



# Radiologic Assessment of Thyroid Disease

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# Disclosure

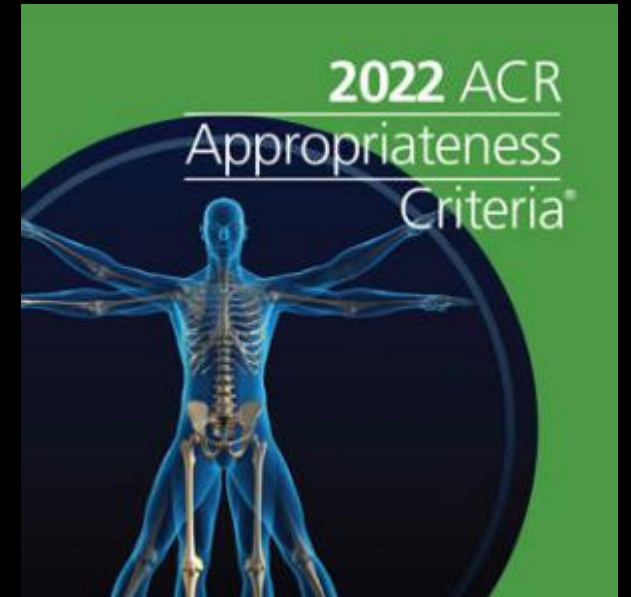
Nothing to disclose

# Objectives

- Discuss thyroid nodule work up and risk stratification
- Discuss clinical scenarios that may change imaging selection and case management

# ACR Appropriateness Criteria

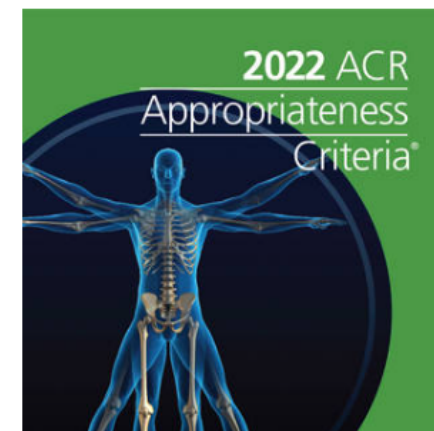
**American College of Radiology**  
**ACR Appropriateness Criteria®**  
**Thyroid Disease**



# ACR Appropriateness Criteria

The ACR Appropriateness Criteria<sup>®</sup> (AC) are evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision for a specific clinical condition. Employing these guidelines helps providers enhance quality of care and contribute to the most efficacious use of radiology. [Learn more »](#)

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## AC Portal

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Explore by procedure



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An interactive way to access the AC topics, variants, clinical scenarios, and recommendations. Use keyword filters and search features to more easily find all content.

### Thyroid Disease

[← Back](#)

#### Variants

- 1 Palpable thyroid nodule. Not goiter. Euthyroid. Initial imaging.
- 2 Suspected goiter. Initial imaging.
- 3 Thyrotoxicosis. Initial imaging.
- 4 Primary hypothyroidism. Initial imaging.
- 5 Preoperative evaluation of differentiated thyroid cancer.

#### Documents

- [Narrative](#)
- [Evidence Table](#)
- [Lit Search](#)
- [Appendix](#)



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[← Back](#)

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### Documents

[Narrative](#)
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[Appendix](#)

| Scenario                            | Procedure  | Adult RRL          | Peds RRL                | Appropriateness Category |  |
|-------------------------------------|--|--------------------|-------------------------|--------------------------|--|
| Thyroid nodule, palpable, euthyroid | US thyroid   | 0 mSv<br>O         | 0 mSv [ped]<br>O        | Usually appropriate      |  |
|                                     | CT neck with IV contrast                             | 1-10 mSv<br>⊕⊕⊕⊕   | 0.3-3 mSv [ped]<br>⊕⊕⊕⊕ | May be appropriate       |  |
|                                     | CT neck without IV contrast                          | 1-10 mSv<br>⊕⊕⊕⊕   | 0.3-3 mSv [ped]<br>⊕⊕⊕⊕ | May be appropriate       |  |
|                                     | MRI neck without IV contrast                         | 0 mSv<br>O         | 0 mSv [ped]<br>O        | Usually not appropriate  |  |
|                                     | MRI neck without and with IV contrast                | 0 mSv<br>O         | 0 mSv [ped]<br>O        | Usually not appropriate  |  |
|                                     | I-123 uptake scan neck                               | 1-10 mSv<br>⊕⊕⊕⊕   | Null                    | Usually not appropriate  |  |
|                                     | I-131 uptake scan and Tc-99m pertechnetate scan neck | 10-30 mSv<br>⊕⊕⊕⊕⊕ | Null                    | Usually not appropriate  |  |
|                                     | CT neck without and with IV contrast                 | 1-10 mSv<br>⊕⊕⊕⊕   | 3-10 mSv [ped]<br>⊕⊕⊕⊕⊕ | Usually not appropriate  |  |
|                                     | FDG-PET/CT whole body                                | 10-30 mSv<br>⊕⊕⊕⊕⊕ | Null                    | Usually not appropriate  |  |

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[← Back](#)

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| Thyroid nodule, palpable, euthyroid | US thyroid   | 0 mSv<br>O         | 0 mSv [ped]<br>O        | Usually appropriate      |  |
|                                     | CT neck with IV contrast                             | 1-10 mSv<br>⊕⊕⊕⊕   | 0.3-3 mSv [ped]<br>⊕⊕⊕⊕ | May be appropriate       |  |
|                                     | CT neck without IV contrast                          | 1-10 mSv<br>⊕⊕⊕⊕   | 0.3-3 mSv [ped]<br>⊕⊕⊕⊕ | May be appropriate       |  |
|                                     | MRI neck without IV contrast                         | 0 mSv<br>O         | 0 mSv [ped]<br>O        | Usually not appropriate  |  |
|                                     | MRI neck without and with IV contrast                | 0 mSv<br>O         | 0 mSv [ped]<br>O        | Usually not appropriate  |  |
|                                     | I-123 uptake scan neck                               | 1-10 mSv<br>⊕⊕⊕⊕   | Null                    | Usually not appropriate  |  |
|                                     | I-131 uptake scan and Tc-99m pertechnetate scan neck | 10-30 mSv<br>⊕⊕⊕⊕⊕ | Null                    | Usually not appropriate  |  |
|                                     | CT neck without and with IV contrast                 | 1-10 mSv<br>⊕⊕⊕⊕   | 3-10 mSv [ped]<br>⊕⊕⊕⊕⊕ | Usually not appropriate  |  |
|                                     | FDG-PET/CT whole body                                | 10-30 mSv<br>⊕⊕⊕⊕⊕ | Null                    | Usually not appropriate  |  |

**American College of Radiology  
ACR Appropriateness Criteria®  
Thyroid Disease**

**Variant 1:** Palpable thyroid nodule. Not goiter. Euthyroid. Initial imaging.

| Procedure  | Appropriateness Category | Relative Radiation Level |
|--|--------------------------|--------------------------|
| US thyroid   | Usually Appropriate      | O                        |
| CT neck with IV contrast                             | May Be Appropriate       | ☼☼☼                      |
| CT neck without IV contrast                          | May Be Appropriate       | ☼☼☼                      |
| MRI neck without and with IV contrast                | Usually Not Appropriate  | O                        |
| MRI neck without IV contrast                         | Usually Not Appropriate  | O                        |
| I-123 uptake scan neck                               | Usually Not Appropriate  | ☼☼☼                      |
| I-131 uptake scan and Tc-99m pertechnetate scan neck | Usually Not Appropriate  | ☼☼☼☼                     |
| CT neck without and with IV contrast                 | Usually Not Appropriate  | ☼☼☼                      |
| FDG-PET/CT whole body                                | Usually Not Appropriate  | ☼☼☼☼                     |

**Variant 2:**                      **Suspected goiter. Initial imaging.**

| Procedure  | Appropriateness Category | Relative Radiation Level |
|--|--------------------------|--------------------------|
| US thyroid   | Usually Appropriate      | ○                        |
| CT neck without IV contrast                          | Usually Appropriate      | ☼☼☼                      |
| CT neck with IV contrast                             | May Be Appropriate       | ☼☼☼                      |
| I-123 uptake scan neck                               | May Be Appropriate       | ☼☼☼                      |
| I-131 uptake scan and Tc-99m pertechnetate scan neck | May Be Appropriate       | ☼☼☼☼                     |
| MRI neck without and with IV contrast                | May Be Appropriate       | ○                        |
| MRI neck without IV contrast                         | May Be Appropriate       | ○                        |
| CT neck without and with IV contrast                 | Usually Not Appropriate  | ☼☼☼                      |
| FDG-PET/CT whole body                                | Usually Not Appropriate  | ☼☼☼☼                     |

| Appropriateness Category Name  | Appropriateness Rating  | Appropriateness Category Definition  |
|--|---|--|
| Usually Appropriate  | 7, 8, or 9  | The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.  |
| <div data-bbox="191 549 649 606">May Be Appropriate</div> <div data-bbox="191 863 649 978">May Be Appropriate (Disagreement)</div> | <div data-bbox="955 549 1159 606">4, 5, or 6</div> <div data-bbox="1044 892 1070 949">5</div> | <div data-bbox="1312 406 2509 721">The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.</div> <div data-bbox="1312 749 2509 1078">The individual ratings are too dispersed from the panel median. The different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 5 is assigned.</div> |
| Usually Not Appropriate  | 1, 2, or 3  | The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.  |

**Variant 1:**                      **Palpable thyroid nodule. Not goiter. Euthyroid. Initial imaging.**

| Procedure  | Appropriateness Category | Relative Radiation Level |
|--|--------------------------|--------------------------|
| US thyroid   | Usually Appropriate      | ○                        |
| CT neck with IV contrast                             | May Be Appropriate       | ☢☢☢                      |
| CT neck without IV contrast                          | May Be Appropriate       | ☢☢☢                      |
| MRI neck without and with IV contrast                | Usually Not Appropriate  | ○                        |
| MRI neck without IV contrast                         | Usually Not Appropriate  | ○                        |
| I-123 uptake scan neck                               | Usually Not Appropriate  | ☢☢☢                      |
| I-131 uptake scan and Tc-99m pertechnetate scan neck | Usually Not Appropriate  | ☢☢☢☢                     |
| CT neck without and with IV contrast                 | Usually Not Appropriate  | ☢☢☢                      |
| FDG-PET/CT whole body                                | Usually Not Appropriate  | ☢☢☢☢                     |

**Variant 2:**

**Suspected goiter. Initial imaging.**

| Procedure  | Appropriateness Category | Relative Radiation Level |
|--|--------------------------|--------------------------|
| US thyroid   | Usually Appropriate      | ○                        |
| CT neck without IV contrast                          | Usually Appropriate      | ☢☢☢                      |
| CT neck with IV contrast                             | May Be Appropriate       | ☢☢☢                      |
| I-123 uptake scan neck                               | May Be Appropriate       | ☢☢☢                      |
| I-131 uptake scan and Tc-99m pertechnetate scan neck | May Be Appropriate       | ☢☢☢☢                     |
| MRI neck without and with IV contrast                | May Be Appropriate       | ○                        |
| MRI neck without IV contrast                         | May Be Appropriate       | ○                        |
| CT neck without and with IV contrast                 | Usually Not Appropriate  | ☢☢☢                      |
| FDG-PET/CT whole body                                | Usually Not Appropriate  | ☢☢☢☢                     |

**Variant 3:**                      **Thyrotoxicosis. Initial imaging.**

| Procedure  | Appropriateness Category | Relative Radiation Level |
|--|--------------------------|--------------------------|
| US thyroid   | Usually Appropriate      | ○                        |
| I-123 uptake scan neck                               | Usually Appropriate      | ☢☢☢                      |
| I-131 uptake scan and Tc-99m pertechnetate scan neck | Usually Appropriate      | ☢☢☢☢                     |
| CT neck with IV contrast                             | Usually Not Appropriate  | ☢☢☢                      |
| CT neck without IV contrast                          | Usually Not Appropriate  | ☢☢☢                      |
| MRI neck without and with IV contrast                | Usually Not Appropriate  | ○                        |
| MRI neck without IV contrast                         | Usually Not Appropriate  | ○                        |
| CT neck without and with IV contrast                 | Usually Not Appropriate  | ☢☢☢                      |
| FDG-PET/CT whole body                                | Usually Not Appropriate  | ☢☢☢☢                     |

**Variant 4:**                      **Primary hypothyroidism. Initial imaging.**

| Procedure  | Appropriateness Category | Relative Radiation Level |
|--|--------------------------|--------------------------|
| CT neck with IV contrast                             | Usually Not Appropriate  | ☢☢☢                      |
| CT neck without and with IV contrast                 | Usually Not Appropriate  | ☢☢☢                      |
| CT neck without IV contrast                          | Usually Not Appropriate  | ☢☢☢                      |
| FDG-PET/CT whole body                                | Usually Not Appropriate  | ☢☢☢☢                     |
| I-123 uptake scan neck                               | Usually Not Appropriate  | ☢☢☢                      |
| I-131 uptake scan and Tc-99m pertechnetate scan neck | Usually Not Appropriate  | ☢☢☢☢                     |
| MRI neck without and with IV contrast                | Usually Not Appropriate  | ○                        |
| MRI neck without IV contrast                         | Usually Not Appropriate  | ○                        |
| US thyroid   | Usually Not Appropriate  | ○                        |



**Variant 5:**

**Preoperative evaluation of differentiated thyroid cancer.**

| Procedure                             | Appropriateness Category | Relative Radiation Level |
|---------------------------------------|--------------------------|--------------------------|
| US thyroid                            | Usually Appropriate      | O                        |
| CT neck with IV contrast              | Usually Appropriate      | ⚙⚙⚙                      |
| MRI neck without and with IV contrast | May Be Appropriate       | O                        |
| CT neck without IV contrast           | May Be Appropriate       | ⚙⚙⚙                      |
| MRI neck without IV contrast          | May Be Appropriate       | O                        |
| FDG-PET/CT whole body                 | Usually Not Appropriate  | ⚙⚙⚙⚙                     |
| CT neck without and with IV contrast  | Usually Not Appropriate  | ⚙⚙⚙                      |
| I-123 scan whole body                 | Usually Not Appropriate  | ⚙⚙⚙                      |
| I-131 scan whole body                 | Usually Not Appropriate  | ⚙⚙⚙⚙                     |
| Octreotide scan whole body            | Usually Not Appropriate  | ⚙⚙⚙⚙                     |

**Variant 6:**                      **Early imaging after treatment of differentiated thyroid cancer.**

| Procedure                             | Appropriateness Category          | Relative Radiation Level |
|---------------------------------------|-----------------------------------|--------------------------|
| US thyroid                            | Usually Appropriate               | ○                        |
| I-123 scan whole body                 | May Be Appropriate                | ☢☢☢                      |
| CT neck with IV contrast              | May Be Appropriate (Disagreement) | ☢☢☢                      |
| I-131 scan whole body                 | May Be Appropriate (Disagreement) | ☢☢☢☢                     |
| MRI neck without and with IV contrast | May Be Appropriate                | ○                        |
| CT neck without IV contrast           | Usually Not Appropriate           | ☢☢☢                      |
| MRI neck without IV contrast          | Usually Not Appropriate           | ○                        |
| FDG-PET/CT whole body                 | Usually Not Appropriate           | ☢☢☢☢                     |
| CT neck without and with IV contrast  | Usually Not Appropriate           | ☢☢☢                      |
| Octreotide scan whole body            | Usually Not Appropriate           | ☢☢☢☢                     |

| Variant 7: Suspected recurrence of differentiated thyroid cancer. |                          |                          |
|---|--------------------------|--------------------------|
| Procedure   | Appropriateness Category | Relative Radiation Level |
| CT neck with IV contrast  | Usually Appropriate      | ☢☢☢                      |
| US thyroid  | Usually Appropriate      | ○                        |
| I-123 scan whole body   | Usually Appropriate      | ☢☢☢                      |
| MRI neck without and with IV contrast                             | Usually Appropriate      | ○                        |
| CT chest with IV contrast   | May Be Appropriate       | ☢☢☢                      |
| CT chest without IV contrast                                      | May Be Appropriate       | ☢☢☢                      |
| FDG-PET/CT whole body   | May Be Appropriate       | ☢☢☢☢                     |
| I-131 scan whole body   | May Be Appropriate       | ☢☢☢☢                     |
| CT neck without IV contrast                                       | May Be Appropriate       | ☢☢☢                      |
| MRI neck without IV contrast                                      | May Be Appropriate       | ○                        |
| CT chest without and with IV contrast                             | Usually Not Appropriate  | ☢☢☢                      |
| CT neck without and with IV contrast                              | Usually Not Appropriate  | ☢☢☢                      |
| Octreotide scan whole body  | Usually Not Appropriate  | ☢☢☢☢                     |

**Variant 8:****Suspected recurrence of medullary thyroid cancers.**

| Procedure                                       | Appropriateness Category | Relative Radiation Level |
|---|--------------------------|--------------------------|
| US thyroid                                      | Usually Appropriate      | ○                        |
| CT neck with IV contrast                        | Usually Appropriate      | ⊕⊕⊕                      |
| CT chest with IV contrast                       | Usually Appropriate      | ⊕⊕⊕                      |
| MRI neck without and with IV contrast           | Usually Appropriate      | ○                        |
| CT abdomen with IV contrast                     | May Be Appropriate       | ⊕⊕⊕                      |
| CT abdomen without and with IV contrast         | May Be Appropriate       | ⊕⊕⊕⊕                     |
| MRI abdomen without and with IV contrast        | May Be Appropriate       | ○                        |
| MRI complete spine without and with IV contrast | May Be Appropriate       | ○                        |
| Bone scan whole body                            | May Be Appropriate       | ⊕⊕⊕                      |
| CT chest without IV contrast                    | May Be Appropriate       | ⊕⊕⊕                      |
| CT neck without IV contrast                     | May Be Appropriate       | ⊕⊕⊕                      |
| FDG-PET/CT whole body                           | May Be Appropriate       | ⊕⊕⊕⊕                     |
| MRI abdomen without IV contrast                 | May Be Appropriate       | ○                        |
| MRI complete spine without IV contrast          | May Be Appropriate       | ○                        |
| MRI neck without IV contrast                    | May Be Appropriate       | ○                        |
| CT abdomen without IV contrast                  | Usually Not Appropriate  | ⊕⊕⊕                      |
| CT chest without and with IV contrast           | Usually Not Appropriate  | ⊕⊕⊕                      |
| CT neck without and with IV contrast            | Usually Not Appropriate  | ⊕⊕⊕                      |
| DOTATATE PET/CT skull base to mid-thigh         | Usually Not Appropriate  | ⊕⊕⊕                      |
| I-123 scan whole body                           | Usually Not Appropriate  | ⊕⊕⊕                      |
| I-131 scan whole body                           | Usually Not Appropriate  | ⊕⊕⊕⊕                     |
| Octreotide scan whole body                      | Usually Not Appropriate  | ⊕⊕⊕⊕                     |

# ACR TI-RADS



Thyroid Imaging Reporting & Data System

# Thyroid Ultrasound Reporting Lexicon: White Paper of the ACR Thyroid Imaging, Reporting and Data System (TIRADS) Committee

Edward G. Grant, MD<sup>a</sup>, Franklin N. Tessler, MD<sup>b</sup>, Jenny K. Hoang, MBBS<sup>c</sup>, Jill E. Langer, MD<sup>d</sup>, Michael D. Beland, MD<sup>e</sup>, Lincoln L. Berland, MD<sup>b</sup>, John J. Cronan, MD<sup>f</sup>, Terry S. Desser, MD<sup>f</sup>, Mary C. Frates, MD<sup>g</sup>, Ulrike M. Hamper, MD<sup>b</sup>, William D. Middleton, MD<sup>j</sup>, Carl C. Reading, MD<sup>j</sup>, Leslie M. Scoutt, MD<sup>k</sup>, A. Thomas Stavros, MD<sup>l</sup>, Sharlene A. Teehey, MD<sup>j</sup>

## Abstract

Ultrasound is the most commonly used imaging technique for the evaluation of thyroid nodules. Sonographic findings are often not specific, and definitive diagnosis is usually made through fine-needle aspiration biopsy or even surgery. In reviewing the literature, terms used to describe nodules are often poorly defined and inconsistently applied. Several authors have recently described a standardized risk stratification system called the Thyroid Imaging, Reporting and Data System (TIRADS), modeled on the BI-RADS system for breast imaging. However, most of these TIRADS classifications have come from individual institutions, and none has been widely adopted in the United States. Under the auspices of the ACR, a committee was organized to develop TIRADS. The eventual goal is to provide practitioners with evidence-based recommendations for the management of thyroid nodules on the basis of a set of well-defined sonographic features or terms that can be applied to every lesion. Terms were chosen on the basis of demonstration of consistency with regard to performance in the diagnosis of thyroid cancer or, conversely, classifying a nodule as benign and avoiding follow-up. The initial portion of this project was aimed at standardizing the diagnostic approach to thyroid nodules with regard to terminology through the development of a lexicon. This white paper describes the consensus process and the resultant lexicon.

**Key Words:** Thyroid nodule, ultrasound, thyroid cancer, structured reporting, thyroid imaging

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## INTRODUCTION

The incidence of thyroid nodules has increased tremendously in recent years. The reasons for this increase are likely multifactorial but are largely attributed to widespread application of high-resolution ultrasound to the thyroid itself and the frequent incidental detection of nodules on

other imaging modalities. In distinction to palpation, which demonstrates nodules in only 5% to 10% of the population, autopsy and sonography detect them in at least 60% [1]. Although nodules are extremely common, the incidence of malignancy in them is relatively low, ranging between 1.6% and 12% [2,3].

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The authors have no conflicts of interest related to the material discussed in this article.

# Thyroid Imaging Reporting and Data System (TI-RADS): A User's Guide<sup>1</sup>

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In 2017, the Thyroid Imaging Reporting and Data System (TI-RADS) Committee of the American College of Radiology (ACR) published a white paper that presented a new risk-stratification system for classifying thyroid nodules on the basis of their appearance at ultrasonography (US). In ACR TI-RADS, points in five feature categories are summed to determine a risk level from TR1 to TR5. Recommendations for biopsy or US follow-up are based on the nodule's ACR TI-RADS level and its maximum diameter. The purpose of this article is to offer practical guidance on how to implement and apply ACR TI-RADS based on the authors' experience with the system.

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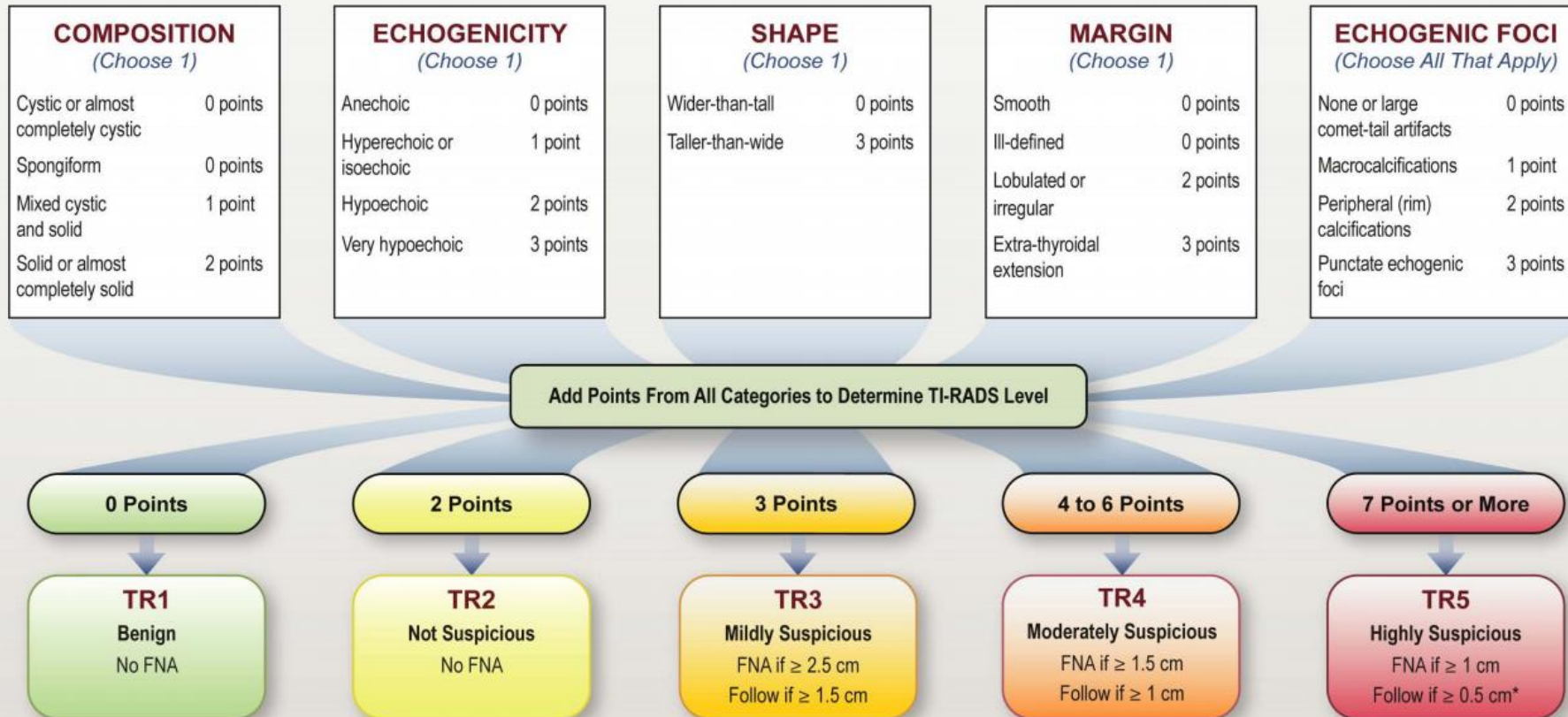
An earlier incorrect version of this article appeared online and in print. This article was corrected on April 2, 2018.

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# ACR TI-RADS



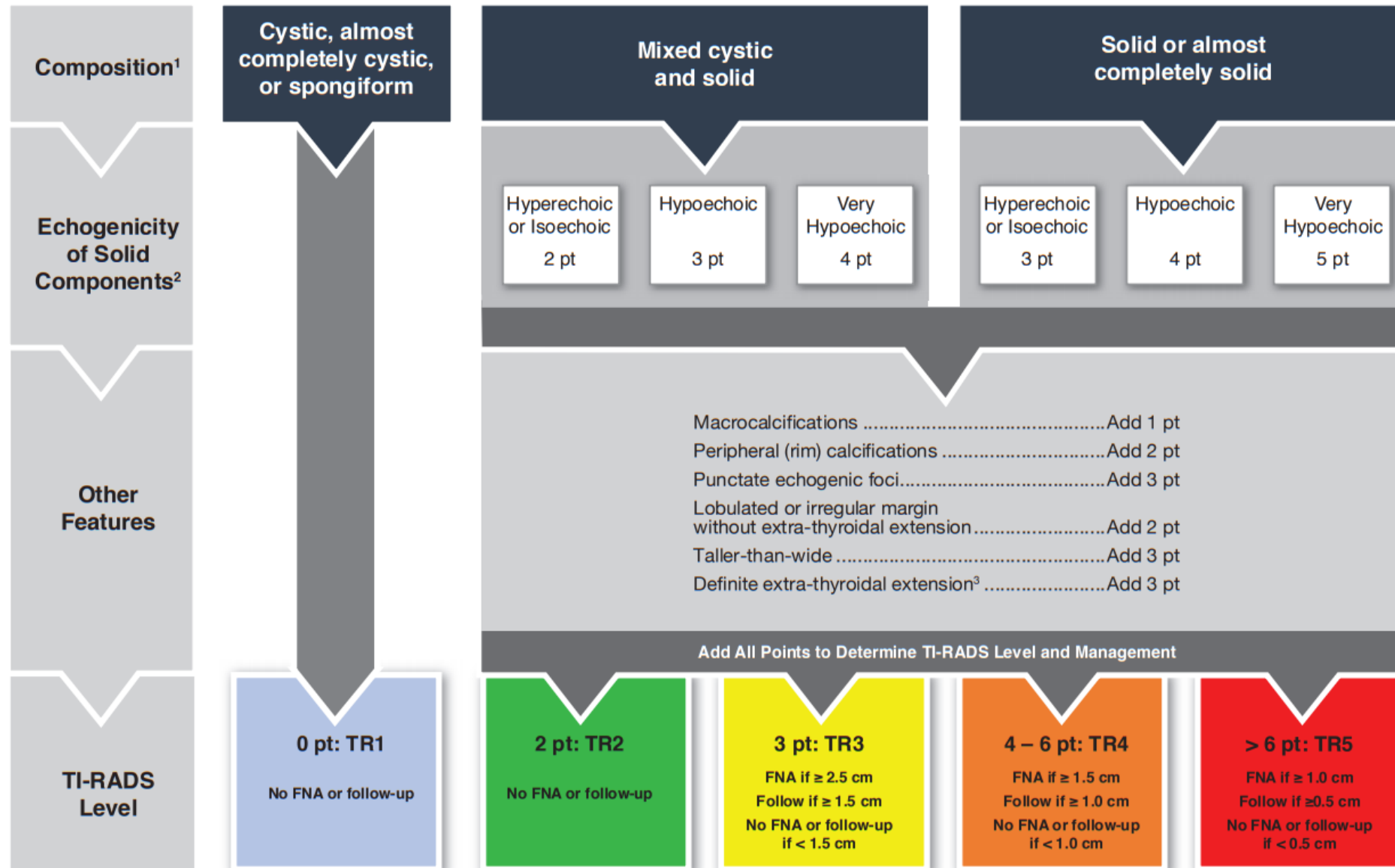
| COMPOSITION  | ECHOGENICITY   | SHAPE   | MARGIN   | ECHOGENIC FOCI  |
|--|--|---|--|---|
| <p><i>Spongiform</i>: Composed predominantly (&gt;50%) of small cystic spaces. Do not add further points for other categories.</p> <p><i>Mixed cystic and solid</i>: Assign points for predominant solid component.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

\*Refer to discussion of papillary microcarcinomas for 5-9 mm TR5 nodules.





# ACR TI-RADS™



<sup>1</sup> Classify nodule as solid if composition cannot be determined

<sup>2</sup> Classify nodule as isoechoic if echogenicity cannot be determined

<sup>3</sup> Nodules with definite extra-thyroidal extension should be considered malignant until proven otherwise

# Special scenarios

- PET avid nodule
- Suspicious lymph nodes
- Previously biopsied nodule
- No nodules to recommend for management

# Objectives

- Discuss thyroid nodule work up and risk stratification
- Discuss clinical scenarios that may change imaging selection and case management



# Radiologic Assessment of Thyroid Disease

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