

Original study

Surgical outcomes of thyroidectomy patients: Single-center experience

Tiroidektomili hastaların sonuçları; Tek merkez deneyimi

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ABSTRACT

Thyroid cancer incidence has been on the rise globally, attributed to advancements in detection technologies. Surgical outcomes and complications of thyroidectomy remain debated, with varying evidence on the safety and timing of completion of thyroidectomy. This study aims to retrospectively evaluate thyroidectomy patients at a regional reference clinic, comparing outcomes with existing literature.

A retrospective analysis of 471 thyroidectomy patients (2012-2022) included demographic data, preoperative assessments, and postoperative complications. Data were analyzed using SPSS. Patients with malignancy pathology results were compared with benign cases. Exclusions included those under 18 and reoperated cases.

Females predominated (81.5%), aligning with global trends. Malignant cases had higher rates of AUS-FLUS and follicular neoplasia on FNAB. Postoperative T4 values were significantly higher in benign cases, while TSH values were lower. Vocal cord paralysis occurred in 10.8%, with nerve monitoring reducing permanent damage post-2018.

Demographic findings mirrored global trends, emphasizing the female predominance in seeking thyroidectomy. FNAB effectively predicted malignancy, supporting accurate preoperative assessments. Postoperative thyroid and laboratory values varied between benign and malignant groups, with nerve monitoring reducing permanent damage rates.

Thyroidectomy, a common procedure for thyroid diseases, requires meticulous planning to minimize complications. FNAB results, laboratory values, and nerve monitoring significantly influence outcomes. This study contributes a comprehensive overview of thyroidectomy outcomes, emphasizing the need for careful preoperative assessments and the integration of advanced technologies. The findings prompt further research for a more nuanced understanding of thyroidectomy outcomes.

Keywords: Thyroidectomy; recurrent laryngeal nerve monitorisation; thyroid cancer

ÖZET

Tiroid kanseri insidansı küresel olarak artmaktadır ve bu durum, tespit teknolojilerindeki ilerlemelere bağlanmaktadır. Tiroidektominin cerrahi sonuçları ve komplikasyonları, tamamlanmış tiroidektominin güvenliği ve zamanlaması konularında farklı kanıtların olduğu bir tartışma halindedir. Bu çalışma, bölgesel bir referans kliniğinde tiroidektomi geçirmiş hastaları retrospektif olarak değerlendirmeyi amaçlamaktadır ve sonuçları mevcut literatürle karşılaştırmayı hedeflemektedir.

2012-2022 yılları arasında 471 tiroidektomi hastasının retrospektif analizi, demografik verileri, preoperatif değerlendirmeleri ve postoperatif komplikasyonları içermiştir. Veriler SPSS kullanılarak analiz edilmiştir.

Malign patoloji sonuçlarına sahip hastalar, benign vakalarla karşılaştırılmıştır. 18 yaşın altındakiler ve dış merkezde yeniden ameliyat geçirenler çalışmaya dahil edilmemiştir.

Kadınlar çoğunlukta (%81.5) ve bu, küresel eğilimlere uyumlu bir şekildeydi. Malign vakalarda FNAB'da AUS-FLUS ve foliküler neoplazi oranları daha yüksekti. Postoperatif T4 değerleri benign vakalarda anlamlı derecede yüksekken, TSH değerleri düşüktü. Vokal kord paralizisi %10.8 oranında görüldü ve 2018 sonrasında sinir izleme, kalıcı hasarı azalttı.

Demografik bulgular, kadınların tiroidektomi talebindeki küresel eğilimleri yansıtarak vurgulamıştır. FNAB, maligniteyi etkili bir şekilde öngörmüş ve doğru preoperatif değerlendirmeleri desteklemiştir. Postoperatif tiroid ve laboratuvar değerleri, benign ve malign gruplar arasında değişmiş ve sinir izleme, kalıcı hasarı azaltmıştır.

Tiroid hastalıklarının yaygın bir tedavi yöntemi olan tiroidektomi, komplikasyonları minimize etmek için dikkatli planlama gerektirmektedir. FNAB sonuçları, laboratuvar değerleri ve sinir izleme, sonuçları önemli ölçüde etkilemektedir. Bu çalışma, tiroidektomi sonuçlarına kapsamlı bir bakış sunmakta ve dikkatli preoperatif değerlendirmelerin ve ileri teknolojilerin entegrasyonunun önemini vurgulamaktadır. Bulgular, tiroidektomi sonuçlarının daha derin bir anlayışını sağlamak için ileri araştırma alanlarını öne çıkarmaktadır.

Anahtar kelimeler: Tiroidektomi; rekürren laringeal sinir monitörizasyonu; tiroid kanseri

INTRODUCTION

Thyroid cancer is a significant health concern, with its incidence steadily increasing worldwide over the past thirty years. The rise in incidence has been observed in high-income countries such as the United States, South Korea, the United Kingdom, and several European countries (1). This increase has been attributed to the update of thyroid cancer detection technologies, which accounted for at least some of the rising incidence (2). The frequency of occurrence is higher in regions where goiter is endemic, such as Turkey, making the endemic goiter region significant (3). Additionally, genetic factors, childhood head and neck radiation, iodine deficiency, nuclear reactor accidents, and hormonal factors play crucial roles in thyroid cancer etiology (4). The incidence of thyroid cancer is known to vary with geographic area, age, and gender, with thyroid cancers being 3-4 times more prevalent in women than in men (4). Furthermore, the incidence of thyroid cancer has been reported to increase in various countries, including the United States, Norway, and France (5). However, some studies have suggested that the increase in thyroid cancer incidence may be attributable to overdiagnosis, particularly in countries where the incidence is rapidly increasing (6).

In terms of surgical outcomes and complications, while complications of thyroidectomy are well-known, some, even when rarely fatal, significantly impair patients' quality of life in their persistent forms (7). The risk factors for the morbidity of thyroid surgery are well-defined, but their actual contributions to morbidity rates are still debated (8). For instance, some studies have reported that completion thyroidectomy is safer than previously thought, with low rates of disabilities and complications (9). However, the timing of completion thyroidectomy and its impact on post-operative complications remain controversial, with conflicting findings from different studies (10). Moreover, the safety and effectiveness of total thyroidectomy for benign multi-

nodular goitre have been reported, with low incidence of disabilities and complications comparable to other surgical units (9).

In conclusion, the incidence of thyroid cancer has been increasing globally, with various factors such as genetic, environmental, and lifestyle factors contributing to its etiology. Surgical outcomes and complications of thyroidectomy remain areas of debate, with conflicting evidence regarding the safety and timing of completion thyroidectomy. It is essential to consider the diverse factors influencing thyroid cancer and its surgical management to provide optimal care for patients.

Our clinic is the reference clinic in the region for thyroid surgery of malignant and benign origin, and both preoperative preparations and long-term postoperative follow-up of these patients are carried out in our hospital. We think that this will increase the reliability of our patient data and therefore its contribution to the literature.

The objective of our study is to retrospectively evaluate patients who underwent thyroidectomy in our clinic, scrutinize their surgical outcomes, and correlate the results of our patient group, encompassing a wide population due to being the sole reference hospital in the region, with the existing literature.

MATERIAL and METHOD

All patients who underwent thyroidectomy at our clinic between January 2012 and January 2022 were retrospectively assessed. Demographic data, laboratory parameters, preoperative imaging results, preoperative fine needle aspiration cytology results, surgical records, postoperative clinical follow-ups, and complications during this period were evaluated retrospectively. Data of patients with pathology results consistent with malignancy were compared with those reported as benign. Patients under 18, those for whom data could not be accessed, and those reoperated due to local recurrence after surgery at an external center were excluded.

Research data were analyzed using SPSS (Statistical Package for Social Sciences for Windows v.22.0, SPSS Inc., Chicago, IL). Descriptive statistics were presented based on the normal distribution of data. For continuous variable data analysis, t-tests or Mann-Whitney U tests were used depending on normal distribution. Chi-square or Fisher's exact test was used for categorical data comparison. The relationship between variables was assessed using Pearson or Spearman correlation tests, depending on data distribution. A significance level of $p < 0.05$ was considered statistically significant.

RESULTS

During the specified dates, the number of patients who underwent surgery was 503. It was ob-

served that 17 of these patients underwent completion thyroidectomy due to prior surgery at an external center. For 15 patients with prior external center surgeries, data on intraoperative nerve monitoring (IONM) or their outcomes could not be accessed either through the database or by contacting the patients. Consequently, 471 patients were included in the study. Of these patients, 384 (81.5%) were female, and 87 (18.5%) were male. The mean age was 50.55 ± 12.9 years. When the patients were divided as malignant (Gm) or benign (Gb) according to the final pathology results, according to the FNAB results, the results of AUS- FLUS and Follicular neoplasia in the Gm group were significantly higher than in Gb ($p < 0.001$). Comparative results between the two groups are summarized in Table 1.

		Gb (n=357)	Gm (n=114)	Total (n=471)	P
Age (\pmSD)		51.17 (12.69)	48.60 (13.40)	50.55 (12.9)	0.064 ^t
Gender (%)	Woman	290 (81.2)	94 (82.5)	384 (81.5)	0.769
	Man	67 (18.8)	20 (17.5)	87 (18.5)	
Preop FNAB (%)	Non-diagnostic	21 (5.9)	3 (2.7)	24 (5.1)	<0.001*
	Benign	283 (79.3)	40 (35.1)	323 (68.6)	
	AUS-FLUS	35 (9.8)	19 (16.7)	54 (11.5)	
	FN	7 (2)	12 (10.5)	19 (4)	
	Suspicion of malignancy	11 (3.1)	34 (29.8)	45 (9.6)	
	Malignant	0 (0)	6 (5.3)	6 (1.3)	
Operation (%)	Left lobectomy	30 (8.4)	10 (8.8)	40 (8.5)	0.829*
	Right lobectomy	35 (9.8)	9 (7.9)	44 (9.3)	
	Total thyroidectomy	292 (81.8)	95 (83.3)	387 (82.2)	
Pathology (%)	Folluklar adenoma	22 (6.2)	0 (0)	22 (4.7)	<0.001*
	Diffuse hyperplasia	3 (0.8)	0 (0)	3 (0.6)	
	Nodular hyperplasia	239 (66.9)	0 (0)	239 (50.7)	
	MNG	83 (23.2)	0 (0)	83 (17.6)	
	lymphocytic thyroiditis	3 (0.8)	0 (0)	3 (0.6)	
	Hurtle cell tumor	7 (2)	0 (0)	7 (1.5)	
	Hurtle cell carcinoma	0 (0)	3 (2.6)	3 (0.6)	
	PMC	0 (0)	33 (28.9)	33 (7)	
	PTC- classic type	0 (0)	46 (40.4)	46 (9.8)	
	PTC- FV	0 (0)	21 (18.4)	21 (4.5)	
	PTC- OV	0 (0)	6 (5.3)	6 (1.3)	
	FTC	0 (0)	4 (3.5)	4 (0.8)	
	MTC	0 (0)	1 (0.9)	1 (0.2)	

FNAB: Fine Needle Aspiration Biopsy, AUS: Atypia of Undetermined Significance, FLUS: Follicular Lesion of Undetermined Significance, FN: Follicular Neoplasm, MNG: Multinodular Goiter, PMC: Papillary Microcarcinoma, PTC: Papillary Thyroid Carcinoma, FV: Follicular Variant, OV: Oncocytic Variant, FTC: Follicular Thyroid Carcinoma, MTC: Medullary Thyroid Carcinoma, SD: Standard Deviation, t: Independent Groups t Test, *: Chi-square Test

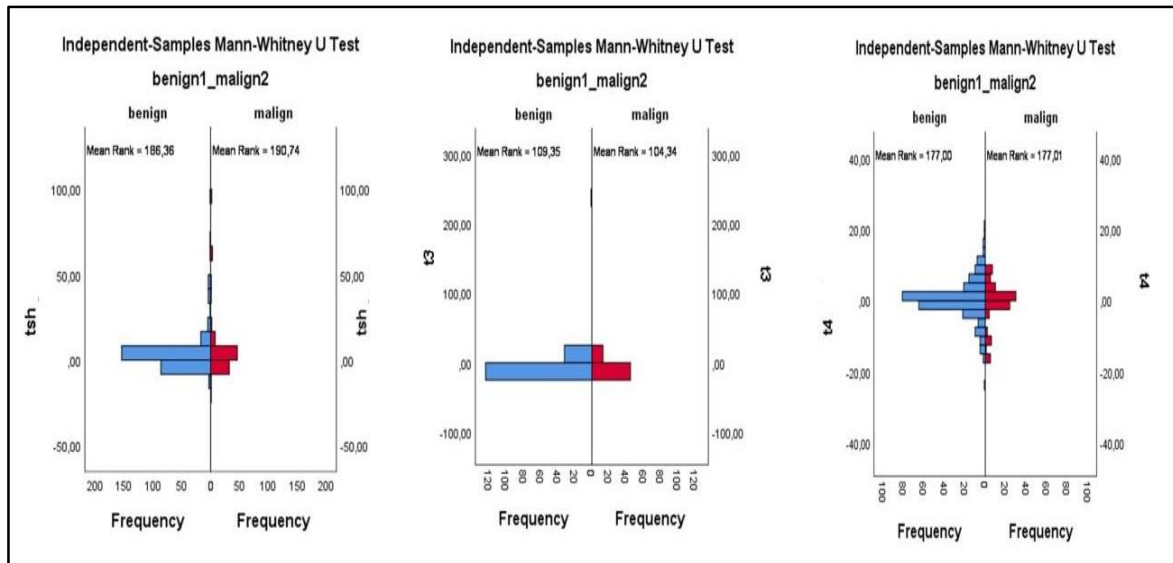
Comparative analyses of preoperative and postoperative values of T3, T4, and TSH levels, changes in laboratory parameters during the postoperative period, and comparative results of postoperative calcium levels between Gb and Gm groups revealed that postoperative T4 values in the benign

group were significantly higher, and TSH values were significantly lower compared to the malignant group ($p < 0.001$ for both parameters). While no significant difference was found in postoperative T3 values between the groups, postoperative T4 values

were significantly higher, and TSH values were significantly lower in the benign group ($p < 0.001$ and $p = 0.017$, respectively). There was no significant difference in the preoperative-postoperative changes in laboratory values between the two groups ($p > 0.05$ for each parameter). No significant difference was observed in postoperative calcium values between the two groups ($p = 0.691$) (Table 2, Graph 1).

In the assessment of complications in patients, postoperative vocal cord paralysis was observed in 51 patients (10.8%). Among these 51 patients, vocal cord paralysis was permanent in 9 and tempo-

rary in 42. Our clinic has been using nerve monitoring since 2018, and based on the data from that year, it is noteworthy that 7 patients with permanent nerve damage resulted from surgeries without nerve monitoring, whereas only 2 cases of permanent vocal cord paralysis occurred in cases where nerve monitoring was used. There was no significant difference about age and gender between patients who has temporary VCP or permanent VCP ($p > 0.05$ for all). Information regarding vocal cord paralysis provided in Table 3.



Graph 1: Preoperative-postoperative TSH, T3, T4 change graphs.

Table 2: Comparison of laboratory data within and between groups.

	Gb		Gm		P (Gb vs. Gm)		P ^d
	Preop	Postop	Preop	Postop	Preop	Postop	
T3 (iqr)	4.89 (4.38-5.43)	3.97 (3.32-4.66)	4.77 (4.24-5.24)	3.68 (2.85-4.47)	0.200	0.090	0.600
T4 (iqr)	13.76 (1.73-16.79)	13.51 (1.94-17.99)	2.23 (1.48-14.75)	3.9 (1.61-13.2)	<0.001	<0.001	0.999
TSH (iqr)	1.29 (0.64-2.68)	2.55 (1.09-5.71)	2.08 (1.28-3.89)	3.77 (1.6-7.54)	<0.001	0.017	0.731
Calcium (mg/dL) (iqr)	-	8.44 (7.86-9.09)	-	8.52 (7.97-9.06)		0.691	

TSH: Thyroid stimulating hormone, Gb: Benign group, Gm: Malignant group, preop: preoperative, postop: postoperative

Table 3: Comparative results of patients who developed VCP.

		Before 2018 (n:38)		After 2018 (n:13)		p	
		t vcp (n:31)	p vcp (n:7)	t vcp (n:11)	p vcp (n:2)	p:0.804	
Age		47.58 (6.93)	44.43 (4.92)	46.91 (7.63)	41.5 (7.78)	p ^p :0.425	p ^t :0.729
Gender	Woman	20 (64.5)	4 (57.1)	6 (54.5)	1 (50)	p ^p :0.858	p ^t :0.559
	Man	11 (35.5)	3 (42.9)	5 (45.4)	1 (50)		

VCP: vocal cord paralysis, t: temporary p: permanent

DISCUSSION

Upon examining the demographic characteristics of the 471 patients included in the study, a significantly higher proportion of females was observed. This aligns with existing literature, indicating that thyroid diseases are generally more prevalent in women (11). The tendency for women to be more susceptible to thyroid diseases has been associated with hormonal changes affecting the thyroid gland's functions (12). In this context, our study's demographic data parallel existing information, confirming that women more frequently seek thyroidectomy.

According to the FNAB results, the results of AUS-FLUS and follicular neoplasia in the Gm group were significantly higher than in Gb which is similar with literature (13). These findings demonstrate that FNAB is an effective tool for predicting malignancy preoperatively and align with the literature (14). In comparing postoperative thyroid and laboratory values, it was determined that postoperative T4 and TSH values were significantly higher and lower, respectively, in the benign group. While significant differences were observed in postoperative T4 values between the groups, there was no significant difference in postoperative T3 values. No significant differences were detected between the groups in terms of laboratory changes and postoperative calcium values. The findings are similar to the literature. (15, 16).

A noteworthy finding in the study is that since the adoption of nerve monitoring in surgeries from 2018 onwards, the number of patients with permanent nerve damage has been lower (17). This underscores the effectiveness of nerve monitoring in preserving nerve integrity during thyroidectomy and reducing the risk of vocal cord paralysis (12). Examining the rates of vocal cord paralysis in relation to the total number of patients, postoperative vocal cord paralysis was identified in 51 patients (10.8%) (Fan et al., 2021). Evaluating this rate in comparison to similar studies in the literature is crucial. Current literature suggests that post-thyroidectomy vocal cord paralysis rates generally range from 1% to 10% (18, 19). In this context, our study's vocal cord paralysis rates can be considered consistent with the literature.

In the overall evaluation of this study, thyroidectomy was successfully performed, but complications did occur. Based on FNAB results, it can be said that preoperative assessments were conducted accurately, justifying surgical intervention. Significant differences between benign and malignant groups were shown in terms of thyroid and laboratory values. This highlights the substantial changes in thyroid functions post-thyroidectomy, emphasizing the need for careful patient monitoring. Particularly, there was no significant change in postoperative calcium levels, but severe complications such as vocal cord paralysis were observed.

The role of nerve monitoring emerged as a crucial factor, as surgeries with nerve monitoring

since 2018 showed a lower incidence of permanent nerve damage. This indicates that nerve monitoring is an effective tool for preserving nerve integrity and reducing the risk of vocal cord paralysis during thyroidectomy. Compared with the literature, the use of nerve monitoring aligns with many studies indicating a reduction in the incidence of vocal cord paralysis.

The unique aspects of this study include its broad sample, providing a comprehensive assessment of thyroidectomy outcomes. Evaluating a total of 471 patients, this study makes a significant contribution to understanding the effects of thyroidectomy in general surgical practice. However, the study has certain limitations.

One of the major limitations is its retrospective design. Retrospective designs may introduce reliability issues due to the lack of real-time data collection and the retrospective evaluation of information. A prospective design allows better control of the data collection process and increased standardization.

Another limitation is the inability to include many parameters that could predict malignancy. The exclusion of parameters such as genetic factors, family history, and thyroid hormone levels to more accurately determine malignancy risk is a limitation of the study.

Moreover, assessments of vocal cord paralysis are based solely on ear nose and throat (ENT) consultation results. This may result in an incomplete understanding of how paralysis affects patients' daily lives. For a more comprehensive assessment of the impact of vocal cord paralysis on the quality of life, a multidisciplinary approach should be adopted in future studies.

On the other hand, the wide sample of the study has assisted in providing broader applicability of the obtained findings to general surgical practice. This is a significant advantage for understanding the effects of thyroidectomy outcomes and obtaining more general information for clinical applications.

In conclusion, although thyroidectomy is a widespread procedure for treating thyroid diseases, it requires careful planning for the evaluation of surgical outcomes and the minimization of complications. Factors such as FNAB results, laboratory values, and nerve monitoring can significantly impact thyroidectomy outcomes. Therefore, surgical teams must conduct meticulous preoperative assessments, choose appropriate surgical techniques, and utilize new technologies, especially nerve monitoring. While this study provides a comprehensive overview of thyroidectomy outcomes, it also highlights potential areas for future research that can guide upcoming studies.

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