

Ultrasonography and fine-needle aspiration in indeterminate thyroid nodules: A systematic review of diagnostic test accuracy

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Background

- Ultrasonography can lead to over-diagnosis and unnecessary treatment of thyroid nodules
- American Thyroid Association (ATA) and American College of Radiology (ACR) have established criteria to help guide sonographic reporting
- Fine-needle aspiration biopsy (FNAB) has a high specificity for detecting malignancy, but 10–20% of nodules are classified as cytologically indeterminate (Bethesda III or IV)
- The purpose of this study was to determine whether combining sonographic risk stratification and cytology improves post-test probability of thyroid malignancy

Methods

- Registered in PROSPERO (CRD42020179869)
- We included full-text studies that reported both sonographic (e.g., TIRADS or ATA criteria) and cytology data in adults with Bethesda III and IV nodules. Our reference standard was final surgical pathology or core-needle biopsy
- We searched Medline, EMBASE, and Web of Science from database inception to April 15, 2021
- Study quality was assessed using QUADAS-2 tool
- We utilized a random-effects bivariate model to investigate sensitivity, specificity and likelihood ratios
- Heterogeneity was assessed using I^2 and an alpha of 0.05 denoted statistical significance

Results

- We identified 7416 articles, of which 15 were included in the meta-analysis
- All studies were observational cohort in design and reported similar distribution in patient demographic factors
- We found no evidence of publication bias and study bias was primarily notable for lack of reporting of blinding status or the index test or reference standard

Table 1. Pooled analysis for BSRTC III thyroid nodules (95% CI)

Sonographic risk stratification criteria	No. of studies	No. of thyroid nodules	Pooled sensitivity	Pooled specificity	Positive likelihood ratio (PLR)	Negative likelihood ratio (NLR)	Diagnostic odds ratio (DOR)	Post-test probability (%) ⁺	
								Positive test	Negative test
K-TIRADS	6	1288	0.78 (0.62, 0.89)	0.53 (0.31, 0.74)	1.66 (1.09, 2.55)	0.41 (0.24, 0.71)	4.01 (1.74, 9.27)	15.6 (10.8, 22.1)	4.60 (2.60, 7.30)
ATA	5	735	0.52 (0.25, 0.77)	0.90 (0.74, 0.97)	5.12 (2.36, 11.1)	0.54 (0.32, 0.92)	9.51 (3.71, 24.4)	36.3 (20.8, 55.2)	5.70 (3.40, 9.30)
EU-TIRADS	5	552	0.38 (0.20, 0.60)	0.81 (0.73, 0.87)	1.97 (1.19, 3.26)	0.77 (0.56, 1.05)	2.57 (1.16, 5.71)	18.0 (11.7, 26.6)	7.90 (5.90, 10.4)
ACR TIRADS	3	652	0.70 (0.37, 0.90)	0.60 (0.36, 0.80)	1.73 (1.32, 2.27)	0.51 (0.28, 0.93)	3.39 (1.84, 6.27)	16.1 (12.8, 20.1)	5.40 (3.00, 9.40)

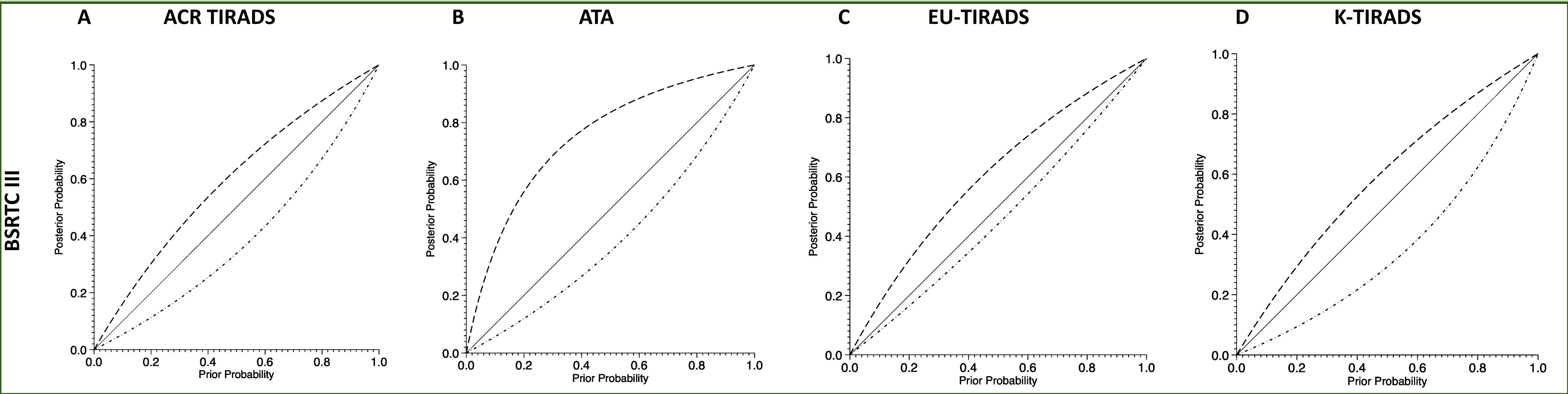


Figure 1. Probability-modifying plot for sonographic risk criteria in Bethesda III nodules

- For Bethesda III nodules, ATA criteria had the highest specificity, PLR, and DOR while K-TIRADS had the highest sensitivity
- For Bethesda IV nodules, results were limited by the small number of included studies

Conclusions

- Although dependent on institutional malignancy rates, Bethesda III nodules with high-suspicion ATA sonographic features possess a high post-test probability for malignancy and may benefit from surgical excision or molecular testing
- Conclusions are limited by the methodological quality of included studies

References

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