID CARTILAGE

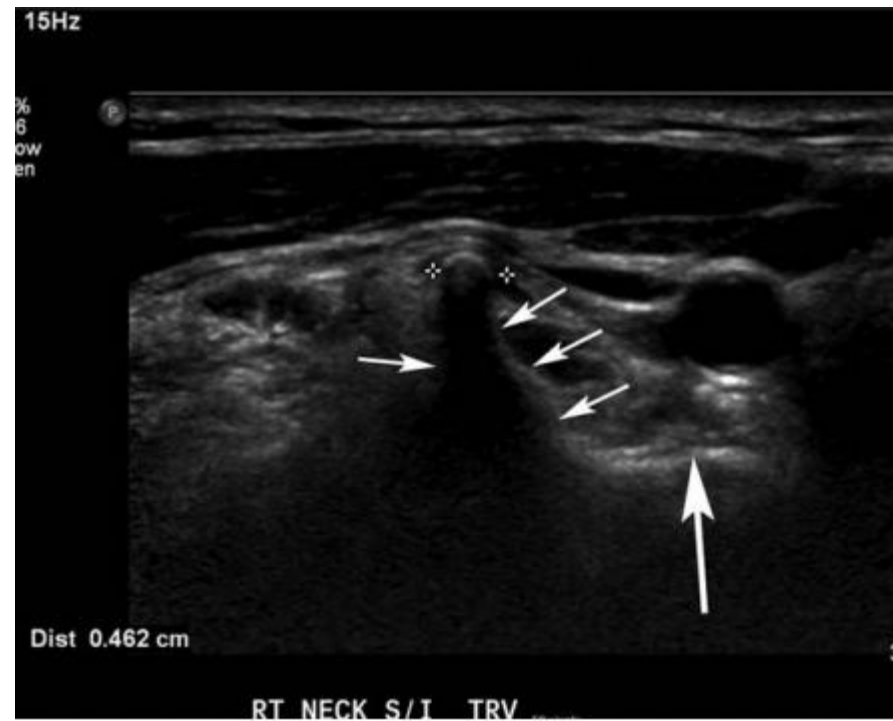




# THYROID AND CRICOID CARTILAGE

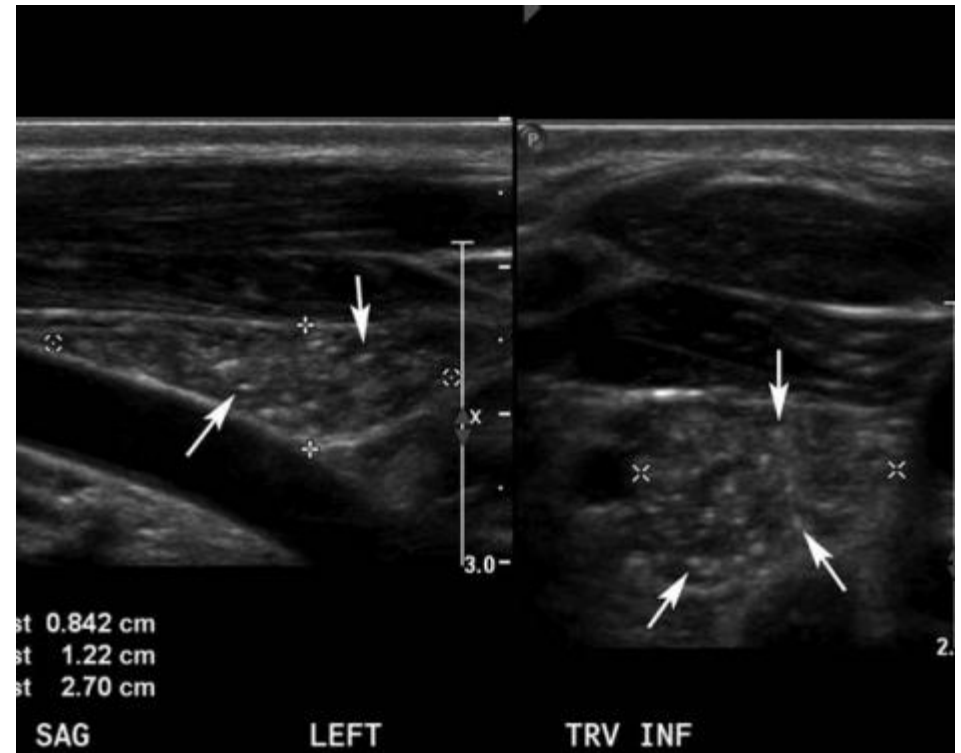


# TRANSVERSE PROCESS OF THE CERVICAL SPINE



# NORMAL CERVICAL THYMUS

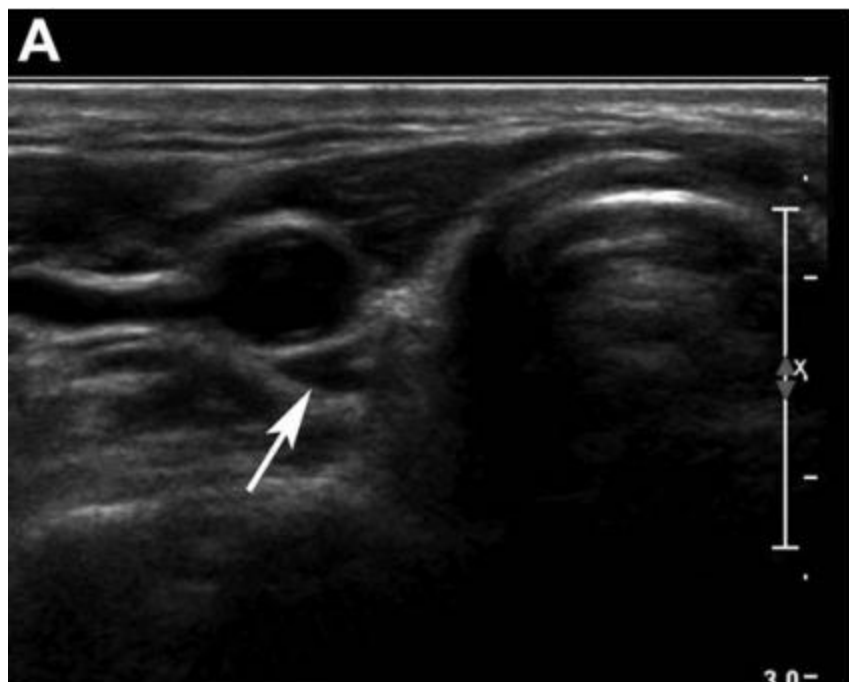
- Characteristic location in the **inferior neck**,
- The **triangular** appearance
- The characteristic **starry sky** echotexture



## ***NORMAL CERVICAL SYMPATHETIC GANGLION***

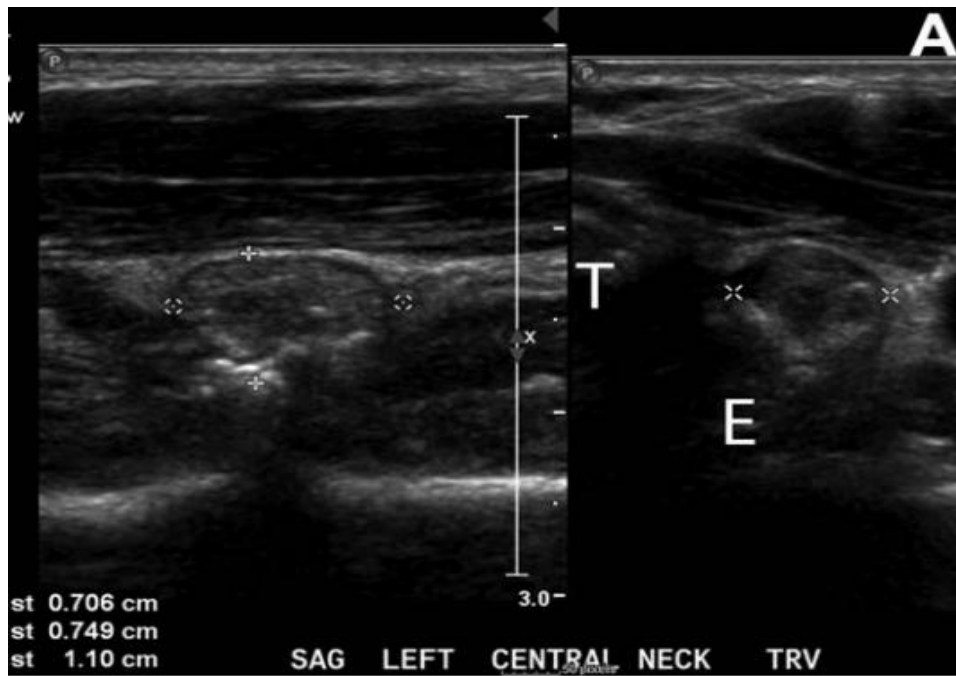
- **Middle** sympathetic ganglion is seen as an **ovoid hypoechoic** structure usually located **lateral to the CCA** but can be seen medially as well.
- On longitudinal imaging, the **fusiform configuration** can sometimes be appreciated and is characteristic when it shows contiguity with other linear hypoechoic structures that represent sympathetic nerves.
- The **inferior thyroidal artery** usually lies posterior or close to the middle cervical sympathetic ganglion and acts as an anatomic marker.
- The cervical sympathetic ganglion should not be biopsied or ablated, as these procedures may result in **Horner syndrome**.

## MIDDLE CERVICAL SYMPATHETIC GANGLION



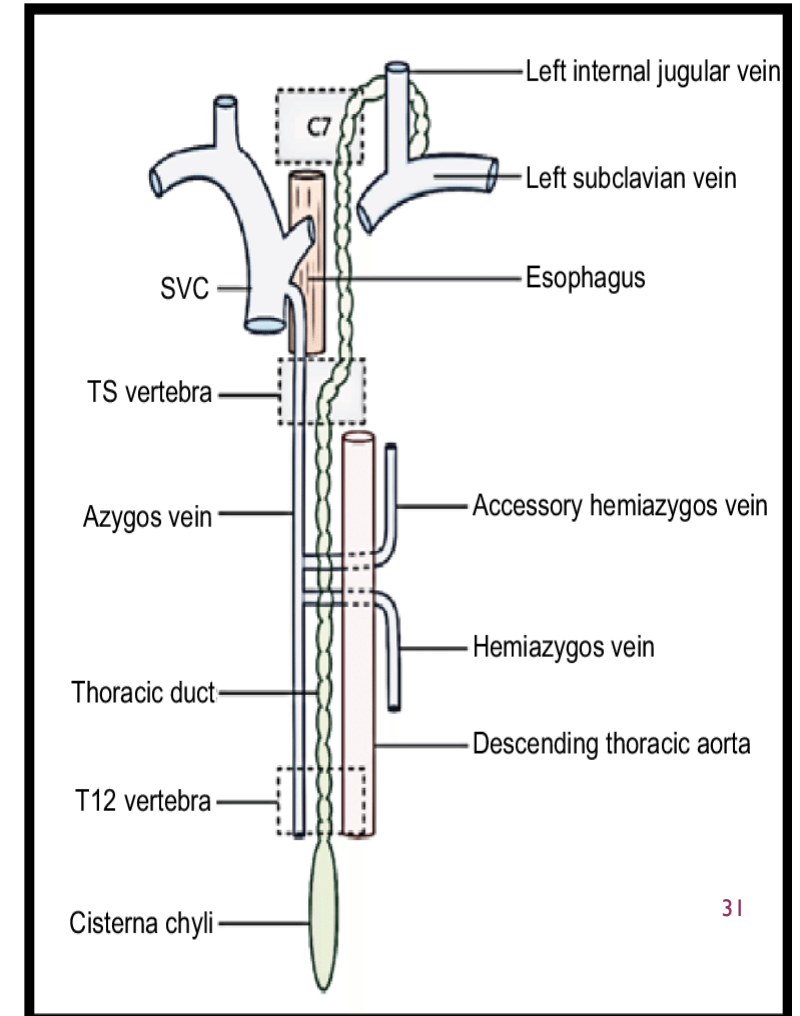
Middle cervical sympathetic ganglion mimicking a thyroid bed lesion. A, Transverse grayscale image depicts a hypoechoic structure in the right thyroidectomy bed (arrow), initially thought to represent a lymph node. B, Subsequent sagittal grayscale image reveals a spindleshaped lesion (large arrow) contiguous with a nerve (small arrow), located adjacent to the inferior thyroidal artery (arrowhead).

# PHARYNGOESOPHAGEAL DIVERTICULUM

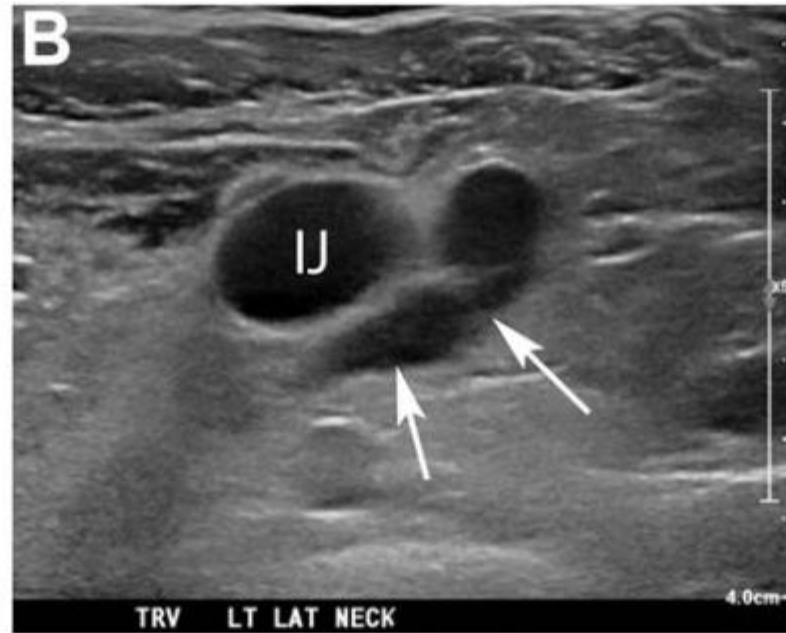
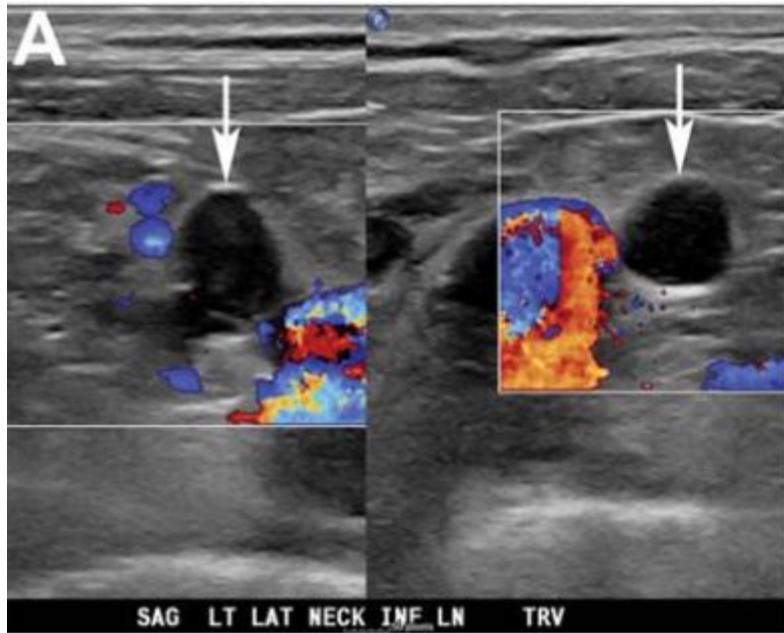


# TERMINAL ASPECT OF THE THORACIC DUCT

- The thoracic duct diameter in healthy volunteers was reported to be 2.5 mm but was found to increase to 13 mm in patients with liver cirrhosis or congestive cardiac failure.
- Dilation of the terminal thoracic duct can be mistaken for lateral compartment cystic lymphadenopathy
- Cystic structure extending toward and communicating with the internal jugular vein near the venous angle (junction of internal jugular vein and subclavian vein).
- Compressibility and internal particulate motion



# TERMINAL ASPECT OF THE THORACIC DUCT MIMICKING A CYSTIC LYMPH NODE

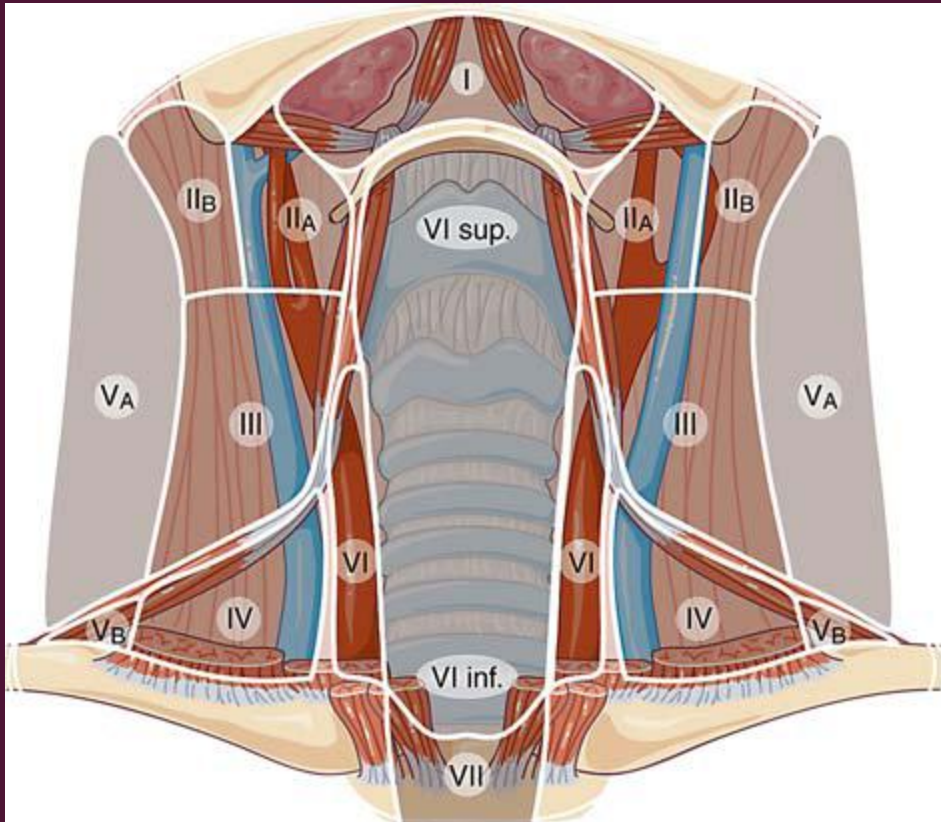






# *Metastatic Lymphadenopathy*

- 60-75% occur in Z3 or Z4
- 20% occur in Z6
- Tend to affect the ipsilateral neck



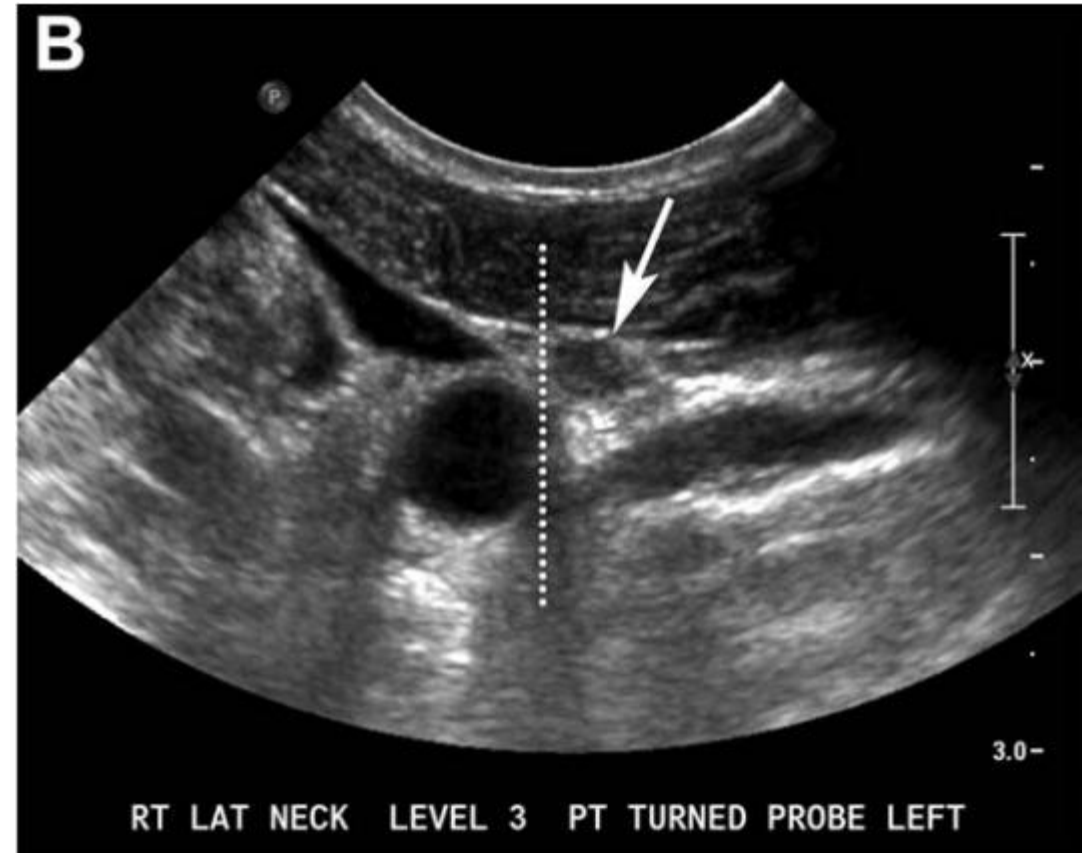
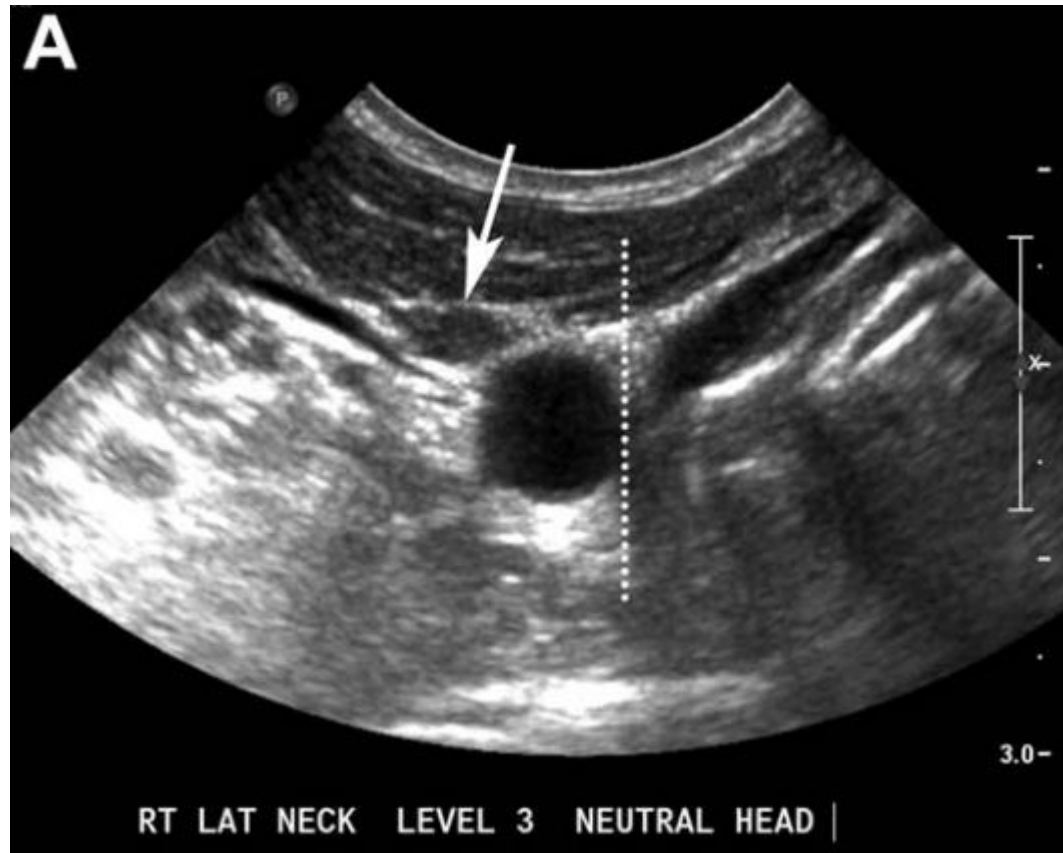
### **Midline central neck (Levels I & VI)**

Lateral border: medial border of CCAs  
 Superior border: submental  
 Inferior border: sternum

### **Lateral neck (Levels II-IV)**

Superior border: submandibular gland  
 Inferior border: clavicle  
 Medial border: medial aspect of carotid /  
 jugular complex  
 Lateral border: lateral edge of SCM

*Effect of head position on apparent location of a lymph node*



**Box 1 | Neck lymph node classification<sup>86</sup>****Normal**

- Hilum preserved, ovoid shape and normal size, absent or hilar vascularization. No suspicious signs (for example, microcalcifications or cystic appearance)

**Indeterminate**

Absence of a hilum and at least one of the following characteristics:

- Round shape (positive predictive value 63%)
- Increased short axis,  $\geq 8$  mm in size in level II and  $\geq 5$  mm in size in levels III and IV
- Increased central vascularization

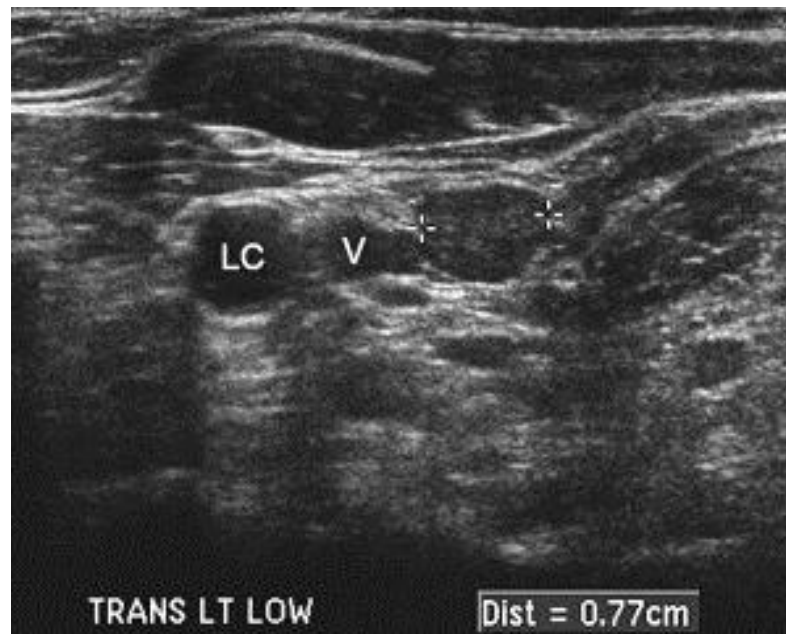
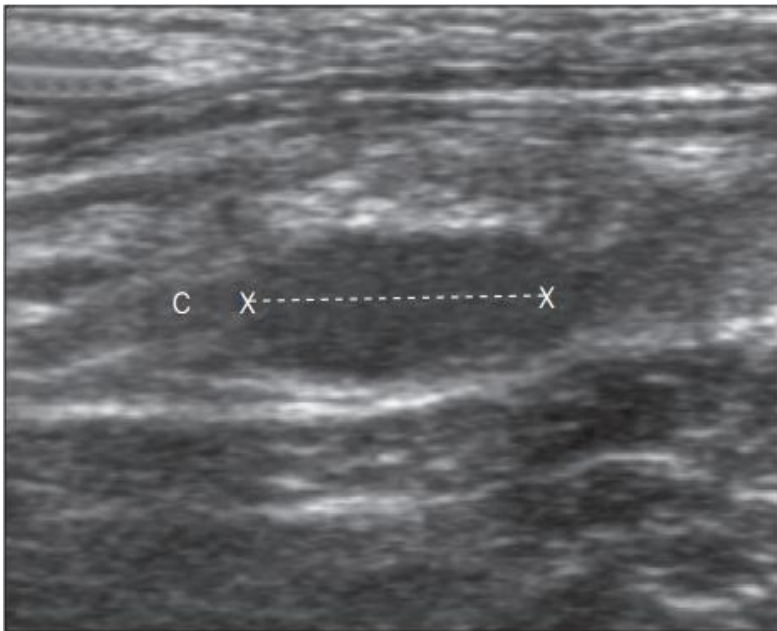
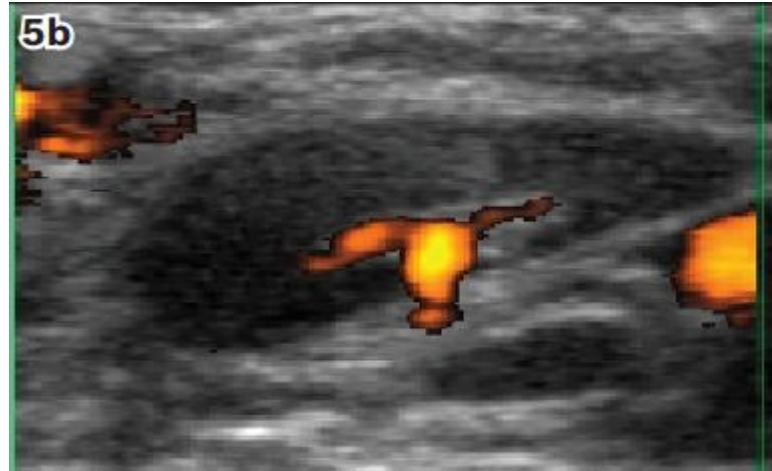
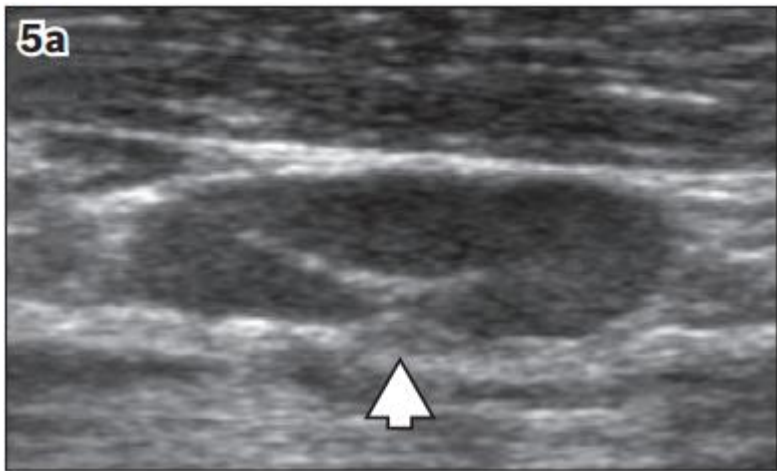
**Suspicious**

At least one of these features:

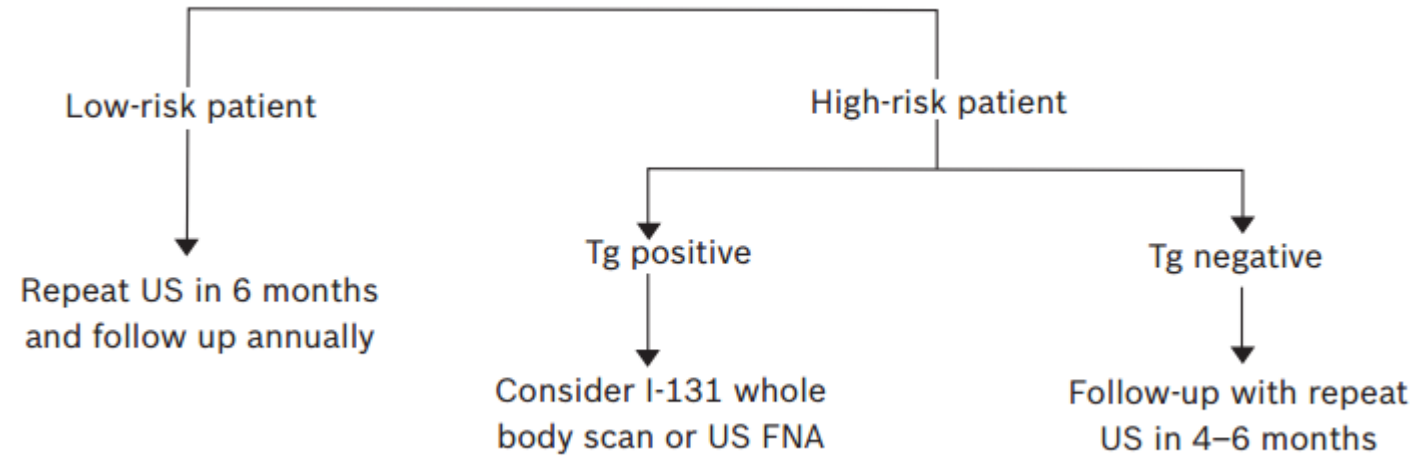
- Microcalcifications (positive predictive value 88–100%)
- Partially cystic appearance (positive predictive value 77–100%)
- Peripheral or diffusely increased vascularization (positive predictive value 77–80%)
- Parenchymal hyperechoic-looking thyroid tissue (positive predictive value 66–96%)

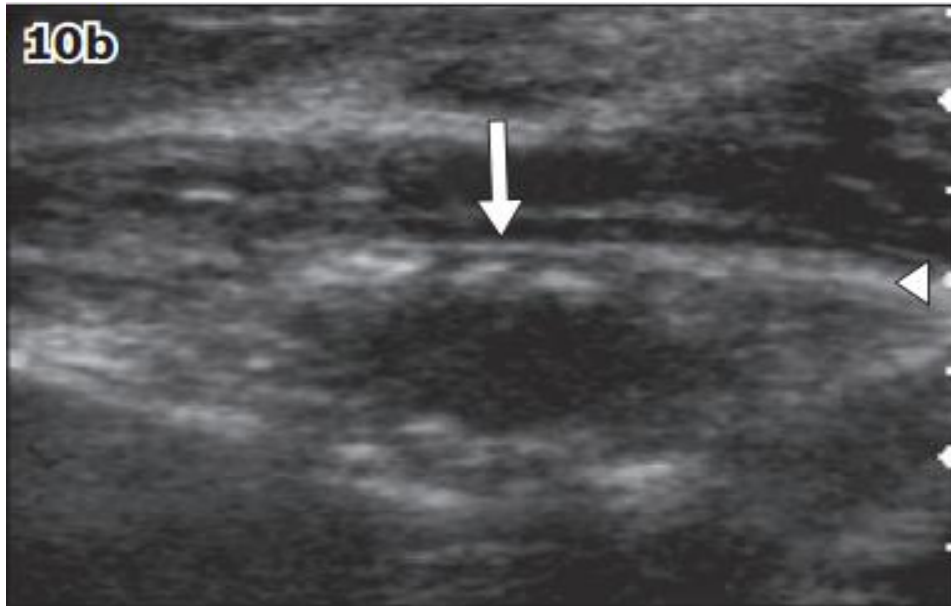
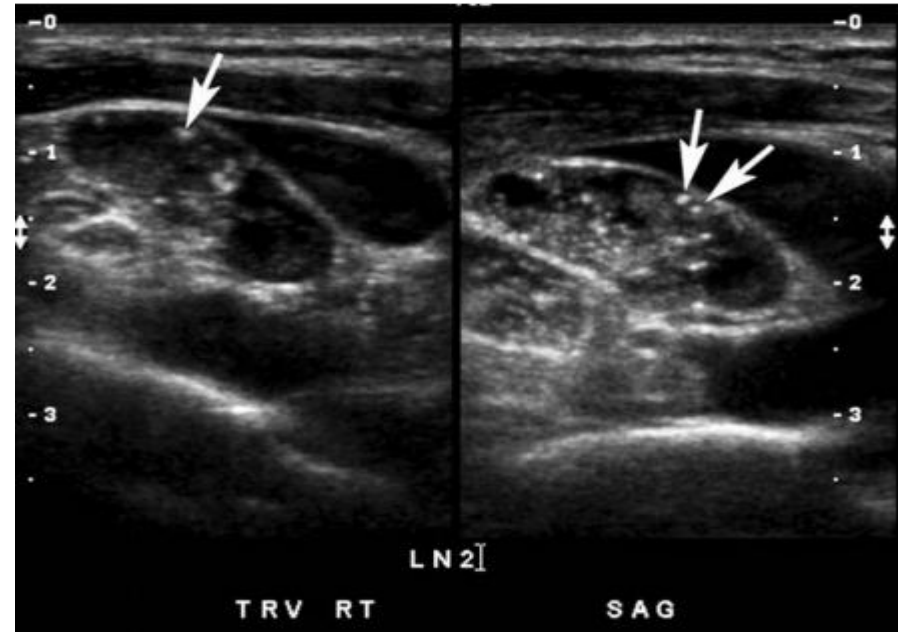
**up to 18%** of histologically **benign** lymph nodes display **suspicious features on an ultrasonograph**

Sign	Positive predictive value (%)
Microcalcifications	88–100
Cystic component	77–100
Peripheral vascularization	77–80
Hyperechogenicity (thyroid tissue-like)	66–96

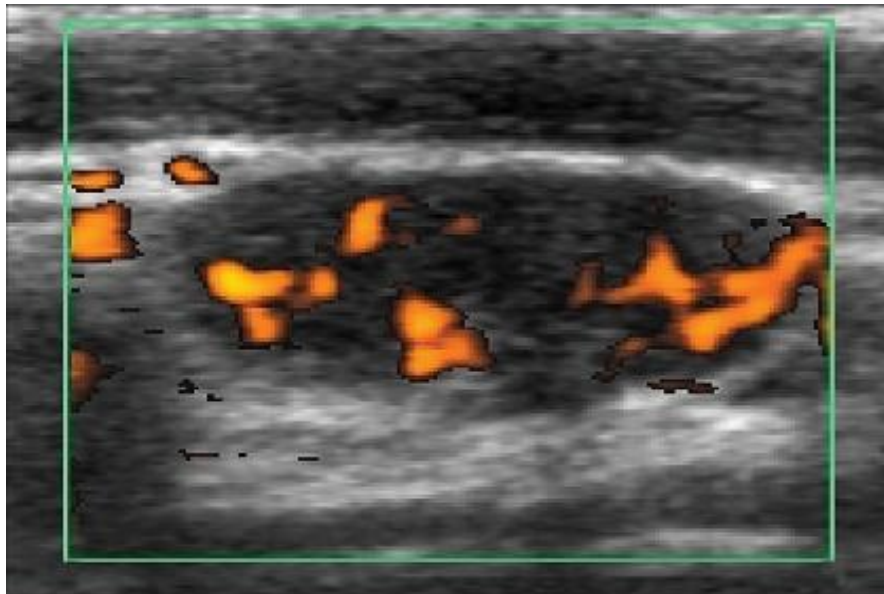
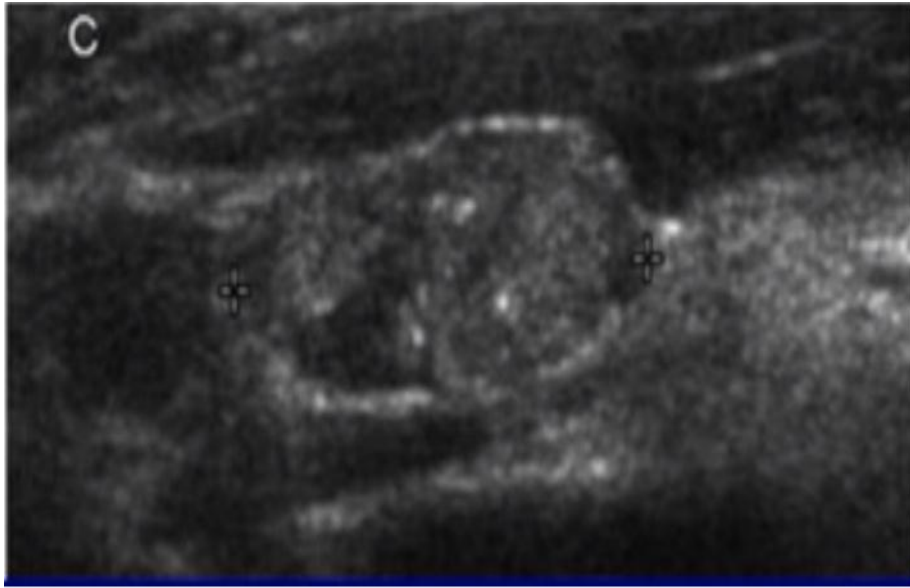


## Management Of Indeterminate/Not Completely Benign Nodes





**Metastatic lymph node from papillary thyroid carcinoma.**



**Metastatic lymph node from papillary thyroid carcinoma.**



# TAKE HOME MESSAGE

- ❑ **Sampling** should be considered for lesions **6 mm or larger** with worrisome characteristics.
- ❑ size (**larger than 1mm**) and **distribution pattern** of internal echogenic foci are helpful criteria for differentiating **suture granulomas** from locally recurrent tumors.
- ❑ **Calcifications** and **cystic changes** are relatively **uncommon** in parathyroid adenomas.
- ❑ **Remnant thyroid tissue** is often located near the ligament of berry, which is attached to **the inferior margin of the cornu of the cricoid cartilage**.
- ❑ Patients with **a high risk of disease recurrence** who do not respond excellently to treatment should be followed up with serum TSH, thyroglobulin and anti-thyroglobulin antibody determination and neck ultrasonography **every 6–12 months**.
- ❑ **60-75%** recurrences occur **in Z3 or Z4** of cervical lymph nodes.



***THANK YOU.....***