

Comparison of ultrasonography findings and fine needle aspiration biopsy results in benign-malign differentiation of thyroid nodules

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ABSTRACT

Aims: The aim of this study was to compare the ultrasonography findings and cytology-histopathology findings of thyroid nodules undergoing a fine needle aspiration biopsy.

Methods: The records of patients with thyroid nodules who underwent a fine needle aspiration biopsy between January 2023 and February 2024 in the radiology clinic were retrospectively analyzed. Patients with malign, benign, and atypia of undetermined significance on pathology were evaluated. The correlation and concordance between ultrasonography, cytology, and histopathology findings were investigated.

Results: A total of 114 patients with biopsy pathology results of 75 (65.7%) benign, 21 (18.4%) malign, and 18 (15.7%) atypia of uncertain significance were evaluated. The study included 87 (76%) female and 27 (24%) male patients. The mean age of all patients was 53.04 years. There was no significant correlation between age, gender, nodule location, and pathology result. The presence of contour irregularity and microcalcification in the nodule was significant for malignancy ($p < 0.001$).

Conclusion: Ultrasonography is an effective diagnostic method to differentiate between benign-malign thyroid neoplasms. Ultrasound-guided fine needle aspiration biopsy has a high diagnostic rate. It is helpful in determining the subsequent clinical management option for most patients.

Keywords: Biopsy, thyroid nodule, ultrasonography, microcalcification

INTRODUCTION

Thyroid diseases are among the most common diseases in our country and in the whole world. Thyroid nodules are space-occupying lesions that are distinguished from the adjacent thyroid parenchyma by imaging applications. Nodules have been found in 10-67% of the adult population by ultrasonography (US) and in more than 50% of thyroid glands in autopsy series.¹ Thyroid nodule are more common in women (4:1 F:M). The prevalence increases with decreased iodine intake.^{2,3} Most nodules are asymptomatic, but when symptomatic, they may present with thyroid dysfunction or rarely with compression symptoms.³ Detected nodules may be benign or malign. The prevalence of malignancy in thyroid nodules based on biopsy results is approximately 10%.³

Ultrasound is a highly effective and preferred method for evaluating the parenchyma of the thyroid gland, detecting

tissue stiffness due to chronic diseases, and determining the characteristics of thyroid nodules.⁴ After thyroid gland US, ultrasound-guided fine needle aspiration (FNA) biopsy is performed on the selected nodules.⁵ Ultrasound-guided FNA of the thyroid refers to a minimally invasive procedure in which tissue samples are collected from a thyroid nodule or other suspicious thyroid lesion. It is usually performed rapidly in outpatients, and complications after this procedure are rare.^{6,7}

In the literature, there are classification systems such as the Thyroid Image Reporting and Data System (TI-RADS)⁸ that describe the findings of nodules suspicious for malignancy. There are many studies in the literature like our study conducted by different centers comparing thyroid nodule FNAB cytology-histopathology results with US findings.



The aim of this study was to compare ultrasonography findings with cytology-histopathology findings of thyroid nodules undergoing fine needle aspiration biopsy in our clinic.

METHODS

This retrospective study was conducted in accordance with the principles of the Declaration of Helsinki by performing a retrospective archive search of patients who underwent a fine needle biopsy of thyroid nodule tissue samples in our Radiology Unit between January 2023 and January 2024. The approval of the Kırıkkale University Faculty of Medicine Local Ethics Committee was obtained (Date: 20.03.2024, Decision No: 2024.03.10).

A total of 114 patients who were older than 18 years of age and whose fine needle thyroid nodule biopsy pathology results were reported as benign (75), malign (21), and atypia of uncertain significance (18) were included in the study. Three groups, including benign, malign, and atypia of uncertain significance, were compared with each other. Nodule size (<1.5cm, 1.5-2.5cm, >2.5cm), nodule location (left, right, isthmus), contour (regular, irregular), and presence of microcalcification (present or absent) were evaluated in the ultrasound report via the hospital information system. Demographic data on the patients was collected.

A thyroid biopsy was performed on a LOGIQ E9 (GE Healthcare, Wauwatosa, WI, USA) US system using high-resolution linear probes with a bandwidth of 6-15 MHz. A US-guided biopsy was performed with the patient in the supine position with the neck extended using 10 ml syringes with 22-Gauge fine needles (Figure 1, Figure 2). Biopsies were usually performed by sending the needle perpendicular or at a 45-degree angle to the transducer axis. During the procedure, the needle was moved back and forth in the nodule. The material obtained was sprayed onto slides and allowed to air dry. The slides were fixed to cardboard, and it was noted from which nodule the biopsies were taken. The slides fixed to the cardboard were sent to the pathology department of our hospital. The lobe and nodule from which the biopsy procedure was performed were recorded in the hospital data processing system. Biopsy materials were evaluated in the pathology laboratory of our hospital.



Figure 1. Thyroid USG with high resolution linear probes with 6-15 MHz bandwidth

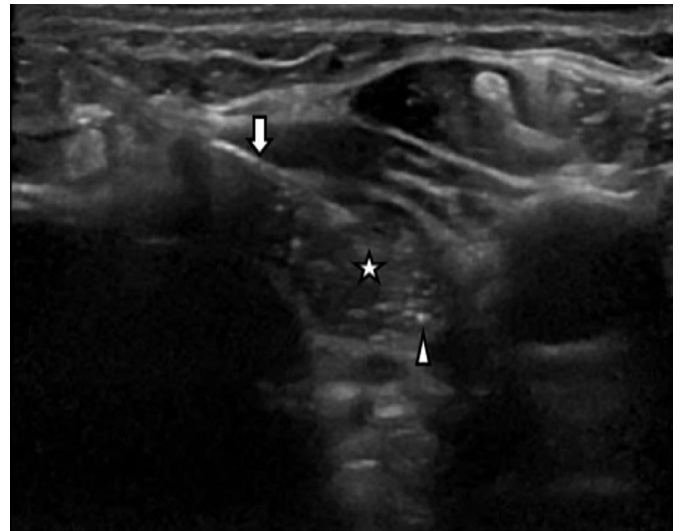


Figure 2. Fine needle aspiration biopsy (arrow) from a solid nodule (star) containing microcalcifications (triangle) in the left lobe of the thyroid gland

The IBM SPSS version 24 program was used for all statistical analyses. The Shapiro-Wilk test will be used to determine the normal distribution. Normally distributed descriptive values were expressed as mean and standard deviation, and non-normally distributed values were expressed as median (min-max). In two-group comparisons of continuous variables, normally distributed variables were compared by the t test, and non-normally distributed variables were compared by the Mann-Whitney U test. A chi-square test was applied in the comparison of categorical variables, and $p < 0.05$ was considered significant.

RESULTS

A total of 114 patients with biopsy results of 75 (65.7%) benign, 21 (18.4%) malign, and 18 (15.7%) atypia of uncertain significance were evaluated. The study included 87 (76%) female and 27 (24%) male patients. The mean age of all patients was 53.04 years. Demographic characteristics of the patients and pathology results are given in Table 1. No significant correlation was found between age and gender variables and nodule pathology results.

Table 1. Patient characteristics and pathology result

Variables	Bening (n:75)	Malign (n:21)	Atypia of undetermined significance (n:18)
Age, mean \pm SD	55.03 \pm 14.1	48.43 \pm 15.4	50.33 \pm 13.1
Gender, n%			
Men	14 (12.3)	7(6.1)	6(5.2)
Women	61(53.6)	14(12.3)	12(10.5)

In our study, no significant correlation was found between the location of the nodule in the left lobe, right lobe, and isthmus and the pathology result of benign-malign-atypia of undetermined significance (AUS) ($p > 0.05$). No significant correlation was found between nodule size (<1.5cm, 1.5-2.5 cm, >2.5cm) and the benign-malign pathology result, but in the distinction between malign-AUS, nodules reaching a size of 2.5 cm or more were found to be significant for malignancy ($p < 0.001$).

When the nodule contour was evaluated, the presence of an irregular contour was found to be significant for malignancy

and AUS in the benign-malign distinction and in the benign-AUS distinction ($p < 0.001$). No significant correlation was found between contour irregularity and the distinction of benign-malign atypia ($p > 0.05$).

When the presence of microcalcification was evaluated, the presence of microcalcification in the nodule was significant for malignancy in the benign-malign and AUS-malign distinctions ($p < 0.001$). No significant correlation was found between the presence of microcalcification and the distinction of AUS-benign ($p > 0.05$).

Table 2. Nodul characteristics and pathology result

Variables	Benign (n:75)	Malign (n:21)	Atypia of undetermined significance (n:18)
Location, n(%)			
left	31(27.1)	11(9.6)	10(8.7)
right	36(31.5)	9(7.8)	8(7)
isthmus	8(7)	1(0.8)	0
Size, n(%)			
<1.5cm	28(24.5)	10(8.7)	4(3.5)
1.5-2.5 cm	28(24.5)	5(4.3)	13(11.4)
>2.5cm	19(16.6)	6(5.2)	1(0.8)
Contour, n(%)			
Regular	65(57)	8(7)	10(8.7)
Irregular	10(8.7)	13(11.4)	8(7)
Calcification, n(%)			
Yes	71(62.2)	13(11.4)	18(15.7)
No	4(3.5)	8(7)	0

DISCUSSION

The frequency of thyroid nodule diagnoses has increased with increasing imaging methods. Thyroid nodule fine needle biopsy has become one of the most common interventional procedures in many centers. There are many studies in the literature and classification systems such as TI-RADS in the selection of nodules for biopsy.^{8,9} Papillary thyroid cancer and follicular thyroid cancer, the most common malign lesions of the thyroid, typically peak in the middle age group in the 3rd and 4th decades. The E:F ratio is 1:2.5 and is more common in women.¹⁰ In our study, thyroid nodule diagnosis and hospital admission for biopsy were significantly higher in the female gender. However, no significant correlation was found between age and gender variables and nodule pathology results. The possible reason for this may be the small sample size.

Malhi et al.¹¹ biopsied 704 thyroid nodules with echogenic foci and 246 thyroid nodules without echogenic foci. They found that the prevalence of malignancy ranged from 15.4% to 19.5% for echogenic foci, excluding comet artifacts (3.9%). They found that all echogenic foci, except comet artifacts, were associated with cancer risk. In our study, similar to the study of Malhi et al.¹¹, the presence of microcalcifications was found to be significant for malignancy in benign-malign differentiation ($p < 0.001$). Again, the presence of microcalcifications was found to be significant for malignancy in the malign-significant atypia distinction ($p < 0.001$).

Cinar HG et al.¹² found that 50 of the nodules were benign (51.5%) and 47 were malign (48.5%) as a result of a biopsy of 97 thyroid nodules, of which 81 were female (83.5%) and 16 were male (16.5%). No significant relationship was found

between the risk of malignancy and whether the nodule was a right or left lobe or isthmus. In our study, similar to the study of Cinar HG et al.¹², no significant correlation was found between the location of the nodule in the left lobe, right lobe, and isthmus and the pathology results of benign-malign-atypia of uncertain significance ($p > 0.05$).

In the literature, there are many studies with different results on the relationship between nodule size and malignancy risk. The current approach is to use the ratio of the anteroposterior (AP) to the mediolateral (ML) size of the nodule.¹³ Bestepe N et al.¹⁴ compared the size and pathology results of 5561 thyroid nodules in 2463 patients and grouped the nodules as 540 (9.7%) <1 cm, 2413 (43.4%) 1-1.9 cm, 1600 (28.8%) 2-3.9 cm, and 1008 (18.1%) ≥ 4 cm. The malignancy rates for nodules less than 1 cm, 1-1.9 cm, 2-3.9 cm, and ≥ 4 cm were 25.6%, 10.6%, 9.7%, and 8.5%, respectively, and ROC curve analysis failed to identify an optimal cut-off value for diameter or volume to predict malignancy for all thyroid nodules or nodules larger than 4 cm. In this surgical series, the risk of malignancy did not increase with increasing nodule diameter or volume, and they concluded that the diameter or volume of the nodule cannot be used to predict malignancy or to decide on surgical resection. In our study, similar to the study by Bestepe N et al.¹⁴, no significant correlation was found between nodule size (<1.5 cm, 1.5-2.5 cm, >2.5 cm) and benign-malign pathology results in the direction of malignancy, but nodules reaching a size of 2.5 cm or more were found to be significant in terms of malignancy in the differentiation of malign-insignificant atypia ($p < 0.001$).

Chatti et al.¹⁵ analyzed ultrasound data of 198 nodules (99 malign nodules and 99 benign nodules) in a single-center, retrospective study of 156 patients who underwent thyroidectomy. They found a strong association between thyroid nodule contour irregularity and malignancy (OR=7.47; $p < 10^{-3}$). In our study, similar to the study by Chatti et al.¹⁵, the presence of an irregular contour was found to be significant for malignancy and AUS in the benign-malign distinction and in the benign-AUS distinction ($p < 0.001$). No significant correlation was found between contour irregularity and the distinction of benign-malign atypia ($p > 0.05$).

Limitations

There are several limitations in our study, the first of which is the small number of patients. Secondly, since the study was retrospective, thyroid ultrasound examination and fine needle biopsy were performed by different radiologists. This may have caused differences in biopsy technique, but in this single-center study, we tried to standardize the methods with dialogue and coordination between radiologists.

CONCLUSION

In recent years, with the increasing frequency of thyroid nodule diagnosis, the detection of suspected malign thyroid nodules with imaging devices has gained more importance. In the TI-RADS classification system, which groups thyroid nodules according to suspicion of malignancy, the presence of contour irregularity and microcalcification has been reported to increase the risk of malignancy in the nodule. In our study, it was found that the presence of contour irregularity and

microcalcification in the nodule similarly increased the risk. The detection of these features is a guide in determining the nodule to be biopsied.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Kırıkkale University Faculty of Medicine Clinical Researches Ethics Committee (Date: 20.03.2024, No: 2024.03.10).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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