Thyroid and Parathyroid Ultrasound Protocol

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**NOTE for all examinations:**

1. If documenting possible flow in a structure/mass, all color/Doppler should be accompanied by a spectral gate for waveform tracing
   **EXCEPTION:** Thyroid nodules; spectral tracing does not need to be provided

2. CINE clips to be labeled:
   - MIDLINE structures: “right to left” when longitudinal and “superior to inferior” when transverse
   - RIGHT/LEFT structures: “lateral to medial” when longitudinal and “superior to inferior” when transverse
   **each should be 1 sweep, NOT back and forth**

**Thyroid**

General

- Longitudinal: lateral, mid, medial both lobes
- Transverse: inferior, mid, superior both lobes and isthmus

WHEN & WHAT to CINE:

- If completely normal gland: no CINE is required
- If any part of gland is abnormal:
1. Both lobes (even if only 1 is abnormal): Transverse CINE from submandibular gland/hyoid bone to sternal notch through each lobe SEPARATELY

   → If possible, include portion of isthmus on each side
   → If not possible, separate transverse CINE through isthmus

2. ONLY abnormal lobe (s): Longitudinal CINE

Size and Volume:

- Measure size of each lobe and provide volume; provide prior volume if relevant prior is available (if no volume on prior, provide prior measurements)

- Measure thickness (AP) of isthmus on transverse view

Vascularity:

- Representative color Doppler images in longitudinal of each lobe and transverse of isthmus

Nodules:

For reference, ACR TI-RADS Summary Table is attached at the end of this document. This is used by radiologists to describe and categorize nodules and highlights important features to document in nodule imaging.

**If measuring a nodule that has been previously biopsied, please provide SIZE (at time of biopsy or immediately preceding formal study), DATE of biopsy and PATHOLOGY results (if available)**

For organization:

- Nodules should be labeled, measured and described in the following order to maintain consistency between examinations:

  - 1. Right lobe: superior to inferior
  - 2. Isthmus: right to left
  - 3. Left lobe: superior to inferior
Label each nodule on the images to match labels and description on worksheet: Nodule 1 on the images should be same as nodule 1 on the worksheet, Nodule 2 on the images should be same as nodule 2 on the worksheet, etc.

Note, in a multinodular gland with nodules in the right, isthmus and left, this may mean that the 1st nodule measured on the left is called “Nodule #4”. Do not start numbers over from #1.

Attempt to re-label nodules the same as prior examinations, i.e.:

-Nodule #4 on examination from 2015 should be labeled Nodule #4 on examination from today

-If Nodule #4 is no longer well seen, document this and continue numbering as per prior examination/worksheet

Document on worksheet: Location, Size, Basic features (composition, calcifications, margin)

1. Location:
   - Which side: Right or left lobe
   - Which third: Inferior pole, interpolar, or superior pole
     - Which area within this third: Anterior, posterior, medial, lateral, anteromedial, anterolateral, posteromedial, posterolateral

2. Size in 3 dimensions: measure in horizontal and vertical (rather than oblique) for consistency across exams

   NOTE: Make AP measurement for nodule in the transverse plane on the same image where you measure transverse dimension

3. DESCRIBE basic features: composition, calcifications, and margin (in Sonoreview: Select features on worksheet):
   1. Composition: solid, cystic/partially cystic or spongiform
      - If possible show comet-tail artifact for colloid
   2. Echogenic Foci/Calcification: absent or present
      - If possible, elaborate as to macrocalcification versus microcalcification
   3. Margin: smooth or suspicious
- Suspicious = jagged, irregular, portion of nodule extends beyond thyroid, etc.

NOTE: For worksheets, please draw only an oval/circle for the nodule. It is not necessary to detail internal architecture on the diagrams. The legend has been removed for clarity.

Provide adequate images that document nodule vascularity & echogenicity: Do not need to be described on worksheet by technologist. Radiologist will assess at time of imaging review.

- Vascularity: Evaluate vascularity of each nodule in real-time.
- Provide: Single color CINE (transverse) through gland.

--> Add more CINEs if gland size warrants to ensure that all nodules are visualized.

- Dedicated color images of each nodule with color are not necessary, EXCEPT:

**NOTE EXCEPTIONS:**

1. If there is truly dramatic vascularity of a nodule in real-time: provide short color Doppler of the nodule, CINE if helpful
2. Cyst: provide single image with color box over anechoic cyst
3. Vessel: if appears like a hypoechoic nodule or cyst on a still image, provide image with color box to show it is a vessel

-Echogenicity: Provide images that clearly show nodule in relationship to remainder of thyroid and strap muscles

- Technologist does not have to denote echogenicity on worksheet but it is important to tailor images to help radiologist document accurate echogenicity (CINEs can help here)

→ For reference:

  - Radiologists evaluate echogenicity as it relates to the thyroid gland and the strap muscles. Definitions used by radiologists (per TIRADS document, see table at end of protocol for reference)
Echogenicity = hyper – iso – hypo - VERY hypo

- Hyperechoic is > thyroid
- Iso is = thyroid
- Hypoechoic is < than thyroid but = or > strap muscle
- VERY hypoechoic is < strap muscle

Guidelines for what to measure:

- Size:
  → SOLID: Measure nodules that are 5 mm or more (in any dimension)
  → CYSTIC/PARTIALLY CYSTIC: Measure nodules that are 1 cm or more (in any direction)

  ** Smaller nodules (solid < 5mm; cystic/partially cystic < 1cm) do not need to be measured or formally recorded on worksheet

  o HOWEVER: Please note their presence and general description
    → For example: “multiple small additional solid/cystic nodules bilaterally”

- Multinodular gland: Measure the 3 most suspicious nodules per side and 2 most suspicious in the isthmus

Neck Compartments:

- Evaluate for abnormalities
- Document enlarged lymph nodes: location and size (3 dimensions), comment on presence of calcification

  → Measure 3 largest on each side, if enlarged or abnormal
  → Provide specific images of the central hilum including color Doppler in abnormal lymph nodes

- Accurately mark location of nodes on worksheet

Examples of abnormal nodes:

- Thick, irregular, and/or nodular cortex
- Hypervascular cortex
- Effaced echogenic hilum or non-visualized vascular pedicle
- Microcalcifications (regardless of size or other morphology)
- Short axis = or > 10 mm (submandibular: 15 mm), regardless of morphology
- Anything else deemed worrisome by technologist

**Partial or Complete Thyroidectomy**

- If available, provide date of surgery, side of malignancy/abnormality and pathology (from Epic, clinic order, etc.)

**If partial, follow protocol above for “Thyroid” for the side still present**

- Thyroid bed in longitudinal and transverse:
  
  ➔ Transverse CINE through thyroid bed
  ➔ Transverse CINE out laterally from submandibular gland/hyoid bone to sternal notch
  ➔ Longitudinal CINE through thyroidectomy bed
  ➔ Provide representative images: at least 3 in transverse and 3 in longitudinal

- Any mass or cysts should be measured and documented

**Neck Compartments:**

- Evaluate for abnormalities

- Document enlarged lymph nodes: location and size (3 dimensions), comment on presence of calcification
  
  ➔ Measure 3 largest on each side, if enlarged or abnormal (see above)
→ Provide specific images of the central hilum including color Doppler in abnormal lymph nodes

- Accurately mark location of nodes on worksheet

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**PARATHYROID**

Note: Majority of parathyroid will be next to the thyroid gland, immediately posterior or inferior to the thyroid gland

→ Generally hypoechoic to normal thyroid gland with feeding vessel

Representative still and CINE images in longitudinal and transverse images:

- From carotid artery bifurcation superiorly to thoracic inlet inferiorly: scan through carotid arteries to midline bilaterally

**As parathyroid glands may be hidden below the clavicles in the lower neck and upper mediastinum, it may be helpful to have the patient swallow during the examination with constant real-time observation.**

**Upper mediastinum may be imaged with an appropriate probe by angling under the sternum from the sternal notch.**
# ACR TI-RADS

## Composition
- Cystic or almost completely cystic: 0 points
- Spongiform: 0 points
- Mixed cystic and solid: 1 point
- Solid or almost completely solid: 2 points

## Echogenicity
- Anechoic: 0 points
- Hypoechoic: 1 point
- Isoechoic: 0 points
- Hyperechoic: 2 points
- Very hypoechoic: 3 points

## Shape
- Taller-than-wide: 3 points
- Widely-lateral: 0 points

## Margin
- Smooth: 0 points
- Ill-defined: 0 points
- Lobulated or irregular: 2 points
- Extrathyroidal extension: 3 points

## Echogenic Foci
- None or large innocent artifacts: 0 points
- Microcalcifications: 1 point
- Peripheral (≤1 cm): 2 points
- Punctate echogenic foci: 3 points

### Add Points From All Categories to Determine TI-RADS Level

- **0 Points**: TR1 - Benign, no FNA
- **2 Points**: TR2 - Not Suspicious, no FNA
- **3 Points**: TR3 - Mildly Suspicious, FNA if ≥ 2.5 cm
- **4 to 6 Points**: TR4 - Moderately Suspicious, FNA if ≥ 1.5 cm
- **7 Points or More**: TR5 - Highly Suspicious, FNA if ≥ 1 cm, follow if ≥ 0.5 cm³

**Tr1**
- 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.

**Tr2**
- Anechoic: Applies to cystic or almost completely cystic nodules.
- Hypoechoic: Compared to adjacent parenchyma.
- Very hypoechoic: More hypoechoic than strap muscles.
- Assign 1 point if echogenicity cannot be determined.

**Tr3**
- Taller-than-wide: Should be assessed on the 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.

**Tr4**
- Lobulated: Protrusions into adjacent tissue.
- Irregular: Jagged, spiculated, or sharp angles.
- Extrathyroidal extension: Obvious invasion = malignancy.

**Tr5**
- Large elongated artifacts: V-shaped, >1 mm, in cystic components.
- Microcalcifications: Cause acoustic shadowing.
- Peripheral: Complete or incomplete along margin.

*Refer to discussion of papillary microcystic tumors for 5-8 mm TR5 nodules.*

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**Table of Echogenicity, Shape, Margin, and Echogenic Foci**

<table>
<thead>
<tr>
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