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Relationship between dominant nodule diameter and malignancy in thyroid nodules

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Abstract

Aim: Various reports have been presented regarding the presence of thyroid nodules in patients and whether there is a relationship between the size of the nodule diameter and thyroid malignancy, or whether the nodule diameter can provide information about malignancy. This study aimed to investigate the relationship between dominant nodule diameter and cancer development in patients who applied to our outpatient clinic due to swelling in the neckand were diagnosed with nodular goiter and operated on.

Methods: 232 adult patients who applied to the general surgery outpatient clinic of our hospital between January 2020 and December 2023 with complaints of neck swelling and difficulty swallowing and underwent thyroidectomy with the diagnosis of nodular goiter were included in the study. Age, gender, dominant nodule diameter in preoperative ultrasonography, and postoperative histopathology reports were recorded from the file records.

Results: The average age of the patients was 19.7±15.8 years, and 122 (52.6%) were male. The average nodule diameter was 24.3 ± 8.8 mm. Malignancy was detected in the histopathological examination of the operation material of 92 (39.7%) of the patients. The rate of malignancy detected in women was found to be significantly higher than in men (46.4% vs. 33.6%; p = 0.047). The mean age of those with malignancy was significantly higher than that of those without malignancy (54.3 vs. 46.7; p < 0.001). The mean nodule diameter in the group with malignancy was found to be significantly lower than in those without malignancy (20.0 mm vs. 27.1 mm; p < 0.001).

In logistic regression analysis, female gender (OR: 1.70; 95% CI: 1.02–2.90; p = 0.048), age (OR: 1.03; 95% CI: 1.01–1.05; p < 0.001), and dominant nodule diameter (OR: 0.80; 95% CI: 0.75–0.88; p < 0.001) were identified as independent predictors of thyroid malignancy.

References Accordingly, it was determined that the risk of thyroid malignancy increased 1.7 times (1.0-2.9) in women, 1.03 times with each increase in age, and decreased 0.8 times with each mm increase in nodule diameter. In multiple regression analysis, female gender, age, and nodule diameter were found to be independent risk factors. In the ROC analysis, the sensitivity and specificity of the 23.0 mm threshold value for nodule diameter in predicting malignancy were found to be 66.3% and 72.1%, respectively (AUC < 0.5; p < 0.001; lower bound = 0.185; upper bound = 0.325).

Conclusion: The findings of our study showed that female gender, older age, and smaller nodule diameter are factors that increase the risk of thyroid malignancy in patients who have decided to undergo thyroid surgery, and that nodule diameter can provide important information in predicting thyroid malignancy.

Keywords

thyroid, thyroidectomy, malignancy, nodule diameter

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Introduction

Thyroid cancers are among the most common endocrine cancers. Thyroid nodules are a condition that can be seen frequently in the normal population, with varying incidences reported between 4-10% in the population. The frequency of thyroid nodules turning into thyroid cancer is very low, less than 5%.[1-4] Various factors, such as the diameter of the thyroid nodules, the patient's thyroid hormone levels, the presence of thyroiditis, and findings related to malignancy, are effective in deciding whether or not to undergo thyroid surgery. Many imaging techniques are used in thyroid-related diseases. In addition, histopathological examination of the tissue taken by fine needle aspiration biopsy or during the operation clarifies the diagnosis.[3-6]

Various reports have been presented regarding the presence of thyroid nodules in patients and whether there is a relationship between the size of the nodule diameters and thyroid malignancy or whether the nodule diameter can provide information about malignancy.[7-22] This study aimed to investigate the relationship between dominant nodule diameter and cancer development in patients who applied to our outpatient clinic due to swelling in the neck and were diagnosed with nodular goiter and operated on.

Materials and Methods

This retrospective observational study included 232 adult patients who applied to the general surgery outpatient clinic of our hospital with complaints of neck swelling and difficulty in swallowing between January 2020 and December 2023 and underwent thyroidectomy with the diagnosis of nodular goiter. The patient's file records were scanned. Age, gender, dominant nodule diameter on preoperative ultrasonography (USG), and postoperative histopathology reports were recorded from the file records. Patients under the age of 18, patients for whom thyroidectomy was not decided, even though they had thyroid disease, those with secondary thyroid disease, and those with a malignancy other than the thyroid were not included in the study.

Ethics Approval

The study was approved by the Ethics Committee of Private Medical Park Ordu Hospital and conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

All statistical analyses in the study were performed using SPSS 25.0 software (IBM SPSS, Chicago, IL, USA). Descriptive data were given as mean and standard deviation in numerical data, and distributions of nominal variables were given as numbers and percentages. Comparisons between groups in terms of categorical variables were made with the Chi-Square test. Whether continuous variables conformed to normal distribution was analyzed with the Kolmogorov-Smirnov Test. Differences between the two groups in terms of non-normally distributed continuous variables were analyzed with the Mann-Whitney U test. The risk coefficients of the variables in terms of malignancy were determined by logistic regression analysis. The predictive capacity of the 23 mm threshold value for dominant nodule diameter for malignancy was analyzed by ROC analysis. The results were evaluated within the 95% confidence interval, and p values <0.05 were considered significant. Bonferroni correction was made where necessary.

Reporting Guidelines

This study was reported in accordance with the STROBE guidelines.

Results

The mean age of the patients was 49.7 ± 15.8 years, and 122 (52.6%) were male. The mean nodule diameter was 24.3 ± 8.8 mm. Malignancy was detected in the histopathological examination of the operation material of 92 (39.7%) of the patients. A total of 88.4% of the operations were bilateral total thyroidectomy (Table 1). The rate of malignancy detected in women was found to be significantly higher than in men (46.4% vs. 33.6%; p = 0.047). The mean age of those with malignancy was significantly

Table 1. Distributions according to some variables

	n	%
Total	232	100.0
Gender		
Male	122	52.6
Female	110	47.4
Malignancy		
None	140	60.3
Present	92	39.7
Operation type		
Bilateral total thyroidectomy	205	88.4
Unilateral total thyroidectomy	21	9.1
Completion thyroidectomy	6	2.6
	Mean	**SD**
Age (years)	19.7	15.8
Nodule diameter (mm)	24.3	8.8

SD: Standard deviation

Table 2. Distribution of malignancy according to some variables and comparison of mean age and nodule diameter according to the presence of malignancy

	No malignancy		Malignancy present		p
	n	%	n	%	
Total	140	60.3	92	39.7	
Gender					
Male	81	66.4	41	33.6	0.047
Female	59	53.6	51	46.4	
Operation type					
Bilateral total thyroidectomy	123	60.0	82	40.0	0.936
Unilateral total thyroidectomy	13	61.9	8	38.1	
Completion thyroidectomy	4	66.7	2	33.3	
	Mean	**SD**	**Mean**	**SD**	
Age (years)	46.7	15.5	54.3	15.0	<0.001
Nodule diameter (mm)	27.1	8.2	20.0	8.0	<0.001

SD: Standard deviation

Table 3. Univariate and multivariate logistic regression analysis of factors associated with thyroid malƒögnancy

	Univariate			Moltivariate		
	p	Exp(B)	95% CI	p	Exp(B)	95% CI
Gender (female)	0.048	1.7	1.02 – 2.90	<0.001	0.1	0.1-0.4
Age	<0.001	1.3	1.01 – 1.05	<0.001	1.8	1.01.2001
Nodul diameter	<0.001	0.9	0.8-0.9	<0.001	0.8	0.8-0.9

Exp(B): Exponential B coefficient (risk coefficient of the variable in terms of malignancy, odds ratio), CI: Confidence interval for Exp(B) (lower-upper)

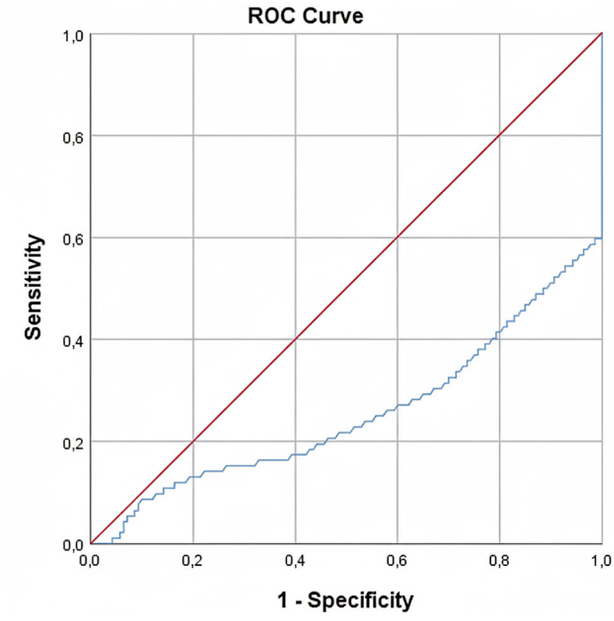

Figure 1. Receiver operating characteristic (ROC) curve analysis of dominant nodule diameter for predicting thyroid malignancy (AUC = 0.775; 95% CI: 0.685–0.825; p < 0.001).

higher than that of those without malignancy (54.3 vs. 46.7; p < 0.001). The mean dominant nodule diameter in the group with malignancy was found to be significantly lower than in those without malignancy (20.0 mm vs. 27.1 mm; p < 0.001) (Table 2). In the logistic regression analysis, female gender (p = 0.048), age (p < 0.001), and dominant nodule diameter (p < 0.001) variables were found to be independent risk factors for thyroid malignancy. Accordingly, it was determined that the risk of thyroid malignancy increased 1.7 times (1.0-2.9) in women, 1.03 times with each increase in age, and decreased 0.8 times with each mm increase in nodule diameter. In multiple regression analysis, female gender, age, and dominant nodule diameter were found to be independent risk factors (Table 3). In the ROC analysis, the area under the curve (AUC) for dominant nodule diameter in predicting malignancy was 0.775 (95% CI: 0.685–0.825; p < 0.001). The sensitivity and specificity of the 23.0 mm cut-off value were 66.3% and 72.1%, respectively (Figure 1).

Discussion

The relationship between thyroid nodule diameter and thyroid malignancy is controversial. Studies on this subject have mostly been conducted between patients with thyroid cancer and healthy populations without cancer.[7-22] In our study, the relationship between nodule diameter and malignancy was shown between patients who underwent thyroidectomy and those in whom malignancy was detected, and those in whom malignancy was not detected.

Shin et al.[7] reported in their meta-analysis that increased diameter of the thyroid nodule may be associated with malignancy. Again, in some studies, it has been reported that the risk of malignancy increases proportionally with the diameter of the thyroid nodule.[8,9] Bohacek et al.[10] found that the rate of malignancy increased in nodules with a diameter of 2-3 cm, but the rate decreased in larger diameters. Albuja-Cruz et al.[11] reported that nodules with a diameter of more than 4 cm were not associated with malignancy. Symonds et al.[12] reported that thyroid nodules provide insufficient information about thyroid malignancies. Cappelli et al.[13] Shresta et al.[14] and Deveci et al.[15] reported that there was no relationship between nodule diameter and malignancy. Bestepe et al.[16] reported that nodule diameter did not provide information about malignancy in thyroid surgery patients. Karadeniz et al.[17] reported that groups with nodule diameters above and below 4 cm were similar in terms of malignancy rate. Mehenna et al.[18] showed that the risk of malignancy increased in those with high thyroid nodule diameter, but there was no relationship between nodule diameter and malignancy in their thyroid surgery series. McHenry et al.[10] found that the frequency of malignancy decreased as the thyroid nodule diameter increased. Rausei et al.[20] also showed that the rate of benign disease was higher in patients with larger nodule diameters in patients who underwent thyroid surgery. Shayganfar et al.[21] also reported that the average thyroid nodule diameter was lower in the group with malignancy, and the risk of malignancy increased, especially in cases below 12 mm. Chen et al.[22] also found that the papillary carcinoma rate decreased significantly as the thyroid nodule diameter increased. In our study, the average nodule diameter in the group with malignancy was found to be significantly lower than in those without malignancy [20.0 mm vs. 27.1 mm]. In the logistic regression analysis, dominant nodule diameter was found to be an independent risk factor for thyroid malignancy. Accordingly, it was determined that the risk of thyroid malignancy decreased by 0.8 times for every mm increase in nodule diameter. Additionally, in the ROC analysis, the sensitivity and specificity of the 23.0 mm threshold value for nodule diameter in predicting malignancy were found to be 66.3% and 72.1%, respectively. All these findings show that the diameter of the dominant nodule may be related to thyroid malignancy in patients who have decided to undergo thyroid surgery and may

provide important information regarding malignancy, and that the risk of malignancy may be increased, especially in those with smaller nodule diameters.

Rausei et al.[20] and Shayganfar et al.[21] reported that the average age was lower in those with thyroid malignancy than in those without malignancy and that there was no relationship between malignancy and gender. In our study, unlike these studies, only thyroidectomy patients were examined, and the rate of malignancy detected in women was found to be significantly higher than in men. In addition, the average age of those with malignancy was found to be significantly higher than that of those without malignancy. Logistic regression analysis determined that female gender and age were independent risk factors for thyroid malignancy. Accordingly, it was determined that the risk of thyroid malignancy increased 1.7 times in women and 1.03 times with each increase in age. In multiple regression analysis, female gender, age, and nodule diameter were determined to be independent risk factors. All these findings show that in addition to smaller nodule diameter, female gender and advanced age may significantly increase the risk of thyroid malignancy in patients who have decided to undergo thyroid surgery.

Limitations

There were some limitations in our study. In the study, only postoperative histopathological examination results were evaluated in patients who underwent thyroid surgery. Therefore, risk factors for long-term malignancy could not be analyzed.

Conclusion

The findings obtained from our study showed that female gender, older age, and smaller nodule diameter are factors that increase the risk of thyroid malignancy in patients who have decided to undergo thyroid surgery, and that nodule diameter can provide important information in predicting thyroid malignancy.

Ethics Declarations
This study was approved by the Ethics Committee of Private Medical Park Ordu Hospital (Date: 2024-11-09, No: 2024/1479)

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.

Informed Consent
Written informed consent was waived by the Ethics Committee due to the retrospective design of the study and the use of anonymized patient data.

Conflict of Interest
The authors declare that there is no conflict of interest.

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Data Curation: A.Ö.
Resources: İ.K.
Writing – Original Draft Preparation: A.Ö.
Writing – Review & Editing: İ.K.
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Supervision: İ.K.

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, and 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.

Abbreviations
AUC: Area Under the Curve
CI: Confidence Interval
Exp(B): Exponential B Coefficient
OR: Odds Ratio
ROC: Receiver Operating Characteristic
SD: Standard Deviation
SPSS: Statistical Package for the Social Sciences
STROBE: Strengthening the Reporting of Observational Studies in Epidemiology
USG: Ultrasonography

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