Can a Radiological Scoring System for Assessing the Malignant Potential of Thyroid Nodules be Safely Applied in Clinical Practice?

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Introduction

Thyroid nodules have a high prevalence within the general population, with some studies reporting prevalences of up to 68%[1].

Currently, the majority of thyroid nodules, including those found incidentally, require fine needle aspiration and biopsy (FNAB) to determine their malignant potential. It is hoped that a radiological scoring system can be used to safely identify those nodules that need not undergo further investigation,. [2-5]

Whilst considerable overlap in radiological characteristics exists for benign and malignant lesions. Recently validated radiological criteria using a thyroid imaging reporting and data system scoring (TIRADS) have shown correlation between six suspicious features and a cumulative risk of malignancy (table 1). [2,3,4]

The purpose of this study was to assess the potential of TIRADS for implementation into clinical practice at our institution

TIRADS identified six radiological features with a cumulative risk of malignancy: [2, 3 + 4]

Solid Composition

Microcalcifications

Microlobulated or Irregular Margins

Hypoechogenicity
(Darker than surrounding thyroid parenchyma)

Marked Hypoechogenicity
(Darker then infrahyoid/strap muscles)

Taller than Wide
(Anteroposterior diameter > Transverse diameter)

Conclusions

In our centre the TIRADS diagnostic accuracy on static ultrasound appeared inferior to current established diagnostic techniques. This may be due to the retrospective use of a limited number of static images.

We anticipate that prospective use of TIRADS using dynamic images alongside current clinical diagnostic techniques will be more accurate.

We hope that through this audit we have managed to introduce an objective means of uniform assessment and reporting of thyroid nodules that has the potential to safely reduce the number of unnecessary FNABs.

Objective

To assess sensitivity, specificity and reliability of ultrasound scanning (USS) in evaluation and differentiation of benign from malignant thyroid lesions.

	TIRADS score				
	1	**2**	**3**	**4**	**5**
Interpretation	Negative	Pattern consistent with benignity	Probably Benign	**4a**: low suspicion for malignancy **4b**: Intermediate suspicion for malignancy **4c**: Concerning	Highly suggestive of malignancy
Number of Suspicious US features	0	0	0	**4a**: 1 **4b**: 2 **4c**: 3 or 4	5
Risk of Malignancy (%)	0	0	<5	**4a:** 5-10 **4b/c:** 10-80	>80

Table 1: Breakdown of how TIRADS score has been previously demonstrated to correlate with risk of malignancy. Distinction between TIRADS 2 and 3 is dependent upon the presence of specific patterns known to represent a benign nodule. Adapted from [2 + 3]
US: Ultrasound Scan

Methods

Patients presenting with a thyroid nodule between 2007 and 2012 to the thyroid service at our institution and in whom surgical histology data was subsequently available were studied.

Pre-operative thyroid ultrasound images were anonymised and retrospectively reviewed by two independent, blinded, radiologists. Only static images were available for analysis.

Each nodule was assigned a TIRADS score.

In concordance with previous studies, nodules assigned a score of 1-3 were considered benign and those assigned a score of 4a-c and 5 were considered malignant.

Final histology was used as the definitive outcome variable. TIRADS sensitivity, specificity, positive and negative predictive values for malignancy were determined. In addition, a Cohen's Kappa coefficient (κ) was used to determine inter-radiologist agreement. The Kappa coefficient demonstrates the statistical power of agreement between radiologists.

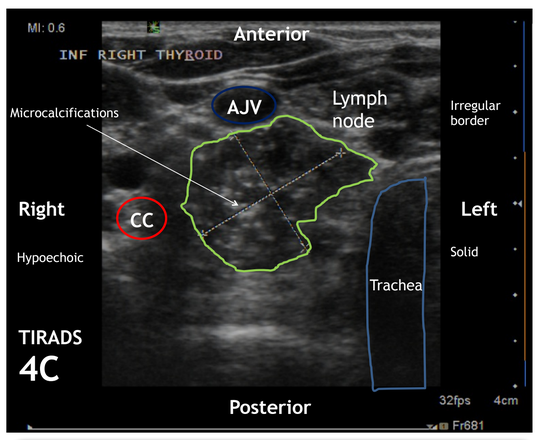

Fig 1. Example of a papillary thyroid carcinoma with a TIRADS score of 4C, note the four suspicious features. CC Common Carotid Artery; AJV Anterior Jugular Vein

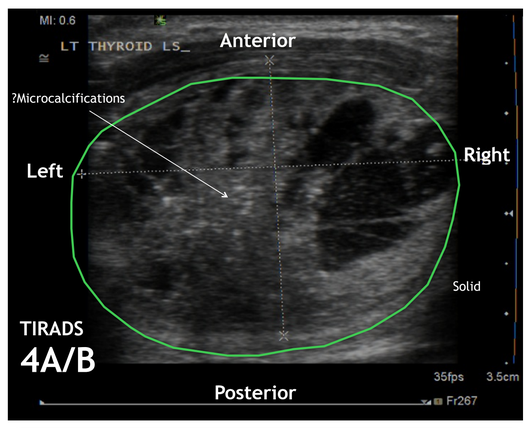

Fig 2: An example of a papillary thyroid carcinoma that both radiologists had difficulty with. A score of 4A was assigned due to its predominantly solid composition. However, neither radiologist could confidently decide whether or not the areas marked 'microcalcifications' were colloid or calcification. This highlights the difficulties with static image reporting.

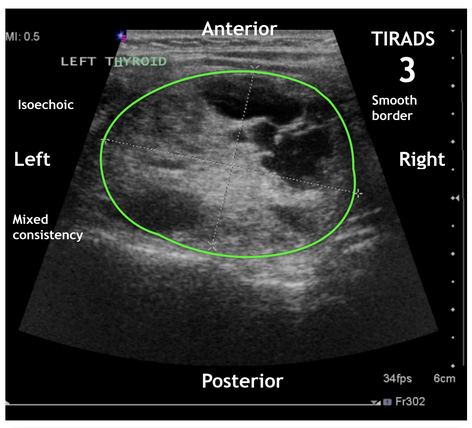

Fig 3. Example of a benign colloid nodule with no features suspicious of malignancy

Results

Of 58 patients (45F, 13M), with 71 nodules, 49 benign, and 22 malignant nodules were identified histologically.
In total 18 patients had a malignancy, three of which were multifocal.

Of the 22 malignant nodules, 15-18 were assigned a TIRADS score >3 by our two radiologists. Conversely, 15-16 of the 49 benign nodules scored ≤3. A TIRADS score of 4a or higher yielded a sensitivity of 68.2 - 81.8% and a specificity of 30.6-32.7% for malignancy. Importantly 5.63 - 9.86% of malignancies were missed using TIRADS.

Ranges represent reporting discrepancies between the radiologists.

Our radiologists agreed on final TIRADS score (≤3 vs >3) in 83.1% of cases, κ=0.60.

There were two key limitations in our study. Firstly, the use of retrospective scans meant only static images were available for analysis. Secondly, these scans were performed by radiologists of varying experience who were not specifically looking to demonstrate TIRADS criteria. This made interpretation challenging for our radiologists.

References

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