

Benign Cytology in Highly Suspicious Thyroid Nodules: Punctate Echogenic Foci as a Source of Diagnostic Discordance in Bethesda-TIRADS Scoring System

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ABSTRACT

Introduction
Within the TIRADS, identification of punctate echogenic foci (PEF) within thyroid nodules results in a classification of TIRADS 4 or 5, often prompting fine needle aspiration (FNA). Studies have shown that there is a wide range of risk of malignancy for TIRADS 4 and 5 nodules, between 20% and 70%.

Methodology
We evaluated the diagnostic utility of PEF identification and investigated instances of discordance. This single-center retrospective study reviews patient records to identify adults with thyroid nodules evaluated by ultrasound and cytology between 2010-2026. Inclusion criteria include nodules classified as TIRADS 4–5 with punctate echogenic foci and corresponding Bethesda cytology, with adequate clinical data. Descriptive statistics and binary logistic regression analysis are used to assess associations and estimate proportions.

Results
A total of 127 cases were included in the study. The mean age was 55.4 years, and most cases were female (76.4%), while the remaining were male. Most nodules with punctate echogenic foci were classified as TIRADS 5 (70%), followed by TIRADS 4/5 and 4. On the subsequent cytology, Bethesda II (51.9%) was the most common, followed by Bethesda VI, III, I, and V.

A binary logistic regression analysis showed that among nodules with punctate echogenic foci, TIRADS 5 nodules had 7.8 times higher odds of malignancy than TIRADS 4 nodules (p = 0.0015). Papillary thyroid carcinoma was the most frequent cancer diagnosed. However, the malignancy rates, even in the presence of PEF, are 9.4% and 44.6% for TIRADS 4 and 5, respectively.

Conclusion
Our study shows that thyroid nodules are being overcalled as TIRADS 5, to which PEF contribute significantly, thereby increasing rates of FNA of benign nodules. This study is ongoing, and will further review the cases to differentiate whether the etiology of the calcifications represent inspissated colloid or psammoma bodies.

BACKGROUND

The Thyroid Imaging Reporting and Data System (TIRADS) is a reporting system for thyroid nodules on ultrasound proposed by the American College of Radiology. Scoring is determined from five categories of ultrasound findings: composition, echogenicity, shape, margin, and echogenic foci. The higher the cumulative score, the higher the TIRADS level and the likelihood of malignancy.

The diagnostic accuracy of TIRADS appears to be moderate, with 89.5% sensitivity and 54% specificity (7). In our experience, the TIRADS system is more sensitive and less specific than these reported statistics. TIRADS V, which is described to be highly specific for the presence of malignancy, has been frequently observed to assigned to Bethesda II nodules at our institution. Punctate echogenic foci (PEF), which are assigned 3 points in TIRADS, commonly upgrade thyroid nodules to TIRADS V, necessitating fine needle aspiration and cytologic evaluation. In this preliminary study, we set to characterize our institutional TIRADS-Bethesda concordance in thyroid nodules with PEF.

RESULTS

A total of 127 cases were included in the study. The mean age was 55.4 years, and most cases were female (76.4%), while the remaining were male. The nodules were located most commonly in left lobe (n=48%), followed by right lobe (45.6%), isthmus (4.7%), and bilaterally (1.5%). Most nodules with punctate echogenic foci were classified as TIRADS 5 (70%), followed by 4 (27.8%) and 4/5 (2.4%).

Bethesda	TIRADS 4	TIRADS 4/5	TIRADS 5
1	0	0	8
2	26	0	40
3	6	0	4
4	2	0	5
5	0	1	5
6	1	2	24

Figure 1. Heatmap shows the distribution of Bethesda categories across TI-RADS groups.

MATERIALS AND METHODS

- Study type: Single-center retrospective study
- Inclusion Criteria:
 - Adults aged 18 years and older
 - Patients with thyroid nodules evaluated through ultrasound and cytology between January 2010-2016
 - Thyroid ultrasound findings of punctate echogenic foci categorized s TIRADS-3, -4, or –5
 - Available corresponding Bethesda cytology
 - Adequacy of clinical records
- Statistical analysis:
 - Descriptive statistics (mean, SD, frequency)
 - Proportion estimation
 - Chi-square test
 - Measures of diagnostic accuracy (sensitivity, specificity, positive predictive value, and negative predictive value)

On the subsequent cytology, Bethesda II (51.9%) was the most common, followed by Bethesda VI (21.2%), III (7.8%), I (6.2%), and V (4.7%) (Figure 1).

A binary logistic regression analysis showed that among nodules with punctate echogenic foci, TIRADS 5 nodules had 7.8 times higher odds of Bethesda V/VI designation than TIRADS 4 nodules (p = 0.0015). Papillary thyroid carcinoma was the most frequent cancer diagnosed (23/127 cases). However, the Bethesda V/VI designation rates, even in the presence of PEF, are 9.4% and 44.6% for TIRADS 4 and 5, respectively.

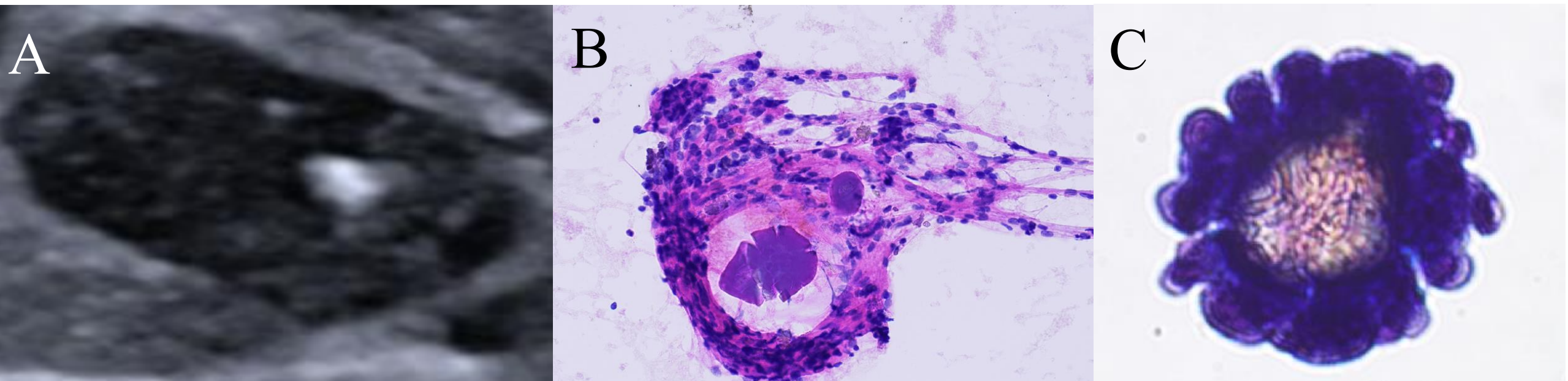


Figure 2. Sonographic image of thyroid nodule with PEF, designated TIRADS 5 (A). Cytologic image of inspissated colloid identified in Bethesda II nodule (B). Cytologic image of a psammomatous calcification identified in Bethesda VI nodule (C).

CONCLUSIONS

- Within our institution, thyroid nodules with punctate echogenic foci are most frequently designated as TIRADS 5, and subsequently determined to be Bethesda V or VI.
- This corresponds with an increased rate of fine needle aspirations conducted on thyroid nodules determined to be Bethesda II.
- Further cytologic and sonographic review is needed to the determine the outcomes of Bethesda V/VI nodules based on surgical pathology reports, as well as determine the cytologic morphology of the calcifications and to investigate potential sonographic features which may be used to further stratify the finding of punctate echogenic foci.

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