Implementation of ACR TI-RADS in a Large Radiology Practice

Rutgers - Robert Wood Johnson Medical School
Department of Radiology, New Brunswick, NJ, USA
Disclosure Statement

- Mannan Parrikh, MD - Nothing to disclose
- Albert C. Li, MD - Shareholder in University Radiology Group, PC

Acknowledgement – Francis Kang, MD for presentation assistance and review
Purpose

- Implement ACR TI-RADS risk categorization and recommendations on outpatient adult thyroid ultrasounds in a large private practice.

  - ACR TI-RADS Categories risk stratify all nodules, decrease number of biopsies performed on benign nodules, and offers evidence based follow-up recommendations to our referring physicians.
Materials and Methods

◇ Educated sonographers and radiologists starting 3 months prior to implementation.
  ◇ Live instructional sessions and emailed educational material.
    ◇ ACR TI-RADS thyroid nodule lexicon such as cystic, solid, lobulated vs. irregular margins, rim calcifications, punctate echogenic foci, taller-than-wide, etc and its associated points according to ACR TI-RADS.
    ◇ ACR TI-RADS risk categories and follow up recommendations.

◇ New thyroid ultrasound scanning protocol and worksheet.
  ◇ Standardized method of nodule measurement (maximum longitudinal dimension on a sagittal image, then on an image perpendicular to the sagittal image, obtain maximum height and width measurements)
  ◇ Limiting to maximum of 4 nodules documented.
  ◇ If more than 4 nodules are present, included the 4 nodules that had the most suspicious characteristics (i.e. highest ACR TI-RADS points).
  ◇ Nodules were numbered on the images.
# Thyroid US Worksheet

**Date:**

**Prior Study:**

**Clinical Hx:**

**Previous Surgery/Biopsy:**

**Background Vascularity:**
- Normal
- Increased

**Background Vascularity:**
- Normal
- Heterogeneous

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## Nodule 1: [Right Isthmus Left] [UP MP LP]

<table>
<thead>
<tr>
<th>Size (now)</th>
<th>x</th>
<th>x</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (prior)</td>
<td>x</td>
<td>x</td>
<td>mm</td>
</tr>
<tr>
<td>Composition</td>
<td>Spongiform / Almost Completely Cystic or Cystic (6)</td>
<td>Mixed Cystic and Solid (1)</td>
<td>Almost Completely Solid or Solid / Indeterminate due to calc (2)</td>
</tr>
<tr>
<td>Echogenicity</td>
<td>Anechoic (6)</td>
<td>Hypoechoic / Isoechoic / Indeterminate (1)</td>
<td>Very Hypoechoic (3)</td>
</tr>
<tr>
<td>Echogenic Foci</td>
<td>None / Comet-tail (2)</td>
<td>Macrocals (1)</td>
<td>Peripheral (tiny calc) (2)</td>
</tr>
<tr>
<td>Margins</td>
<td>Smooth / Ill-defined / Indeterminate (6)</td>
<td>Lobulated / Irregular (3)</td>
<td>Extra-thyroidal extension (3)</td>
</tr>
<tr>
<td>Shape</td>
<td>Wider than Tall (0)</td>
<td>Taller than Wide (3)</td>
<td></td>
</tr>
</tbody>
</table>

**TI-RADS 1** (1 point)
**TI-RADS 2** (2 points)
**TI-RADS 3** (3 points)
**TOTAL Points**

## Nodule 2: [Right Isthmus Left] [UP MP LP]

<table>
<thead>
<tr>
<th>Size (now)</th>
<th>x</th>
<th>x</th>
<th>mm</th>
</tr>
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<tbody>
<tr>
<td>Size (prior)</td>
<td>x</td>
<td>x</td>
<td>mm</td>
</tr>
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<td>Mixed Cystic and Solid (1)</td>
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<tr>
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<td>Very Hypoechoic (3)</td>
</tr>
<tr>
<td>Echogenic Foci</td>
<td>None / Comet-tail (2)</td>
<td>Macrocals (1)</td>
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<tr>
<td>Shape</td>
<td>Wider than Tall (0)</td>
<td>Taller than Wide (3)</td>
<td></td>
</tr>
</tbody>
</table>

**TI-RADS 1** (1 point)
**TI-RADS 2** (2 points)
**TI-RADS 3** (3 points)
**TOTAL Points**

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## Nodule 3: [Right Isthmus Left] [UP MP LP]

<table>
<thead>
<tr>
<th>Size (now)</th>
<th>x</th>
<th>x</th>
<th>mm</th>
</tr>
</thead>
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<tr>
<td>Size (prior)</td>
<td>x</td>
<td>x</td>
<td>mm</td>
</tr>
<tr>
<td>Composition</td>
<td>Spongiform / Almost Completely Cystic or Cystic (6)</td>
<td>Mixed Cystic and Solid (1)</td>
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</tr>
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<td>Echogenicity</td>
<td>Anechoic (6)</td>
<td>Hypoechoic / Isoechoic / Indeterminate (1)</td>
<td>Very Hypoechoic (3)</td>
</tr>
<tr>
<td>Echogenic Foci</td>
<td>None / Comet-tail (2)</td>
<td>Macrocals (1)</td>
<td>Peripheral (tiny calc) (2)</td>
</tr>
<tr>
<td>Margins</td>
<td>Smooth / Ill-defined / Indeterminate (6)</td>
<td>Lobulated / Irregular (3)</td>
<td>Extra-thyroidal extension (3)</td>
</tr>
<tr>
<td>Shape</td>
<td>Wider than Tall (0)</td>
<td>Taller than Wide (3)</td>
<td></td>
</tr>
</tbody>
</table>

**TI-RADS 1** (1 point)
**TI-RADS 2** (2 points)
**TI-RADS 3** (3 points)
**TOTAL Points**

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## Nodule 4: [Right Isthmus Left] [UP MP LP]

<table>
<thead>
<tr>
<th>Size (now)</th>
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<th>x</th>
<th>mm</th>
</tr>
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<tbody>
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<td>Size (prior)</td>
<td>x</td>
<td>x</td>
<td>mm</td>
</tr>
<tr>
<td>Composition</td>
<td>Spongiform / Almost Completely Cystic or Cystic (6)</td>
<td>Mixed Cystic and Solid (1)</td>
<td>Almost Completely Solid or Solid / Indeterminate due to calc (2)</td>
</tr>
<tr>
<td>Echogenicity</td>
<td>Anechoic (6)</td>
<td>Hypoechoic / Isoechoic / Indeterminate (1)</td>
<td>Very Hypoechoic (3)</td>
</tr>
<tr>
<td>Echogenic Foci</td>
<td>None / Comet-tail (2)</td>
<td>Macrocals (1)</td>
<td>Peripheral (tiny calc) (2)</td>
</tr>
<tr>
<td>Margins</td>
<td>Smooth / Ill-defined / Indeterminate (6)</td>
<td>Lobulated / Irregular (3)</td>
<td>Extra-thyroidal extension (3)</td>
</tr>
<tr>
<td>Shape</td>
<td>Wider than Tall (0)</td>
<td>Taller than Wide (3)</td>
<td></td>
</tr>
</tbody>
</table>

**TI-RADS 1** (1 point)
**TI-RADS 2** (2 points)
**TI-RADS 3** (3 points)
**TOTAL Points**
## Nodule 1: [RIGHT ISTHMUS LEFT] [UP MP LP]

<table>
<thead>
<tr>
<th>Size (now)</th>
<th></th>
<th></th>
<th>mm</th>
</tr>
</thead>
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<tr>
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<td></td>
<td>mm</td>
</tr>
<tr>
<td>Composition</td>
<td>Spongiform / Almost Completely Cystic or Cystic (0)</td>
<td>Mixed Cystic and Solid (1)</td>
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<tr>
<td>Echogenicity</td>
<td>Anechoic (0)</td>
<td>Hyperechoic / Isoechoic / Indeterm (1)</td>
<td>Hypoechoic (2)</td>
</tr>
<tr>
<td>Echogenic Foci</td>
<td>None / Comet-tail (0)</td>
<td>Macrolcals (1)</td>
<td>Peripheral (rim) calcs (2)</td>
</tr>
<tr>
<td>Margins</td>
<td>Smooth / Ill-defined / Indeterminate (0)</td>
<td>Lobulated / Irregular (2)</td>
<td>Extra thyroidal extension (3)</td>
</tr>
<tr>
<td>Shape</td>
<td>Wider than Tall (0)</td>
<td>Taller than Wide (3)</td>
<td></td>
</tr>
</tbody>
</table>

TI-RADS 1 (0 point)  
TI-RADS 2 (2 points)  
TI-RADS 3 (3 points)  
TI-RADS 4 (4-6 points)  
TI-RADS 5 (≥7 points)  
TOTAL Points
Dictation Template with Structured Reporting Launched on 7/1/2018

NODULE(S):

Nodule #1
Location: location
Size (mm): size
Composition: composition: Spongiform/Cystic/Almost completely cystic/Mixed cystic and solid/Almost completely solid/Solid/Cannot be determined due to calcifications
Echogenicity: echogenicity: Anechoic/Hyperechoic/Isoechoic/Hyperechoic/Indeterminate/Very hypoechoic
Echogenic foci: echogenic foci: None/Comet-tail/Macrocalcifications/Peripheral calcifications/Rim calcifications/Punctate
Margins: margins: Smooth/Indefinite/Indeterminate/Lobulated/Irregular/Extrathyroidal extension
Shape: Shape: Wider than tall/Taller than wide
TI-RADS Category: TI-RADS: one/two/three/four/five

Next Nodule

IMPRESSION: Impression

Recommendation: Recommendation: Follow up thyroid ultrasound in one year. Follow up thyroid ultrasound in two years. Fine needle aspiration biopsy. No follow-up is recommended for the above described nodule(s) per American College of Radiology TI-RADS Committee. Follow up for previously biopsied thyroid nodule(s) should consider its Bethesda classification. American College of Radiology TI-RADS Committee recommend that imaging follow up for thyroid nodules can stop at 5 years if there is no change in size, as stability over that time span reliably indicates that the nodule has a benign behavior.
Materials and Methods

- 2,115 outpatient thyroid ultrasounds reviewed before and after implementation.
  - 1,368 exams with nodules included.
  - 747 exams excluded (< 5mm cysts, multinodular goiters not describing or measuring specific nodules, exams from 2 joint-venture offices, exams from 1 surgeon with specific requests).

- Compliance measured based on percentage of exams providing ACR TI-RADS risk category for all described thyroid nodules and percentage of exams having specific recommendation in the impression.
Compliant Report

**Exam:** US Thyroid

**Clinical Indication:** Enlargement of thyroid

**Technique:** Grey-scale ultrasound of the thyroid.

**Comparison:** No pertinent prior studies have been submitted for comparison.

**Findings:**
- Right thyroid lobe (mm): 40 x 17 x 18
- Left thyroid lobe (mm): 43 x 17 x 16
- Isthmus (mm): 4
- Background vascularity: Normal
- Background echotexture: Heterogeneous

**Nodule(s):**

- **Nodule #1**
  - Location: Right mid
  - Size (mm): 6 x 4 x 5
  - Composition: Solid
  - Echogenicity: Hypoechoic
  - Echogenic foci: None
  - Margins: Smooth
  - Shape: Wider than tall
  - **TI-RADS Category:** 4 - Follow up ultrasound in one year if nodule is greater or equal to 10 mm. FNA biopsy is recommended if nodule is greater or equal to 15 mm.

- **Nodule #2**
  - Location: Left lower
  - Size (mm): 8 x 7 x 8
  - Composition: Mixed cystic and solid
  - Echogenicity: Isoechoic
  - Echogenic foci: Macrocalcification
  - Margins: Smooth
  - Shape: Wider than tall
  - **TI-RADS Category:** 3 - Follow up ultrasound in one year if nodule is greater or equal to 15 mm. FNA biopsy is recommended if nodule is greater or equal to 25 mm.

**Impression:** Heterogeneous thyroid gland. Mild thyromegaly. Few small thyroid nodules.

**Recommendation:** No follow-up is recommended for the above described nodule(s) per American College of Radiology TI-RADS Committee.
Noncompliant Report

EXAM: THYROID ULTRASOUND

CLINICAL INDICATION: Goiter.

TECHNIQUE: Grey-scale ultrasound of the thyroid.

COMPARISON: No pertinent prior studies have been submitted for comparison.

FINDINGS:
RIGHT thyroid lobe (mm): 49 x 14 x 15
LEFT thyroid lobe (mm): 46 x 15 x 15
Isthmus (mm): 4
Background vascularity: Normal
Background echotexture: Normal

NODULE(S):

Nodule #1
Location: Left lower pole
Size (mm): 7 x 4 x 3
Composition: Solid
Echogenicity: Hypoechoic
Echogenic foci: None
Margins: Smooth
Shape: Wider than tall
TI-RADS Category:

IMPRESSIOON: Right thyroid nodule as described above.

Recommendation: As above.

- Described nodule without giving it an ACR TI-RADS category.
- No recommendation given.
Excluded Report #1

EXAM: THYROID ULTRASOUND

CLINICAL INDICATION: Thyroid nodules.

TECHNIQUE: Grey-scale ultrasound of the thyroid.

COMPARISON: None.

FINDINGS:
RIGHT thyroid lobe (mm): 46 x 13 x 16
LEFT thyroid lobe (mm): 35 x 7 x 12
Isthmus (mm): 2
Background vascularity: Within normal limits
Background echotexture: Heterogeneous

NODULE(S): Small cystic nodules in the right lobe. The largest as described below.

Nodule #1
Location: Right mid lobe
Size (mm): 4 x 4 x 3
Composition: Almost completely cystic
Echogenicity: Anechoic
Echogenic foci: None
Margins: Smooth
Shape: Wider than tall
TI-RADS Category: 1

IMPRESSION: Heterogeneous thyroid gland. Small cystic right thyroid lobe nodule. No discrete solid nodules identified.

Recommendation: Small right thyroid lobe cyst. No follow-up.

-football 5mm cyst.
Excluded Report #2

EXAM: THYROID ULTRASOUND

CLINICAL INDICATION: Nontoxic multinodular goiter.

TECHNIQUE: Grey-scale ultrasound of the thyroid.

COMPARISON: No pertinent prior studies have been submitted for comparison.

FINDINGS:
RIGHT thyroid lobe (mm): 51 x 22 x 21 mm
LEFT thyroid lobe (mm): 53 x 18 x 17 mm
Isthmus (mm): 7 mm.
Background vascularity: Normal
Background echotexture: Normal

NODULE(S): There are several nodules demonstrated within the bilateral thyroid lobe, consistent with multinodular goiter. None of the nodules appear sonographically suspicious.

TI-RADS Category: Not applicable

IMPRESSION:
Multinodular goiter. As noted above, no suspicious thyroid nodule is demonstrated in either lobe or thyroid isthmus on current exam. No FNA is recommended based on current study.

Recommendation: No thyroid sonographic follow-up necessary based upon current sonographic study.
### Results

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>% with ACR TI-RADS Category</th>
<th>% with ACR TI-RADS Category &amp; Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before the Implementation</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>May 1-31, 2018</td>
<td>449</td>
<td>16</td>
<td>16</td>
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<td><strong>July 1, 2018 Implementation</strong></td>
<td></td>
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<tr>
<td>July 15-31, 2018</td>
<td>186</td>
<td>96</td>
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<td>August 15-31, 2018</td>
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<td>September 15-30, 2018</td>
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<tr>
<td>October 15-31, 2018</td>
<td>229</td>
<td>97</td>
<td>90</td>
</tr>
</tbody>
</table>

- **16%** of exams gave ACR TI-RADS category and recommendation prior to implementation.
- **Compliance increased after implementation:**
  - **93-97%** of exams gave ACR TI-RADS risk category.
  - **85-95%** of exams also gave an associated recommendation.
Conclusion

- Successful implementation ACR TI-RADS in a large community practice with high compliance.
- Radiologists followed ACR TI-RADS reporting when provided with worksheets filled in by trained sonographers and an easy-to-use dictation template.
- Study did not assess for radiologist accuracy in thyroid nodule characterization or appropriateness of recommendation.
  - Future goal is to perform inter-observer studies on accuracy of thyroid characterization and recommendations in a large private radiology practice.
References


