

Utilization of thyroid nodule images in consultations: secondary evaluation of a pilot randomized study

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Abstract

Context. Thyroid nodule ultrasound findings are crucial in guiding management decisions for patients with thyroid nodules. However, the frequency with which ultrasound images are discussed and reviewed with patients during clinical visits is not well understood.

Objective. To assess how often thyroid ultrasound images are shown and discussed with patients during consultations, and to identify predictors of image review during clinical visits.

Design and setting. Secondary analysis of a multicenter pilot randomized clinical trial conducted at two academic medical centers in the United States.

Participants. Adults undergoing evaluation for thyroid nodules.

Intervention. Participants were randomized to receive either usual care or care enhanced with a conversation aid.

Main Outcome Measures. The primary outcome was the frequency of thyroid nodule imaging review evaluated as a binary outcome. Secondary outcomes included evaluation of predictors of image discussion.

Results. Eighty-five patients were evaluated. Most participants were women (80%), mean age (60 years, SD 16), and White (86%), undergoing new patient visits (84%). Thyroid nodule ultrasound images were reviewed with patients in 53% of visits (45/85), and in all cases, clinicians initiated the imaging discussion. Predictors of image review included type of consultation (new patient visit) (OR 10.6, 95% CI: 1.79, 62.3). Age, sex, study arm, thyroid nodule size or cancer risk and plan of care (e.g., completing a biopsy) were not statistically associated with review of clinical images.

Conclusions. Review of thyroid ultrasound images during clinical visits is relatively common, with consultation type serving as significant predictor.

Introduction

Thyroid nodules are common and are frequently detected incidentally during imaging studies or routine physical examinations.(1, 2) Thyroid ultrasound is the imaging modality of choice for evaluating these nodules, as it provides detailed information on nodule size, number, and characteristics that can be used to estimate the risk of malignancy.(3-5) These ultrasound features guide risk stratification based on standardized systems such as the American Thyroid Association (ATA) guidelines and the American College of Radiology Thyroid Imaging Reporting and Data System (ACR TI-RADS), playing a central role in determining clinical management strategies.(4, 5)

Despite the availability of evidence-based diagnostic frameworks, the care of patients with thyroid nodules can be oversimplified in clinical practice, potentially leading to unnecessary procedures or

delayed diagnosis.(6, 7) An individualized approach that integrates clinical findings, imaging characteristics, and the patient's values and preferences is essential to deliver high-quality, patient-centered care.(8) For example, a point-of-care tool designed to support clinical conversations between patients with thyroid nodules and their clinicians has shown promise in enhancing patient-centered and collaborative care.(8-11) Clinical evidence emphasize that meaningful patient-clinician collaboration is critical in thyroid nodule care, with ultrasound imaging findings offering an opportunity to personalize recommendations.(7) However, it remains unclear how often clinicians incorporate visual discussion of the thyroid ultrasound images during consultations, or how this practice might impact the quality of care. Evidence from other clinical contexts, such as general practice and head and neck cancer, suggests that clinician-led discussions of imaging results enhance patient understanding, foster engagement in care, and reinforce the collaborative nature of clinical decision making, all of which are desirable outcomes for patients with thyroid nodules.(12-14)

To address these knowledge gaps, we conducted a secondary analysis of recorded clinical encounters to assess the frequency with which thyroid ultrasound images are discussed during patient visits, as well as the factors associated with this practice.

Materials and Methods

Design, Setting, Participants and Intervention

This analysis is based on a secondary evaluation of a multicenter, encounter-level pilot randomized controlled trial conducted to assess the feasibility of study procedures in preparation for a future trial(11). The trial design, setting, and participant eligibility have been described in detail in the primary publication and are summarized here.(11)

Participants were enrolled between 2022 and 2024 at two academic medical centers: the University of Florida (Endocrinology and Head and Neck clinics) and Mayo Clinic (Endocrinology clinic). Clinicians were eligible if they routinely engaged in discussions about thyroid nodule evaluation and management. Eligible patients included English-speaking adults undergoing evaluation for one or more thyroid nodules. Exclusion criteria included a history of hyperthyroidism, pregnancy, prior fine-needle aspiration (FNA) of the index nodule or having received thyroid nodule counseling in the previous year.

Clinical encounters were randomized in a 1:1 ratio to either standard care or standard care supplemented with the Thyroid Nodule Conversation Aid (TNOC), using a computer-generated randomization sequence via REDCap.(15) Patients in the control arm received care as per their clinician's usual practice. In the intervention arm, clinicians were asked to use TNOC, a point-of-care tool developed to support diagnostic conversations about thyroid nodules.(8)

TNOC presents thyroid cancer risk visually using bar charts, natural frequency formats (e.g., "out of 100 people like you"), and pictographs of 100 individuals to convey estimated malignancy risk, which can be personalized by the clinician based on risk stratification systems (ATA or ACR TI-RADS).(8) The tool also

outlines available management options—including observation and additional diagnostic testing—along with concise summaries of benefits, risks, and potential next steps. It includes prompts for patients to reflect on their values and priorities, space to document shared questions, and generates a printable summary with educational materials and frequently asked questions. Importantly, TNOC does not prompt or require clinicians to display or review the patient’s actual thyroid ultrasound images during the visit.

The study received approval from the Institutional Review Boards at participating institutions (University of Florida and Mayo Clinic, Rochester). All patients and clinicians provided written informed consent prior to participation.

Outcomes and baseline variables

In this secondary analysis, we report the frequency with which thyroid ultrasound images were discussed or reviewed during patient consultations. We also identify who initiated these discussions—whether the clinician or the patient—and examine factors associated with the likelihood of image discussion during the visit. Baseline characteristics—including patient sociodemographic information (such as health literacy and subjective numeracy), clinical status, and nodule features—were obtained from patient surveys and clinical records. (16-19)

Review of ultrasound images during the clinical visit and predictors

We evaluated whether thyroid ultrasound images were displayed and explained to patients during clinical consultations, using a structured and predefined framework. For each encounter, we recorded whether the images were reviewed with the patient (yes/no). If reviewed, we categorized who initiated the image discussion—either the clinician, the patient, or a caregiver. These categories were mutually exclusive and coded based on the first person to introduce the discussion during the visit.

All visit recordings were independently reviewed by two trained evaluators using this coding framework. Reviewers met weekly to resolve discrepancies and reach consensus, which was used for the final analysis.

To identify predictors of accurate thyroid cancer risk perception, we first conducted univariable logistic regression analyses of variables that were deemed relevant by the study team: age, sex, largest thyroid nodule size, highest ACR-TIRADS category, study arm (intervention vs. control), whether thyroid biopsy was recommend as the next step and type of visit (first consultation or follow up). A stepwise model selection approach was used to build the final multivariable model, with review of ultrasound images during the clinical visit as the binary outcome. Model fit and multicollinearity were assessed using standard diagnostics.

Statistical Analysis

Continuous variables were summarized as mean (standard deviation [SD]) or median (interquartile range [IQR]), as appropriate, and categorical variables as frequency and percentage (n [%]). Group comparisons were performed using the Wilcoxon rank sum test for continuous variables and Fisher's exact test for categorical variables. Univariable logistic regression models were used to assess associations between baseline characteristics and likelihood of review of ultrasound images during the clinical visit. A stepwise model selection approach was used to identify the final multivariable models. All analyses were conducted according to the intention-to-treat principle using R software (version 4.4.3)

Results

General participant description

In this secondary analysis we included 85 participants, 43 randomized to usual care and 42 to the intervention group (TNOC). Most participants were women (80%), White (86%) and non-Hispanic (98%). The mean age of participants was 58 years (SD 16). **Table 1** summarizes demographic, clinical, and thyroid nodule characteristics stratified by whether a review of thyroid ultrasound clinical images occurred during the visit.

Thyroid ultrasound images discussion

Clinicians reviewed and discussed thyroid ultrasound images with 53% (45/85) of the patients. In all instances where the images were reviewed and discussed (n=45) this practice was initiated by the clinician.

In the multivariable logistic regression model, type of clinical visit was a significant predictor of discussion of thyroid ultrasound images (OR, 10.6, 95% CI 1.79, 62.3), with first visits being much more likely to have an image discussion than follow up visits. Other evaluated predictors (age, sex, thyroid nodule size or cancer risk, study arm and plan of care) did not reach statistical significance. **Table 2** reports the results of the univariable and multivariable models.

Discussion

In this secondary analysis of clinical visits for patients with thyroid nodules, ultrasound images were discussed in 5 out of 10 visits, and in all cases, the discussion was initiated by clinicians. The type of clinical visit (first visit or follow up) was the only significant predictor of this practice. These findings highlight variability in the use of ultrasound imaging during visits and underscore the importance of evaluating its impact on care, as well as developing effective methods for engaging patients in image-based discussions.

A key strength of this study is its novel focus on a commonly occurring yet often overlooked aspect of thyroid nodules care—the review of ultrasound images during clinical consultations. This evaluation was grounded in the systematic analysis of recorded clinic visits using a pre-specified and piloted framework.

Assessments were conducted in duplicate, with consensus reached for final analysis, ensuring methodological rigor. However, the study is limited by its small sample size, which restricted the ability to assess a broader range of potential predictors. Additionally, we did not investigate the underlying reasons why some clinicians chose to review images while others did not, nor did we assess the impact of these discussions on patient outcomes. Despite these limitations, our findings provide preliminary and novel evidence on an understudied yet potentially meaningful aspect of patient-clinician interaction in thyroid care and set the foundation for future studies to explore its implications.

Multiple patient surveys have documented patients' varying interest in reviewing their medical images with a clinician, although these have not focused on patients with thyroid nodules.(20-24) In a survey of 628 patients undergoing imaging studies in two tertiary care centers, 81% expressed interest in reviewing their images with a physician as most (88%) expected this interaction to be beneficial in understanding their body and taking control of their health.(23) In a similar study, including 642 patients, most were interested in the inclusion of images in their reports, with a higher proportion in those in which the findings were abnormal vs normal (89% vs 62%). Yet, only 15% expressed an interest to meet with a radiologist for further discussion.(24) In a survey of 105 patients evaluating attitudes towards having their medical images in the patient portal, 67% were interested in discussing their images with their clinicians.(22) These research studies underscore the clear interest patients have in reviewing their medical images with a clinician, although the motivations – a general desire to access and use all relevant information, a belief that more information is better, the exercise of a right to access their own information, an expression of autonomy and agency, or a sense that better care plans result from such review – are likely varied.

In their qualitative analysis involving 16 radiologists and 31 general practitioners, Carlin et al. found that only some physicians were optimistic about the potential for improved care if patients were shown their images. Additionally, general practitioners thought it professionally beneficial to practice interpreting images by discussing them with patients while expressing limited self-efficacy in doing so.(25) These findings are relevant to the care of patients with thyroid nodules and may help explain why imaging was discussed in some visits but not others—largely driven by clinician preference. For example, in a prior study evaluating diagnostic conversations, we found that discussion topics were almost always introduced by clinicians, highlighting their dominant role in shaping the content and direction of clinical interactions.(26) Notably, all clinicians in our sample were experts in reviewing clinical images, suggesting that other factors—beyond clinician expertise—may limit the discussion of imaging during consultations.

On a broader scope beyond thyroid nodule care, a body of evidence comprised of observational and experimental studies have produced inconsistent results about the effect of reviewing images with patients during the consultation. Notably, these studies neither evaluated specific strategies for reviewing imaging with patients nor included recordings of the consultations. They also did not report any potential harms associated with image use during medical encounters, such as emotional distress, confusion, or privacy concerns.(13, 22) (14) (12) (27) (28)

For example, a pilot, single-arm prospective study examined the impact of a 10-minute radiology consultation with 27 patients undergoing surveillance imaging for head and neck cancer.(13) Following the consultation, patients were better able to understand the results (70% before the consultation to 93% after the session); all patients but one found the consultation beneficial.(13) In another study, a radiologist reviewed nononcologic and non-obstetric images with 86 patients. These patients found the review helpful and expressed a desire for this option in the future. After the consultation, 41 patients (48%) reported a decrease in anxiety.(14)

In a qualitative study of 14 patients who had undergone recent imaging and reported discussing their own images, Carlin et al described potential benefits of discussing images with patients.(12) Patients welcomed the invitation to participate in decision making implied by the presentation of the images for review during the consultation. They also thought that the review improved their understanding of the diagnosis, resulted in an often reassuring emotional response to the situation, and supported the patient-clinician collaboration.(12) In a pilot study of 23 patients who smoke presenting to a cardiovascular outpatient clinic, a consultant reviewed their carotid artery ultrasound results alone or with images and photographs contrasting their own with a healthy artery.(28) There were no statistically significant differences between groups regarding intention to quit smoking, perceived disease severity or smoking cessation rates.(28)

While, to our knowledge, frameworks for integrating images into medical visits to advance patient-centered care are not available, some principles of collaboration between patients and clinicians can provide a foundational structure for this process are summarize in **Table 3**.(29-31) Open communication, assessing patient interest in image review, using clear language, providing contextual explanations, encouraging inquiries, and connecting findings usefully to understanding and responding to the patient situation seem pivotal.(29-31)

Conclusion

The growing interest among patients in reviewing their medical images during clinical visits, along with increased access to radiology reports, highlights a significant opportunity to enhance patient engagement and shared decision-making by incorporating image review into consultations. In this secondary analysis of clinical visits for patients with thyroid nodules, ultrasound images were reviewed in half of the visits, with clinicians initiating all such discussions. The type of clinical visit emerged as the only significant predictor of image discussion. These findings underscore notable variability in the use of imaging during clinical encounters and suggest that image discussion is not yet a standardized practice. The effective integration of imaging into consultations likely depends on a complex interplay of patient, clinician, and contextual factors. In addition to established patient-centered communication practices, further research is needed to identify specific strategies for using image review to support meaningful patient-clinician dialogue and the co-creation of care plans. This study provides preliminary insights and lays the groundwork for future investigations aimed at optimizing the role of imaging in enhancing the quality of thyroid nodule care.

Declarations

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Data availability

Restrictions apply to the availability of some, or all data generated or analyzed during this study to preserve patient confidentiality. The corresponding author will request in detail the restrictions and any conditions under which access to some data may be provided.

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Tables

Table 1. Demographics, clinical and thyroid nodule features according to whether images were discussed during the clinical visit

	All participants, N = 85	Ultrasound images not discussed, N= 40	Ultrasound images discussed, N = 45	p-value
Age, years (mean, SD)	57.4 (15.7)	59.4 (16.9)	55.6 (14.6)	0.260
Sex, Female N, %	68 (80.0%)	32 (80.0%)	36 (80.0%)	>0.999
Race				0.041
American Indian/Alaska Native	1 (1.2%)	0 (0.0%)	1 (2.2%)	
Asian	2 (2.4%)	1 (2.5%)	1 (2.2%)	
Black or African American	7 (8.2%)	6 (15.0%)	1 (2.2%)	
More than one race 1	1 (1.2%)	1 (2.5%)	0 (0.0%)	
Unknown/Not Reported	1 (1.2%)	1 (2.5%)	0 (0.0%)	
White	73 (85.9%)	31 (77.5%)	42 (93.3%)	
Ethnicity				0.218
Not Hispanic or Latino	83 (97.6%)	38 (95.0%)	45 (100.0%)	
General Health				0.111
Excellent/Very good	30 (36.1%)	16 (40%)	14 (32.6%)	
Fair	14 (16.9%)	5 (12.5%)	9 (20.9%)	
Good	35 (42.2%)	16 (40%)	19 (44.2%)	
Poor	4 (4.8%)	3 (7.5%)	1 (2.3%)	
Missing	2	0	2	
Health literacy (help reading forms) Never	54 (64.7%)	22 (55.0%)	33 (73.3%)	0.452
Numeracy (mean, SD)	4.7 (1.0)	4.6 (0.9)	4.8 (1.0)	0.323
Education				0.265
High school graduate	8 (9.9%)	3 (7.9%)	5 (11.6%)	
Graduate or professional degree	40 (49.4%)	16 (42.1%)	24 (55.8%)	
	1(1.2%)	1(2.6%)		

Less than high school	11 (13.6%)	8 (21.1%)	0 (0.0%)	
Professional degree in health related sciences	21 (25.9%)	10 (26.3%)	3 (7.0%) 11 (25.6%)	
Some college, no degree (Missing)	4	2	2	
Income				0.178
>\$150,000	13 (16.3%)	4 (10.8%)	9 (20.9%)	
\$40,000 to \$79,999	19 (23.8%)	7 (18.9%)	12 (27.9%)	
\$80,000 to \$149,999	21 (26.3%)	9 (24.3%)	12 (27.9%)	
< \$40,000	27 (33.8%)	17 (45.9%)	10 (23.3%)	
(Missing)	5	3	2	
Marital status (married)	45 (54.9%)	17 (43.6%)	28 (65.1%)	0.238
Type of visit (new)	71 (83.5%)	29 (72.5%)	42 (93.3%)	0.017
Functional status (euthyroid)	74 (87.1%)	36 (90.0%)	38 (84.4%)	0.529
History of malignancy	13 (15.3%)	4 (10.0%)	9 (20.0%)	0.240
History of radiation to the neck	5(5.9%)	2 (5.0%)	3 (6.7%)	>0.999
Family history of thyroid cancer	7 (8.2%)	3 (7.5%)	4 (8.9%)	>0.999
Largest nodule size (cm) (median, IQR)*	2.3 (1.6)	2.5 (1.9)	2.1 (1.1)	0.441
Highest ACR-TIRADS				0.008
TR1	12 (14.1%)	8 (20.0%)	4 (8.9%)	
TR2	5 (5.9%)	1 (2.5%)	4 (8.9%)	
TR3	24 (28.2%)	10 (25.0%)	14 (31.1%)	
TR4	28 (32.9%)	8 (20.0%)	20 (44.4%)	
TR5	8 (9.4%)	6 (15.0%)	2 (4.4%)	
Unknown/unable to assess	8 (9.4%)	7 (17.5%)	1 (2.2%)	
MNG (yes)	53 (62.4%)	32 (80.0%)	21 (46.7%)	0.002

TNOC, thyroid nodule conversation aid; SD, standard deviation; thyroid nodule size and ACR-TIRADS are reported per nodule; ACR-TIRADS, American college of radiology thyroid imaging reporting and data system; MNG, multinodular goiter.

* Reported at the nodule level

Table 2. Predictors of ultrasound image review during the clinical visit

Variable	Review of ultrasound images during the visit					
	Univariable Logistic Regression			Multivariable Logistic Regression		
	OR	95% CI	P value	OR	95% CI	P value
Age	0.98	0.95, 1.01	0.23			
Sex			0.91			
Female	-	-				
Male	1.07	0.31, 3.66				
Study arm			0.68			>0.9
TNOC	-	-				
UC	0.81	0.30, 2.23		1.03	0.34, 3.14	
Largest nodule size	0.92	0.64, 1.24	0.68			
Highest TIRADS			0.19			
TR1-3	-	-				
TR4-5	2.07	0.69, 6.14				
Plan of care			0.30			
Biopsy	-	-				
Not Biopsy	0.57	0.19, 1.67				
Type of visit			0.009			0.009
Follow up						
New	10.5	1.81, 61.1		10.6	1.79, 62.3	

TNOC, thyroid nodule conversation aid; UC, usual care, OR, odds ratio; CI, confidence interval; TIRADS, American College of Radiology Thyroid Imaging Reporting and Data System.

Table 3. Suggested Steps for Clinicians to Integrate Thyroid Ultrasound Imaging into Patient Discussions

- **The clinician and patient should first determine whether reviewing the image is desirable, relevant, and appropriate during the consultation.**
 - This discussion may include clarifying the purpose of the image, what the patient has already seen or understood, their specific concerns, and how the findings might inform future care decisions. *For example, the clinician might ask whether the patient wants to see thyroid ultrasound images to better understand a newly identified nodule.*
- **Before reviewing the image, the clinician should ensure the patient has appropriate access and an optimal view of the screen (e.g., adjusting the monitor's position and brightness, reducing glare, and ensuring comfortable viewing distance).**
 - *In thyroid ultrasound review, this could mean swiveling the screen so the patient can clearly see the images of their thyroid gland and adjusting the lighting to highlight subtle structures.*
- **When reviewing the image, the clinician should choose the views and orientations most useful for the discussion.**
 - The clinician should orient the patient to what is displayed, specify the type of study, describe the anatomical area under examination (using a model, diagram, or by indicating on the patient's body when appropriate), and clarify the viewing perspective. *For example, the clinician might explain that the ultrasound shows a cross-sectional view of the thyroid, point to the approximate location on the patient's neck, and highlight the borders of the gland and any nodules.*
- **After highlighting key anatomical landmarks, the clinician should describe any pertinent normal findings.**
 - *In thyroid imaging, this might include pointing out the normal homogeneous texture of most of the thyroid tissue and the absence of suspicious lymph nodes nearby.*
- **Next, the clinician should explain any abnormal findings, relating them to the purpose of the test and the patient's symptoms or clinical signs whenever possible.**
 - *For instance, if a thyroid nodule is seen, the clinician can describe its size, shape, and characteristics, and discuss what these features might mean in relation to the patient's symptoms, such as difficulty swallowing or their risk for thyroid cancer.*
- **After addressing the patient's questions or concerns, the clinician and patient can integrate the imaging findings with other relevant factors to co-create a care plan.**
 - *For example, the clinician and patient might decide together whether to pursue a fine-needle aspiration biopsy, schedule follow-up imaging, or continue routine monitoring depending on the ultrasound findings and patient preferences.*