



## Use of the TI-RADS scoring system in the evaluation of thyroid nodules

TI-RADS in the evaluation of thyroid nodules

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### Abstract

**Aim:** Thyroid ultrasonography-guided fine needle aspiration is known to be a cost-effective, safe diagnostic method for evaluating thyroid nodules but it is an invasive procedure. Various sonographic criteria have been proposed to estimate the risk of malignancy in thyroid nodules. TI-RADS (Thyroid Image Reporting and Data System) is one of these scoring systems. In this study, it was aimed to investigate the reliability and applicability of the TI-RADS system in our operated patients with definite TI-RADS results. **Material and Method:** A total of 134 patients who underwent surgery for nodular or multinodular goiter diagnosis between September 2005 and June 2018 in the Medical Park Hospital and Fatsa State Hospital endocrinology clinic and general surgery clinic were included in the study. Demographic characteristics, preoperative thyroid ultrasonographic findings and postoperative pathology results were collected retrospectively. **Results:** In our study, we found the rate of thyroid cancer as 0% in cases with TI-RADS score 2-3, the rate of cancer as 61.5% (12 papillary thyroid cancer and 4 follicular thyroid cancer in total 16 thyroid cancer n: 16) in cases with TI-RADS score 4 and the rate of cancer 88.2% (papillary thyroid cancer n: 24, medullary thyroid cancer n: 2, follicular thyroid cancer n: 2, indeterminate thyroid cancer n: 2) in cases with TI-RADS score 5. **Discussion:** Many studies have shown that this thyroid ultrasonography function is not only a risk classification, but also an effective treatment for patients. In our study, we clearly demonstrated that the use of the TI-RADS scoring system in thyroid nodules assessed by experienced individuals prevented the need for unnecessary fine needle aspiration. These findings show that TI-RADS classification provides reliable results in well-categorized thyroid nodules.

### Keywords

Thyroid; Nodular Goiter; Ultrasound; Thyroid Imaging Reporting; Data System

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**Introduction**

Thyroid nodules are very common in the general population and can be found clinically in 4-7% of the general population. However, it seems that the true prevalence of thyroid nodules is higher (the prevalence is from 8 to 65% in autopsy and from 19 to 35% in ultrasound survey) [1,2]. Although most thyroid nodules are benign hyperplastic lesions, past research has determined that thyroid cancer occurs in 5 to 15% of thyroid nodules [3-5].

Thyroid ultrasonography (US) guided fine needle aspiration (FNA) is known to be a cost-effective, safe diagnostic method for evaluating thyroid nodules [6,7] but it is an invasive procedure [5]. However, nodules made by FNA are found to be 10-42% non-diagnostic and 3-18% unknown follicular lesions [8]. FNA has some limitations such as these. There have been many discussions on the maling characteristics of nodules in the last two decades but no definitive classification has been made yet [9,10].

A typical sonographic pattern of thyroid cancer is absent. During the last 5 years, sonographic studies have been conducted to establish a reliable guide for thyroid nodule [11,12]. Based on the previously established BI-RADS (*Breast Imaging Reporting and Data System*) for breast nodules, some researchers have developed TI-RADS. In 2009, a TI-RADS (*Thyroid Imaging Reporting and Data System*) scoring system based on nodule models with ultrasound imaging was published [5,13]. In this study, it was aimed to investigate the reliability and applicability of the TI-RADS system in our operated patients with definite TI-RADS results.

**Material and Method**

A total of 134 patients who underwent surgery for nodular or multinodular goiter diagnosis between September 2005 and June 2018 in the Medical Park Hospital and Fatsa State Hospital endocrinology clinic and general surgery clinic were included in the study. Demographic characteristics, preoperative thyroid ultrasonographic findings and postoperative pathology results were collected retrospectively.

In the preoperative US of the cases, pathology results were compared according to the nodule with the highest TI-RADS score. The malignancy risk ratio of all TI-RADS categories was analyzed according to the postoperative pathology results. Certain criteria (mild hypoechoogenicity, marked hypoechoogenicity, microlobulation or irregular margins, microcalcifications, taller than wide, irregular thin halo) were taken into account in the imaging of the thyroid nodule by an experienced endocrinologist. The cases were taken into the study according to these criteria. Thyroid ultrasonography was performed with a high-resolution apparatus (The Philips Affiniti 70 ultrasound; Philips North America Corporation 3000 Minuteman Road M / S 109 Andover, MA 01810, USA) equipped with a 5-12 MHz broadband linear array probe. All the steps in the work were done by an experienced person. The TI-RADS classification is shown in Table 1 [4].

**Statistics**

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), Version 23. The numeric

variables as mean ± SD, the categorical variables as percentage were expressed. The groups were compared using the chi square-test. Statistically, p <0.05 was accepted.

**Results**

A total of 134 patients (84 females, 50 males) were included in the study. The mean age of the patients was 45.67 ± 13.4 years. The demographic characteristics of the cases are shown in Table 2. The pathology results of 134 patients included in the study were reported as 65.6 % (n = 88) benign, 32.8 % (n = 44) malignant and 1.49 % (n = 2) malignancy potential in the post-operative period. The distribution of malignancies was 26,86 % (n = 36) papillary thyroid cancer, 4,47% (n = 6) follicular thyroid cancer and 1,49 % (n = 2) medullary thyroid cancer.

The pathology result of patients with TI-RADS score 2 and 3 were 100% benign and with TI-RADS score 4 was % 61,5 maling and with TI-RADS score 5 was % 82,3 maling, %5,8 malignancy in indeterminate. The distribution of cases according to the TI-RADS classification and the analyses of pathological data are shown in Table 3.

**Discussion**

The pathology result of patients with TI-RADS score 2 and 3 were 100% benign and with TI-RADS score 4 was % 61,5 maling and with TI-RADS score 5 was % 82,3 maling, %5,8 malig-

Table 1. TI-RADS Classification

	Sonographic pattern	Thyroid US Specifications	Risk
TI-RADS 1	Normal	No nodule	
TI-RADS 2	Benign	Purely cyst Totally spongiform nodule	%-0
TI-RADS 3	Low Risk	Oval, regular margin, isoechoic, hyperechoic	%2-4
TI-RADS 4	Moderate Risk	Oval, regular margin, hypoechoic	%6-17
TI-RADS 5	High Risk	At least one of the following; -Non-oval shape -Irregular margin -Microcalcifications -Mignificant hypoechoogenicity and solid	%26-87

Table 2. Demographic characteristics of the cases

Parameters	
Gender: Female / Male	84/50
Age (year) SD	45,67±13,4
TSH, mIU/L	3,12±1,6
Anti-TPO, IU/mL	57,3±42,5
Anti-TG, IU/mL	37,9±16,2

TPOAb: Anti-thyroperoxidase autoantibodies, TgAb: Anti-thyroglobulin antibody

Table 3. Distribution of cases according to TI-RADS classification and analysis of pathological data

TI-RADS	Pathology			P- value
	Benign	Malign	Malignancy in indeterminate	
2	%100 (n=26)	-	-	-
3	%100 (n=48)	-	-	-
4	%38,4 (n=10)	%61,5 (n=16)	-	0,024
5	%11,7 (n=4)	%82,3 (n=28)	%5,8 (n=2)	0,015

nancy in indeterminate in our study.

Recommendation on who should be submitted to FNA is still controversial. Despite the fact that various studies have been carried out in this regard, a consensus has not been established. [5]

In recent years, both the American Thyroid Association and the British Thyroid Association have published risk guidelines that can be identified with thyroid US for thyroid nodules [14]. In both guidelines, the main determinant factor for thyroid biopsy was the sonographic patterns of thyroid nodules in place of size. TI-RADS classification predicts malignancy risks according to US characteristics of nodules. Many studies have shown that this thyroid US function is not only a risk classification but also an effective treatment for patients [15]. The TI-RADS classification aims to correlate USG features to cytological classification according to the number of features present in the USG [5]. In our study, we clearly demonstrated that the use of the TI-RADS scoring system in thyroid nodules assessed by experienced individuals prevented the need for unnecessary FNA. The TI-RADS scoring system is deficient in the diagnosis of cancer when cytologic examinations of nodules with a TI-RADS score between 1 and 3 are non-diagnostic, atypical or focal uncertainty. These patients are difficult to diagnose because they are not operated. The risk of cancer in TI-RADS 2 is reported to be 0%, and the risk of cancer in TI-RADS 3 is reported to be 2-4%. In other studies, the expected malignancy rate in TI-RADS 3 was 0.7% [16,17]. Horvath et al. found 14.1%, Russ et al. found % 4.3, Macedo et al. found %5.5 in TI-RADS 3 [9,13,18] In our study, malignancy was 0% in post-operative pathology reports in TI-RADS 2-3 cases.

The risk of cancer was reported to be 6-17% in patients with a TI-RADS score of 4 [8]. In one study, they found malignancy rate of 12.6-66.6% in TI-RADS 4 [19]. In our study, 19.4% (n = 26) of the cases were TI-RADS 4. Of these cases, 61.5% (n = 16) had thyroid cancer diagnosis and these patients (n = 12, papillary thyroid cancer, n = 4, thyroid follicular cancer) constitute 11.9% of the whole group. These findings indicate that TI-RADS classification provides reliable results in well-categorized thyroid nodules.

The risk of cancer in the TI-RADS score 5 group was 26-87%. Other studies have shown that this risk is 85.7%- 75.6% [9,20]. In our study, we found a 88.2% (n = 30) cancer rate in our TI-RADS 5 cases. The distribution of thyroid cancer cases in TI-RADS 5 group was 80% (n = 24) papillary, 6.6% (n = 2) medullary, 6.6% (n = 2) follicular and 6.6% (n = 2) malignancy in indeterminate. When the malignancy rate is analyzed according to TI-RADS categories, statistically significant difference between the groups was detected.

This study has some limitations, such as being retrospective, low number of cases, sonographic assessment performed by different operators.

### Conclusion

When we examined the nodules with pathologic findings in our study, we found that the TI-RADS scoring system in our patients is sufficient to predict the malignancy rate. To avoid unnecessary FNA; we showed that the TI-RADS scoring system is safe.

### Scientific Responsibility Statement

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

### Animal and human rights statement

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.*

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### Conflict of interest

*None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.*

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