Thyroid Imaging Reporting and Data System (TI-RADS): A User's Guide[1]

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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.

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

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Radiologists who interpret thyroid ultrasonography (US) images frequently face the dilemma of how to report nodules, which are extremely common and overwhelmingly benign (1). Like risk-stratification systems from other professional societies and investigators, the American College of Radiology (ACR) Thyroid Imaging Reporting and Data System (TI-RADS) aims to provide an easy-to-apply method for practitioners to determine management (2). We believe that this will improve consistency across practices and institutions and will benefit patients by applying guidelines that are based on evidence and consensus expert opinion.

ACR TI-RADS is founded on the evaluation of US features in five categories—composition, echogenicity, shape, margin, and echogenic foci—in which each feature is assigned 0–3 points (Fig 1). Features in the first four categories each have a single score derived from mutually exclusive choices, whereas more than one feature may be present in the echogenic foci category. The nodule's point total determines its risk level, which ranges from TR1 (benign) to TR5 (highly suspicious). In conjunction with the nodule's maximum diameter, the TR level determines whether to recommend a fine-needle aspiration (FNA) biopsy, a follow-up US examination, or no further action. As with guidelines from professional groups such as the American Thyroid Association and the Korean Society of Thyroid Radiology, the threshold size for recommending FNA decreases as the US features become more malignant appearing (3,4). Because the threshold diameters for mildly and moderately suspicious nodules (TR3 and TR4) are larger than in other systems, adherence to ACR TI-RADS will result in fewer biopsies of benign nodules. Inevitably, however, it will also result in fewer biopsies of malignant nodules, which is why ACR TI-RADS recommends follow-up for some nodules that do not meet the size criteria for FNA.

Feature assignment and measurement are both subject to inevitable interobserver variation. Scanning protocols also come into play, as nodules must be captured and labeled on static images and/or real-time clips to be classified. Finally, the reporting process must be efficient and account for circumstances such as patient or referring physician preferences, previous biopsies, interval growth, and lymphadenopathy. The purpose of this article is to present our perspective on these issues and to provide practical advice to US practitioners who adopt ACR TI-RADS. The opinions expressed are ours and do not reflect or imply endorsement by the ACR.

Essentials

- Reports need only provide structured descriptions of up to four nodules that warrant further attention.
- An initial overview scan facilitates selection of nodules for further attention.
- The position and shape of the solid component of mixed cystic and solid nodules may influence management.

Scanning Protocol and Labeling

ACR TI-RADS recommends formally reporting up to four thyroid nodules with the highest point totals. Because sonographers perform most US studies in radiology practices in the United States, they are often the first ones to encounter nodules. Because it is often impractical for sonographers to obtain images of and measure every nodule, they must become familiar with the criteria that determine which ones warrant further attention from the interpreting radiologist. Before the implementation of ACR TI-RADS, we recommend that sonographers receive in-service training that covers feature assignments and measurement techniques. It also may be helpful to post the ACR TI-RADS chart in the scanning rooms, especially while sonographers are becoming familiar with the five feature categories.

For the patient's initial US study, we recommend that the sonographer take a minute or two to obtain an overview of the entire gland to look for nodules that might require further attention before capturing any images. He or she should then proceed to scan the entire gland following the sequence specified in the laboratory's protocol. In this step, the sonographer should measure up to approximately four nodules that are likely to be reported as requiring biopsy or follow-up based on ACR TI-RADS, as well as obtain sufficient images to document the architecture of the nodules.

As with all sonograms, depth, gain, zoom, focal zone, frequency, pre- and postprocessing, dynamic range, frame averaging, compounding, and other parameters should be optimized. We have also found that real-time clips are very helpful to highlight certain features, notably comet-tail artifacts, which may become more or less conspicuous as the scanning plane traverses the nodule. Nodules of interest may be numbered sequentially, but if the sonographer identifies more than four, their numbering scheme may conflict with the one that the radiologist reports subsequently. Therefore, if this is the patient's first US study, we recommend that the sonographer just label each nodule with its location in the gland (Fig 2). In practices that use worksheets, the sonographer may indicate the location of nodules diagrammatically to make it easier for the interpreting physician.

If the sonogram is being performed for follow-up, whenever possible, the sonographer should review prior images and reports to determine if any nodules were described and measured. Not every such nodule will require

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Abbreviations:
ACR = American College of Radiology
FNA = fine-needle aspiration
PEF = punctate echogenic foci
TI-RADS = Thyroid Imaging Reporting and Data System

Conflicts of interest are listed at the end of this article.

See also the article by Hoang et al in this issue.

Figure 1

Composition		Echogenicity		Shape		Margin		Echogenic Foci	
Cystic or almost completely cystic	0	Anechoic	0	Wider-than-tall	0	Smooth	0	None or large comet-tail artifacts	0
Spongiform	0	Hyperechoic or isoechoic	1	Taller-than-wide	3	Ill-defined	0	Macrocalcifications	1
Mixed cystic and solid	1	Hypoechoic	2			Lobulated or irregular	2	Peripheral (rim) calcifications	2
Solid or almost completely solid	2	Very hypoechoic	3			Extra-thyroidal extension	3	Punctate echogenic foci	3

Figure 1: Sonographic features and associated points grouped according to the five American College of Radiology Thyroid Imaging Reporting and Data System, or TI-RADS, categories.

Figure 2

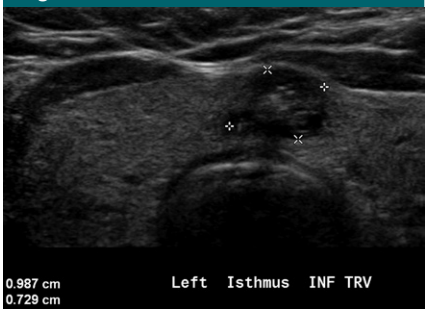


Figure 2: Transverse sonogram of a nodule in a 61-year-old woman. The annotation shows the nodule's location in the left isthmus.

Figure 3

Figure 3: Spongiform 0.9-cm nodule in a 59-year-old woman. More than 50% of the nodule is composed of small cystic spaces. The nodule received 0 points for composition because of its spongiform designation and no additional points in other categories (TR1).

formal reassessment on the current scan, but it is helpful to know where to look before reimaging. Additionally, if the previous sonogram was reported by using ACR TI-RADS, nodules should be numbered as they were in previous reports. To maintain consistency, this applies even if a previously reported nodule is no longer present. For example, if one of four nodules has resolved, the fourth nodule should still be denoted as number 4 on the images and in the report.

Feature Assignment: Improving Accuracy and Consistency

As noted previously, five feature categories form the cornerstone of ACR TI-RADS, and so it is critical to be as objective as possible in applying them. Some features are more straightforward than others—for example, it is usually not difficult to decide whether a nodule is hyperechoic or hypoechoic, but differentiating hypoechoic from markedly hypoechoic nodules may be more challenging. In this section, we offer guidance for the most problematic features in each category. Readers may consult the ACR TI-RADS reporting lexicon white paper, which contains images illustrating many of these features (5).

Composition

In ACR TI-RADS, nodules classified as spongiform are not subject to further feature assignment and are treated as benign, with no further follow-up needed. Most investigators agree that spongiform refers to the presence of very small cysts that are akin to the fluid-filled spaces in a wet sponge, but there is some controversy as to how much of the nodule must have this appearance to qualify (6,7). Per the ACR thyroid lexicon, at least 50% of the nodule's volume should be occupied by tiny cysts (Fig 3) (5). It should be possible to make this determination by observation; if the cystic components comprise less than 50%, the nodule should not be treated as spongiform. Additionally, the presence of other features such as peripheral calcifications or macrocalcifications, which are usually easy to recognize, means that a nodule should not be classified as spongiform. However, the small echogenic foci that represent the back walls of minute cysts should not be misinterpreted as echogenic foci. Nodules with shadowing calcifications that preclude assessment of their architecture are assumed to be solid and therefore receive 2 points for composition.

Distinguishing solid nodules from mixed cystic and solid nodules may be difficult in practice, as they represent a continuum. Unlike with spongiform nodules, ACR TI-RADS does not require that the observer estimate the percentage of a nodule that is solid, as this determination is often highly subjective and is less important than the characteristics of the solid component. This represents a departure from the lexicon, which explicitly describes predominately cystic and predominately solid nodules (5). As a general principle, however, otherwise-solid nodules that contain small cystic components that occupy no more than approximately 5% of the overall volume should be classified as solid (Fig 4).

For nodules that contain more than minimal solid components and

Figure 4

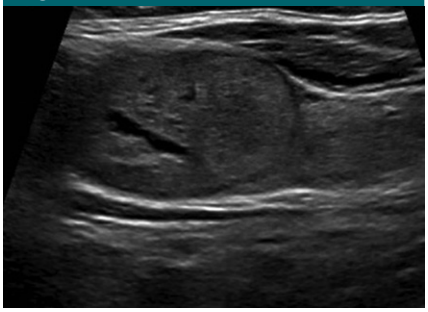


Figure 4: Sagittal sonogram of a 4.6-cm benign colloid nodule in a 65-year-old woman. It was classified as solid (composition score of 2), although small cystic components were present. With 1 more point for isoechogenicity and none in other categories, its point total was 3 (TR3).

Figure 5

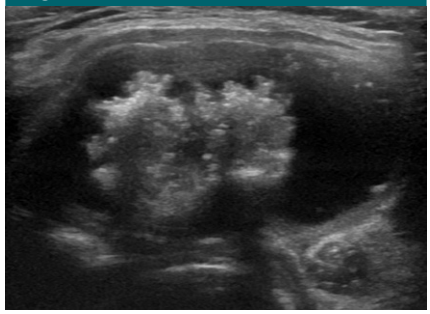


Figure 5: Mixed cystic and solid papillary cancer in a 39-year-old man has a lobulated solid mural component with punctate echogenic foci (PEF). The nodule received 1 point for composition, 1 for its isoechoic solid component, and 3 for PEF, for a total of 5 (TR4).

Figure 6

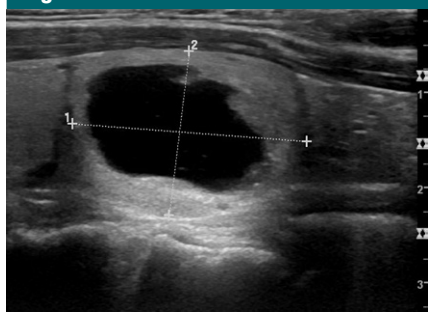


Figure 6: Benign mixed cystic and solid nodule (1 point) in a 40-year-old woman. The 1-point isoechoic solid component is distributed around the periphery. The nodule received 2 points (TR2).

Figure 7

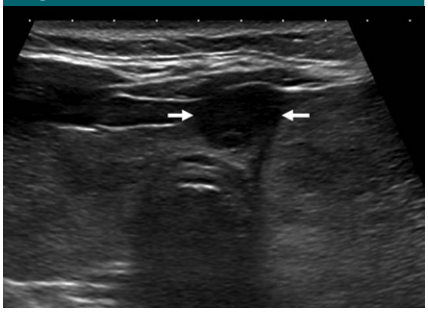


Figure 7: Transverse sonogram shows 2.0-cm markedly hypoechoic papillary carcinoma (arrows) in a 24-year-old woman. The nodule received 2 points for solid composition and 3 for marked hypoechogenicity, totaling 5 points (TR4).

are therefore categorized as mixed cystic and solid, the appearance of the solid component helps determine management. For example, the presence of punctate echogenic foci (PEF) or macro- or peripheral calcifications increases the nodule's suspicion level (8,9). These and other suspicious features that also apply to uniformly solid nodules contribute to the point score of mixed cystic and solid nodules. In addition, the nodule's maximum dimension, not the size of its solid component, governs recommendations. If the solid component is smaller than the size threshold for a completely solid nodule at a given TR level but the overall nodule is above the cutoff, FNA should be recommended. Nodules with suspicious solid tissue that are too small to warrant FNA will still usually require US follow-up, lessening the likelihood that clinically important malignancy will remain undetected in the long term.

Other characteristics of the solid components, including their position and shape, should also be considered. Position refers to the location and symmetry of the solid material relative to the whole nodule. Mural nodules that are isolated, masslike, and protrude into the fluid are more suspicious. Shape refers to the interface between the solid component and adjacent fluid. As with solid nodules, lobulation is a suspicious finding (Fig 5). Conversely, solid material that is relatively smooth and more-or-less evenly distributed around the periphery of a nodule is less concerning (Fig 6). Some authors have also called attention to the interface between solid mural components and the cyst wall, with acute angles being more worrisome (10,11). Position and shape do not contribute to the nodule's point total, but if the solid component exhibits any of these suspicious features, we occasionally recommend FNA even if the nodule does not otherwise meet criteria for biopsy. The presence of flow at color or power Doppler imaging does not reliably indicate that the solid component is malignant, nor does its absence mean that it is benign. However, when seen, vascularity shows that the solid material represents viable tissue rather than blood clot, debris, or necrotic tissue.

Echogenicity

Assigning echogenicity by using the adjacent thyroid parenchyma as a frame of reference is usually straightforward. However, relative reflectivity may vary considerably depending on scanning parameters, particularly gain, transmit frequency, compression, and pre- and postprocessing. When in doubt, we find it helpful to consider echogenicity in multiple planes of section. Real-time clips are valuable in problematic nodule assessments. Because hyperechoic and isoechoic nodules both receive 1 point in ACR TI-RADS, distinguishing them is not crucial. However, it is important to differentiate hypoechoic from markedly hypoechoic nodules, as the latter feature receives 1 additional point in this category. Nodules that are definitively less reflective than the anterior neck muscles, which should be visible on every image, are classified as markedly hypoechoic (Fig 7). Here, too, scanning parameters play a critical role, so it may be useful to obtain images at various gain settings. This maneuver may also facilitate identification of completely anechoic cysts that otherwise mimic markedly hypoechoic nodules. Conversely, the presence of flow within a uniformly hypoechoic nodule confidently characterizes it as solid. If dense calcification

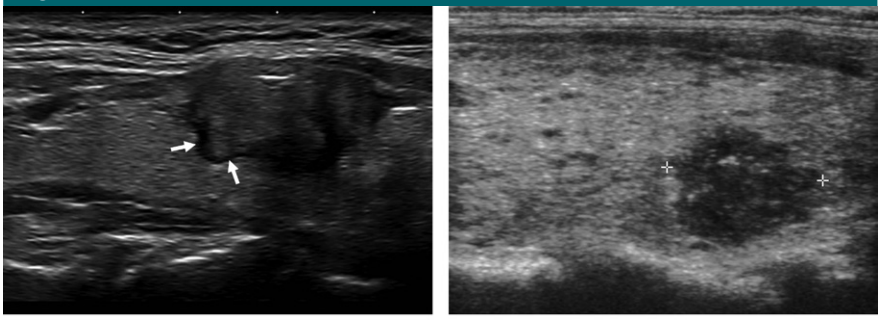
Figure 8

Figure 8: Transverse sonogram of a taller-than-wide papillary cancer in a 47-year-old man. In addition to 3 points for shape, the nodule warranted 2 points for solid composition, 1 point for isoechogenicity, and 3 points for numerous punctate echogenic foci, for a total of 9 points (TR5).

Figure 9

Figure 9: Transverse sonogram in a 52-year-old woman shows a benign follicular nodule with a smooth margin (arrows). The nodule was assigned 2 points for solid composition and 1 for isoechogenicity, for a total of 3 points (TR3).

Figure 10



a. **b.**

Figure 10: **(a)** Sagittal image of a 2.2-cm carcinoma in a 61-year-old man shows a lobulated margin (arrows), a 2-point feature. The nodule also received 2 points for solid composition and 2 for hypoechogenicity, for a total of 6 points (TR4). **(b)** Sagittal sonogram of a 1.2 cm carcinoma with an irregular (spiculated) margin in a 39-year-old woman. In addition to 2 points for its irregular margin, the nodule was assigned 2 points for solid composition, 3 points for very low echogenicity, and 3 points for punctate echogenic foci, for a total of 10 points (TR5).

Figure 11

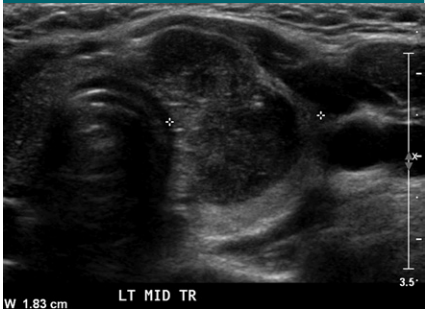


Figure 11: Papillary carcinoma bulging the thyroid border in a 24-year-old woman. No invasion was demonstrated at surgery. The nodule received 2 points for solid composition, 2 for hypoechogenicity, 3 for taller-than-wide shape, and 2 for a lobulated margin. Its point total was 9 (TR5).

makes it impossible to determine a nodule's echogenicity, it is assumed to be at least isoechoic or hyperechoic and receives 1 point in this category.

Shape

Like echogenicity, a nodule's shape (wider-than-tall or taller-than-wide) is rarely difficult to define. "Tallness" refers to a nodule's anteroposterior dimension and "width" to its transverse dimension on an axial image. A gestalt impression of whether a nodule is taller-than-wide is usually sufficient (Fig 8). The goal is to ascertain whether the nodule has grown more front-to-back than side-to-side, which suggests that it has violated tissue planes and is therefore suspicious (12). We also note that nodules that are perfectly round in cross section are technically neither wider-than-tall nor taller-than-wide. When that occurs, it is acceptable to report the nodule as either wider-than-tall or not taller-than-wide. Rarely, it may be appropriate to assess this characteristic on a sagittal image if a nodule is obliquely oriented in that plane, as it may be round in cross section.

Margin

A nodule's margin, defined as the character of its interface with adjacent intra- or extrathyroidal tissue, is best appreciated along its anterior border, which is orthogonal to the ultrasound beam. This is facilitated by scanning with the depth adjusted to show the part of the nodule closest to the transducer. A smooth margin is characterized by an even, gradually curving interface (Fig 9). If lobulation, angulation, or intrusion of the nodule's solid component into the surrounding tissue is present to any extent, the margin should be classified as lobulated or irregular; both warrant 2 points, so it is not important to distinguish them (Fig 10). Extrathyroidal extension is a 3-point feature that is characterized by clear-cut invasion of adjacent structures. This appearance, which is pathognomonic for malignancy, should not be recorded merely because a nodule bulges the border of the thyroid gland (Fig 11). US clips may be helpful to demonstrate that a nodule truly invades the soft tissues, as they will be fixed as the transducer moves. If the nodule's border is not depicted clearly, it is categorized as ill defined and receives 0 points for margin, as this is not a discriminatory feature.

Echogenic Foci

Macrocalcifications and peripheral calcifications rarely present diagnostic problems, as they are usually associated with at least some degree of acoustic shadowing. However, PEF, which may represent psammoma bodies in papillary cancers, are less straightforward. Many PEF are not psammomatous and actually represent the back walls of minute cysts. Additionally, the

speckle pattern of normal or nonmalignant thyroid tissue may at times contain minute bright dots that should not be misinterpreted as PEF (Fig 12). Therefore, we do not report them unless they are discrete and appear only within the nodule, not in adjacent thyroid tissue. This pitfall may be avoided by scrutinizing the suspicious tissue and adjacent parenchyma. If dots are present in both, they are probably not PEF for the purpose of ACR TI-RADS classification. The only exception is the diffuse sclerosing variant of papillary carcinoma, which should not present a problem in diagnosis (13).

ACR TI-RADS distinguishes between small and large comet-tail artifacts. The latter, which are larger than 1 mm and are V shaped, are associated with colloid and are reliable signs of benignity when found in the cystic components of nodules. On the other hand, small comet-tail artifacts should be treated as PEF and therefore receive 3 points when embedded in hypoechoic, solid tissue (Fig 13) (14). If both types coexist in a nodule, the more suspicious one determines how many points to assign. The central tenet is that the mere presence of any comet-tail artifacts should not be grounds for concluding that a nodule is benign.

When different types of echogenic foci are present, the points for each type are summed to determine the overall point total for echogenic foci. For instance, a nodule containing both peripheral calcifications and macrocalcifications would be assigned 3 points in this category (1 point for macrocalcifications plus 2 points for peripheral calcifications). This differs from the other categories, in which the single finding with the highest point value is used to determine the point assignment for that feature.

Measuring Nodules: How to Reduce Errors

ACR TI-RADS recommends measuring a nodule's longest axis and the largest dimension perpendicular to the longest axis on a transverse (axial) image and the largest craniocaudal dimension on a sagittal image. These measurements usually lie parallel or perpendicular to the sound beam, but they will be angled if the nodule is obliquely oriented. Regardless, nodules should be measured by using the same technique that was used in prior studies to assess growth, which may be based on changes in linear measurements or volume.

To improve consistency on follow-up examinations, sonographers/sonologists should review prior sonograms to determine which nodules may warrant continued attention and see how they were measured. Current US systems equipped with high-frequency linear array transducers achieve very high spatial resolution. In practice, however, measurement accuracy is hampered by interobserver variability that is chiefly related to poor border conspicuity. This limitation, which is a property of the interface between the nodule and its surroundings, can be mitigated by meticulous technique, but not eliminated entirely.

As with other features, scanning parameters play an important role. Notably, settings that would be inappropriate for characterizing internal architecture may enhance the visibility of a nodule's margin. For example, lowering the dynamic range or altering pre- and postprocessing settings may make it easier to distinguish the nodule from adjacent tissue, making it easier to tell where to place measurement calipers. Despite the imager's best efforts, however, some nodules cannot be measured reliably if they are poorly defined and merge with their surroundings. When this occurs, this limitation should be noted in the report.

Figure 12

Figure 12: Sonogram of the left thyroid lobe in a 42-year-old man. Minute bright dots representing the speckle pattern of normal or nonmalignant tissue (arrow) should not be misinterpreted as punctate echogenic foci.

Figure 13

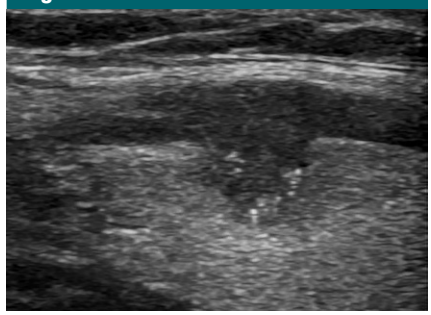


Figure 13: Small comet-tail artifacts and additional echogenic foci (punctate echogenic foci [PEF]) in a papillary carcinoma in a 54-year-old woman. In addition to 3 points for PEF, the nodule was assigned 2 points for solid composition, 2 for hypoechogenicity, and 2 for a lobulated margin, for a total of 9 points (TR5).

Reporting Considerations

Reports of thyroid sonograms should include the following elements:

1. Tridimensional measurements of the right and left lobes and the anteroposterior dimension of the isthmus.
2. An overall description of the thyroid parenchyma.
3. Formal description of up to the four most suspicious nodules.
4. Recommendations for management.

Nodules not reported formally may be mentioned in the overall description by calling attention to them and stating that none warrant FNA or follow-up US per ACR TI-RADS. The sole exception is when a US study is performed to evaluate a nodule that was palpated or detected at another imaging examination. Even if no further action is required, the nodule in question should be formally reported, along with any suspicious incidental nodules.

Per ACR TI-RADS, glands that contain multiple nodules with similar US characteristics usually do not warrant biopsy because it is impractical to sample every nodule. There is no evidence to suggest that performing FNA on the largest nodule improves patient outcomes. For this reason, we recommend

Figure 14

Nodule number: 1

Location: Left upper

Composition: Solid

Echogenicity: Isoechoic

Shape: Wider-than-tall

Margin: Smooth

Echogenic Foci: Peripheral calcifications; macrocalcifications

Size: 1.2 x 1.1 x 0.9 cm

Total Points: 6

ACR TI-RADS category: TR4

Figure 14: Structured template for American College of Radiology (ACR) Thyroid Imaging Reporting and Data System (TI-RADS) reporting.

against the designation "dominant nodule," which is often applied to the largest nodule in the gland. Biopsy is recommended only if one or two nodules have high point totals that would warrant FNA, regardless of whether multiple nodules are present.

We have found that formal reporting is faster with structured report templates that include the elements in ACR TI-RADS (Fig 14). Such templates are easy to implement in any voice recognition system. With practice, we have found that it takes no more than approximately 20 seconds to report each nodule. This approach also makes it easier for referring physicians to read and understand reports, as well as to implement quality assurance and control procedures and peer review.

The ACR TI-RADS chart provides descriptors for each of the five suspicion levels: benign (TR1), not suspicious (TR2), mildly suspicious (TR3), moderately suspicious (TR4), and highly suspicious (TR5). In a recent study, they were associated with aggregate cancer risks of 0.3%, 1.5%, 4.8%, 9.1%, and 35.0%, respectively (15). The ACR TI-RADS recommendations for FNA and follow-up were in part informed by the growing recognition that many thyroid cancers are indolent and unlikely to cause harm to patients during their lifetime (16). Nevertheless, we recognize that patients are increasingly able to view imaging reports though portals and other means and that they may be concerned that an 8-mm TR4 nodule described as "moderately suspicious" will not be sampled for biopsy or even followed up. For this reason, radiologists may elect not to mention the risk descriptors in reports.

By no means are we advocating withholding information; rather, we wish to avoid misinterpretation by patients who may not fully understand the difference in clinical importance between a moderately suspicious thyroid nodule and a similarly suspicious pulmonary lesion. Alternatively, radiologists may report aggregate risks or risk ranges. We also believe that radiologists should discuss reporting preferences with referring physicians to avoid misunderstandings.

Every report that includes one or more formally reported nodules must also provide recommendations for management, whether FNA, follow-up US, or no further action. We believe that statements such as "clinical correlation is needed to determine the need for biopsy" should be avoided. Endocrinologists and other referring physicians should be expected to apply reasonable standard-of-care principles in deciding whether to follow the radiologist's recommendations. For example, a highly suspicious nodule in a patient with a limited life expectancy or other issues may not require biopsy.

Conversely, patient or referring physician preferences may at times warrant deviation from the strict ACR TI-RADS guidelines. Patients with a strong personal or family history that increases the likelihood of cancer, or patients who are highly concerned for other reasons, may require FNA and/or follow-up of nodules that fall below ACR TI-RADS size thresholds. This involves the radiologist in shared decision making that is appropriate for effective medical care. Similarly, ACR TI-RADS recommends FNA of no more than two nodules in one gland, but circumstances may rarely require tissue sampling of more than two nodules.

ACR TI-RADS does not encompass regional lymph nodes, but we believe that at least a brief assessment of nodes may be helpful in determining the need for biopsy in the setting of thyroid nodules. This practice is in keeping with scanning protocols from professional organizations (3,4). If a node has a suspicious appearance, but there are no thyroid nodules that warrant FNA, the node should be sampled. In some patients, it may be appropriate to biopsy a suspicious nodule that does not meet the size threshold for its ACR TI-RADS level. A comprehensive evaluation of nodes is required in patients known to have or suspected of having thyroid cancer. It may be performed at the time of the initial thyroid US examination, in conjunction with a US-guided biopsy, or as a separate preoperative US evaluation after a cancer diagnosis has been made with biopsy.

ACR TI-RADS does not specify what to recommend for nodules that have been sampled previously. Radiologists may defer decisions regarding follow-up US or repeat FNA to referring physicians, who may have information regarding previous biopsy results that are unavailable to the radiologist interpreting a thyroid sonogram. Decisions regarding the need for repeat biopsy will usually be made by the referring physician based on guidelines from the American Thyroid Association or other professional groups (3).

It is also important to recognize that even benign nodules may assume a more suspicious appearance following biopsy, causing them to appear more solid, hypoechoic, or calcified. These so-called mummified nodules will have a higher ACR TI-RADS score, but recent evidence suggests that such nodules should be approached more conservatively and can likely be safely followed with US rather than repeat FNA, regardless of their score (17).

Growth and Follow-up

ACR TI-RADS borrows from the American Thyroid Association guidelines and defines clinically important

growth as a 20% increase in at least two nodule dimensions and a minimal increase of 2 mm, or a 50% or greater increase in volume (3). If a nodule enlarges to the point where it exceeds the size threshold for its ACR TI-RADS level, we recommend FNA, if this has not already been performed. Although rapid enlargement is suspicious, growth does not reliably distinguish between benign and malignant nodules (18). However, nodules that do not grow substantially over the course of 5 years (based on comparison between initial and 5-year sonograms) may be considered benign. Nodules that exhibit an interval increase in ACR TI-RADS level but remain below the size threshold for FNA should be imaged with follow-up US in 1 year.

Conclusion

The ACR TI-RADS risk-stratification system allows practitioners to determine whether thyroid nodules require biopsy, follow-up, or no further action based on their US appearance. Success demands close cooperation between radiologists and sonographers, understanding of the nuances and pitfalls of feature assignments, and attention to detail in reporting and making recommendations.

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Biparametric Prostate MR Imaging Protocol: Time to Revise PI-RADS Version 2?

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Editor:

With great interest, we read the Letters to the Editor by Dr Scialpi and colleagues (1) in the January 2018 issue of *Radiology* and Drs Kaji and Inamura (2) in the February 2018 issue of *Radiology* commenting on the article by Dr Kuhl et al in the July 2017 issue of *Radiology* (3) about a possible reduction in acquisition time of multiparametric magnetic resonance (MR) imaging of the prostate. In particular, Dr Kuhl and colleagues investigated the diagnostic accuracy of a shortened biparametric MR imaging protocol composed by the sole evaluation of axial T2-weighted and diffusion-weighted imaging. The authors showed how this approach led to a similar diagnostic performance in the detection of prostatic lesions compared with the standard multiparametric MR imaging protocol. In the first letter, Dr Scialpi and colleagues (1) pointed out that the elimination of sagittal and coronal T2-weighted images could make it difficult to measure both prostate and lesion volume, as well as to perform targeted biopsy when using fusion systems that require these planes. Furthermore, Dr Scialpi and colleagues suggested that the sagittal plane is essential for the assessment of extraglandular disease. On the other hand, Drs Kaji and Inamura pointed out that, in the article by Dr Kuhl and colleagues, patients were considered having a positive index test result when they had a Prostate Imaging Reporting and Data System (PI-RADS) score of 3, 4, or 5 (2–3). In this setting, considering that dynamic contrast-enhanced (DCE) evaluation allows only for an upgrade of PI-RADS score from 3 to 4 (4), it is clear that its possible contribution to a correct diagnostic assessment is not significant. Our opinion, which is consistent with data available in the literature, is that biparametric MR imaging offers clear and significant advantages over standard multiparametric MR imaging, providing a similar diagnostic accuracy but leading to a significant reduction of acquisition time, which is directly related to both patient discomfort and costs (5). Future studies are strongly warranted to better identify and evaluate all possible strategies and combination of T2-weighted imaging and diffusion-weighted imaging, considering all advantages and disadvantages of their combination. However, in the transition from PI-RADS version 1 to PI-RADS version 2, the role of MR spectroscopy and DCE imaging was already reappraised and reduced, and at the time further concerns regarding the usefulness of DCE were raised (6). In light of the recently published articles on shortened biparametric MR imaging prostatic protocols (3,5,7), our opinion is that DCE should no longer be considered mandatory and its role further revised within a new and up-to-date version of PI-RADS.

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Erratum

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Thyroid Imaging Reporting and Data System (TI-RADS): A User's Guide

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Figure 9 legend should read as follows: Transverse sonogram in a 52-year-old woman shows a benign follicular nodule with a smooth margin (arrows). The nodule was assigned **2 points** for **solid** composition and 1 for isoechogenicity, for a total of **3** points (**TR3**).