ORIGINAL ARTICLE

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

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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].

Ultrasound is superior to other modalities in characterizing thyroid nodules. Unfortunately, the findings are often not specific, and definitive diagnosis usually requires fine-needle aspiration (FNA) biopsy or even surgery. Because nodules are so common, a significant burden is placed on the health care system, and considerable anxiety

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may occur in patients. Furthermore, the majority of thyroid cancers are of the papillary type, which is typically indolent. Long-term studies by Ito et al [4] showed no difference in outcomes between patients with biopsy-proven carcinomas <1 cm undergoing thyroidectomy and those followed with no surgical intervention.

The literature regarding thyroid nodule characterization with ultrasound is expansive, and several professional organizations have put forth position or consensus statements. The two best known in the United States are from the American Thyroid Association (ATA) and the Society of Radiologists in Ultrasound [5,6]. Because FNA biopsy is such an integral part of the workup of thyroid nodules, the American Society of Cytopathology convened its own consensus panel to standardize reporting of biopsy results, which is known as the Bethesda classification [7].

Several authors have suggested a standardized risk stratification system called the Thyroid Imaging, Reporting and Data System (TIRADS), modeled on the BI-RADS® system for breast imaging, which has received widespread acceptance [8-10]. These proposals include the initial report by Horvath et al [9], as well as subsequent proposals by Kwak et al [8] and Park et al [10]. Despite these efforts, none of these TIRADS classifications have been widely adopted, particularly in the United States.

Our objective, therefore, was to develop a practical, standard lexicon for describing the sonographic characteristics of thyroid nodules, with the ultimate aim of applying it to risk stratification and triage of nodules for consistent follow-up in clinical practice.

METHODS

Beginning in 2012, a group of radiologists with expertise in thyroid imaging undertook a three-stage process under the auspices of the ACR; a subcommittee was charged with completing each one. The first effort, led by Lincoln Berland, MD, and Jenny Hoang, MBBS, was aimed at proposing recommendations for nodules discovered incidentally on imaging. This work led to a white paper published in 2015 [11]. The work reported here on the development of an ultrasound lexicon was led by Edward Grant, MD, whereas the final stage, which will be directed at risk stratification on the basis of the lexicon, will be led by Franklin Tessler, MD.

After an extensive literature review, relevant articles were distributed to all subcommittee members. Each radiologist was assigned three or four articles and was asked to list terms used by the authors to describe thyroid nodules. ACR staff members collated the lists, and a master list

was drawn up. Frequency of use was the initial guide for determining which terms would be included in the lexicon.

The committee initially identified nine categories or families of terms that could be applied to all thyroid nodules: nodule composition, echogenicity, characteristics of cystic/solid components, shape, size/dimensions, margins, halo, echogenic foci, and flow/Doppler. Next, subcommittee members re-reviewed the literature to determine whether there was evidence that the categories and terms had discriminatory value in distinguishing benign from malignant nodules, which led to culling the category list. This process resulted in the selection of six final categories. Several of the original categories as well as numerous terms were eliminated from the lexicon or incorporated into other groups based either on infrequency of use or lack of statistical agreement with regard to their diagnostic value. Two members were assigned to develop definitions for each category and its individual terms in a format used for other ACR "RADS" lexicons.

THYROID ULTRASOUND CATEGORIES

Category 1: Composition

Definition.

- Composition describes the internal components of a nodule, that is, the presence of soft tissue or fluid, and the proportion of each.
  - Solid: Composed entirely or nearly entirely of soft tissue, with only a few tiny cystic spaces (Fig. 1A).
  - Predominately solid: Composed of soft tissue components occupying 50% or more of the volume of the nodule (Fig. 1B, online only).
  - Predominately cystic: Composed of soft tissue components occupying less than 50% of the volume of the nodule (Fig. 1C, online only).
  - Cystic: Entirely fluid filled.
  - Spongiform: Composed predominately of tiny cystic spaces (Fig. 1D, online only).

Background and Significance.

- A nodule should fit into one of the foregoing five categories. However, rarely, it may be difficult to determine if a nodule is filled with hemorrhagic material or is solid. Color Doppler flow may be useful in differentiating between the two.
- Papillary thyroid carcinoma (PTC) is most commonly solid, but many solid nodules are also benign; a solid nodule has a 15% to 27% chance of being malignant [6]. Some nodules undergo cystic degeneration or necrosis. A recent study of partially cystic nodules showed that the