

The Effect of Specialization on Postoperative Complications in Thyroid Surgery

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ABSTRACT

Objective: The relationship between the surgeon's experience/volume of performed operations and postoperative results of thyroid surgery is a pressing issue that has been widely discussed in recent publications. This study aimed to compare the complication rates in thyroidectomy operations performed before and after specialization and evaluate the effect of specialization on the outcomes of thyroid surgeries.

Methods: The study included patients who had undergone thyroidectomy with or without neck dissection due to benign or malign thyroid diseases in a single tertiary reference hospital between April 2013 and March 2017. The patients were divided into two groups: those who were operated on before specialization (BS) and after specialization (AS). Age, gender, operation type, postoperative hypocalcemia, incidental parathyroidectomy, recurrent laryngeal nerve (RLN) injury, and postoperative bleeding or hematoma were compared between the groups.

Results: Of the thyroid patients, 776 were operated on (367 (47%) and 409 (53%) of the BS and AS groups, respectively). No significant difference was found between the two groups regarding the postoperative Ca^{2+} level, while the parathormone was significantly lower in the BS group ($p=0.2$ and $p=0.02$, respectively). In addition, postoperative transient hypocalcemia was significantly less common in the AS group ($p<0.001$). The incidental parathyroidectomy rate was significantly higher in the BS group ($p<0.01$). Postoperative transient hoarseness developed in 15 (4%) patients in the BS group and in 2 (0.5%) patients in the AS group. Twelve patients had unilateral vocal cord paralysis, all of whom were in the BS group ($p<0.01$). No significant difference exists between the groups regarding bleeding ($p=0.5$).

Conclusion: This study indicated that specialization in thyroid surgery significantly reduced complications (e.g., hypocalcemia, incidental parathyroidectomy, and RLN injury).

INTRODUCTION

The diseases of the thyroid glands are the second most common endocrine diseases in the general population.^[1,2] Currently, thyroid gland surgeries are widely applied in thyrotoxicosis, thyroid cancer, and relieving cosmetic problems or pressure symptoms in multinodular goiter.^[3] The scope of resection for benign thyroid diseases is still controversial although total thyroidectomy is the standard treatment in malignant thyroid diseases.^[4,5]

Thyroid surgery, previously with high mortality and morbidity rates, has recently become a safe procedure widely applied by many surgeons due to technological developments (e.g., laryngeal nerve monitoring).^[6] Recurrent laryngeal nerve (RLN) injury and hypocalcemia are the most significant and dreaded complications of thyroid surgery because they may create lifetime handicaps in patients.^[7] Several studies have shown that high-volume centers and specialization are associated with low complication rates.^[8] Reducing the mortality from 40% to 0.5% after

more than 5,000 surgeries, Theodor Kocher, one of the pioneers of thyroid surgery, is the first high-volume endocrine surgeon to demonstrate that surgical training and techniques reduce complications.^[9] Growing confidence is evident that general surgeons' specialization into more specific branches such as endocrine surgery improves the outcome of rare diseases.^[10]

In light of significant data, specialization in thyroid surgery has become more common and recognized. This study aimed to compare the complication rates in thyroidectomy operations performed before and after specialization and evaluate the effect of specialization on the outcomes of thyroid surgeries.

MATERIALS AND METHODS

Study design

The study was designed as a retrospective cohort study. The study included patients who had undergone thyroid-

ectomy with or without neck dissection due to benign or malign thyroid diseases in a single tertiary reference hospital between April 2013 and March 2017. The study protocol was approved by the institutional review board (approval number: 2020/514/178/23).

Study cohorts

The general surgery clinic of this study was transformed into a specialized center beginning in April 2014. The patients were divided into two groups: those who were operated on before specialization (BS, April 2013–March 2014) and after specialization (AS, April 2014–March 2016). Those in the BS group were operated on by 11 general surgeons, while those in the AS group were operated on by three general surgeons specializing in thyroid surgeries.

Inclusion and exclusion criteria

The study included patients >18 years operated on in general surgery clinics. Those <18 years, operated on in pediatric surgery or otolaryngology clinics, and not followed up by the clinic of this study in the postoperative period were excluded.

Data

The data were obtained from patient files, surgery reports, and pathology reports. Age, gender, operation type, postoperative hypocalcemia, incidental parathyroidectomy, RLN injury, and postoperative bleeding or hematoma were compared in both groups.

Evaluation and classification of complications

Calcium levels <8.4 mg/dL were considered as the cutoff for the diagnosis of hypocalcemia. Hypocalcemia with a need for Ca²⁺ replacement therapy of <12 months was considered as temporary, and those otherwise were considered as permanent hypocalcemia. Incidental parathyroidectomy was defined as the accidental removal of one or more parathyroid glands during elective thyroid surgery and its inclusion in pathology material.^[1] Perioperative nerve monitoring records in the surgical reports and postoperative vocal cord examinations were used for the RLN injury. Vocal cord examination was performed in the ear, nose, and throat clinic for patients with postoperative hoarseness. The cases with normal vocal cord examination and hoarseness for <6 months were categorized as temporary hoarseness. Those with hoarseness for >6 months, vocal cord dysfunction, and vocal cord paralysis (VCP) were categorized as permanent hoarseness. While evaluating the postoperative bleeding data, only cases that required reexploration and had pressure signs were considered.

Statistical analysis

Statistical analysis was done using the Statistical Package for the Social Sciences (version 24.0, IBM Corp., Armonk,

NY, USA). Descriptive statistical methods (median, frequency, percent, minimum, and maximum) were used to present the data. Pearson chi-square test was used to compare qualitative data, and Fisher's exact test was applied when the number of subgroups was low. The normal distribution of quantitative data was assessed by the Kolmogorov–Smirnov and Shapiro–Wilk tests. The quantitative data without normal distribution were compared with the Mann–Whitney U test. A p value of <0.05 was considered statistically significant.

RESULTS

Of the patients, 776 thyroid patients were operated on (367 (47%) and 409 (53%) before specialization (BS) and after specialization (AS), respectively). Moreover, 590 (76%) and 186 (24%) of the patients were females and males, respectively. The average age was 49.3±12.8 and 48.1±12.4 in the BS and AS groups, respectively. No significant difference between the groups exists in terms of age and gender. However, a significant difference was noted in terms of the extent of thyroidectomy (lobectomy vs. total thyroidectomy, p<0.001; Table 1). The rate of total thyroidectomy was higher in the BS group (73.6% vs. 57.5%), while central and lateral neck dissections due to malignant thyroid diseases were more common in the AS group (7.3% vs. 3.5%).

No significant difference in the postoperative Ca²⁺ level was found between the two groups, while the parathyroid hormone was significantly lower in the BS group (p=0.2 and p=0.02, respectively). Postoperative transient hypocalcemia developed in 61 (16.6%) and 36 (8.8%) patients in the BS and AS groups, respectively. Postoperative transient hypocalcemia was significantly less common in the AS group (p<0.001). In the pathology specimens, incidental parathyroidectomy was found in 88 (24.6%) and 28 (6.8%) of the patients in the BS and AS groups, respectively. However, the rate was significantly higher in the BS group (p<0.01; Table 2).

Postoperative transient hoarseness developed in 15 (4%) and two (0.5%) of the patients in the BS and AS groups, respectively. Twelve patients, all of whom were in the BS group, had unilateral VCP (p<0.01).

Reexploration was required due to bleeding in two (0.5%) and one (0.2%) patient in the BS and AS groups, respectively. No significant difference regarding bleeding exists between the groups (p=0.5).

DISCUSSION

Surgical intervention provides effective treatment with minimal complication and mortality. The concept of specialization, introduced in all sciences in the second half of the twentieth century, was also considered in thyroid surgery as an important branch of general surgery. The relationship between the surgeon's experience/volume of performed operations and the postoperative results of

Table 1. The comparison of demographic data and surgical interventions for the BS and AS groups

Parameters	BS group (n=367)	AS group (n=409)	p
Age, years, mean±SD	49.3±12.8	48.1±12.4	0.830
Male gender, n (%)	125 (34.1)	138 (33.7)	0.920
Lobectomy, n (%)	97 (26.4)	174 (42.5)	
Right	37	94	
Left	60	80	
Total thyroidectomy, n (%)	270 (73.6)	235 (57.5)	<0.001
+CND	9	21	
+FND	2	6	
+MRND	2	3	
Pathology results, n (%)			0.020
Benign	279 (76)	281 (68.7)	
Malignant/mic*	88 (24)/34 (9.3)	128 (31.3)/52 (12.7)	

*mic: <10 mm microcancers. BS: Before specialization; AS: After specialization; SD: Standard deviation, CND: Central neck dissection; FND: Functional neck dissection; MRND: Modified radical neck dissection.

Table 2. The comparison of complication rates in the BS and AS groups

Complications	BS group (n=367)	AS group (n=409)	p
Ca ²⁺ , mg/dL, mean±SD*	8.5±1.1	8.7±0.9	0.200
PTH, mean±SD*	30±27	41±29	0.020
Incidental parathyroidectomy, n (%)	88 (24.6)	28 (6.8)	<0.001
Hypocalcemia, n (%)	65 (17.7)	39 (9.5)	<0.001
Temporary	61 (16.6)	36 (8.8)	
Permanent	4 (1.1)	3 (0.7)	
Hoarseness, n (%)	15 (4.1)	2 (0.5)	0.002
Temporary	15 (4)	2 (0.5)	
VCD or VCP in vocal cord examination	12 (3.3)	0	
Permanent	3 (0.8)	0	
Reexploration due to bleeding, n (%)	2 (0.5)	1 (0.02)	0.500

*Values in the morning on postoperative day one. BS: Before specialization; AS: After specialization; SD: Standard deviation; PTH: Parathormone; VCD: Vocal cord dysfunction; VCP: vocal cord paralysis.

thyroid surgery is a pressing issue that has been widely discussed in recent publications.^[1,3,4,6,8,10] Several studies reported that surgical case series performed by high-volume thyroid surgeons supported this relationship in thyroid surgery.^[1,4,12,13] Surgeon volume has also been shown to affect the outcome for patients with more serious diagnoses such as thyroid cancer.^[1] The surgeon's experience was found to influence not only the complications but also the parameters such as the length of hospital stay and cost.^[1,3,8] The most common complications of thyroid surgery are bleeding, RLN injury, the injury of the external branch of the superior laryngeal nerve, esophageal injury, tracheal injury, infection, and hypocalcemia.^[14]

The most common complication after thyroidectomy is hypocalcemia with a frequency of 20%–30%.^[15] Before or after specializing in thyroid surgeries, the rate of hypocalcemia following thyroidectomy operations was lower than those reported in other studies because lobectomies were also included in this study. Consequently, postoperative

hypocalcemia resulting from surgical injury or accidental removal of the parathyroid gland is mostly seen in patients with central or lateral dissection accompanying thyroidectomy and those with Graves' disease.^[15,16] Meltzer et al.^[17] reported that the rate of hypocalcemia was significantly lower in surgeries performed by specialized and high-volume surgeons. Hauch et al.^[4] have compared the rates of hypocalcemia after thyroidectomy operations performed by low, medium, and high-volume surgeons, and showed that the rate significantly decreased with experienced thyroid surgeons. Similarly, the rate of transient hypocalcemia after thyroidectomy operations performed in the postspecialization period was significantly lower than that in the prespecialization period ($p<0.001$).

Although some studies reported that incidental parathyroidectomy did not affect postoperative hypocalcemia, several studies have shown that the incidence of transient hypocalcemia was higher in patients who had undergone one or more incidental parathyroidectomies.^[18–21] Total

thyroidectomy, the extrathyroidal extension of the tumor, and thyroiditis have been identified as risk factors for incidental parathyroidectomy.^[18,22] The rates of incidental parathyroidectomy have been reported to vary between 6% and 20%.^[19,22] In addition, Sosa et al.^[1] reported that incidental parathyroidectomy rates were lower for high-volume surgeons. Similarly, the rate of incidental parathyroidectomy in this study was significantly lower in the AS compared with the BC group ($p < 0.01$).

Thyroid cancer, Graves' disease, and recurrent goiter significantly increase the risk of RLN injury.^[23] The intraoperative RLN audiovisual monitoring has reduced the risk of nerve injury with advances in technology. The rate of RLN injury has been reported to be 5%–11%, although it is <1% in thyroidectomies performed by experienced surgeons.^[15,24] Thus, the lower rate of RLN injury was because this study was retrospective and that the vocal cord examination was performed only in patients with hoarseness. Kandil et al.^[2] reported that the risk of RLN injury was significantly lower in surgeries performed by high- compared with low-volume surgeons. In contrast, Hauch et al.^[4] showed no significant difference between the surgeries performed by low- and high-volume surgeons in terms of VCP. Moreover, all of the patients who had VCP in this study were in the BS group. In addition, the AS group was significantly superior to the BS group regarding the rate of RLN injury ($p < 0.01$).

Bleeding is a life-threatening complication after thyroid surgery. Albeit rarely, bleeding may require reexploration because it may cause pressure on the airway, block venous and lymphatic drainage, and result in laryngopharyngeal edema. The frequency of bleeding was 0.36%–4.3%.^[25] Several studies have suggested that the high-volume and specialized surgeons significantly reduce bleeding and hematoma resulting from thyroidectomy.^[1,2,4,17,26] However, no significant difference regarding the rate of bleeding that required reexploration was found between the AS and BS groups in this study ($p = 0.500$).

Retrospective design and data from a single center were the major limitations of this study. However, it is motivating and encouraging for young endocrine surgeons because the positive results of the specialization process that has recently started were shown.

CONCLUSION

This study indicated that specialization in thyroid surgery significantly reduced complications such as hypocalcemia, incidental parathyroidectomy, and RLN injury. Therefore, specialization in endocrine surgery contributes to the training of more experienced surgeons with more reliable outcomes.

Ethics Committee Approval

Approved by the local ethics committee.

Informed Consent

Retrospective study.

Peer-review

Internally peer-reviewed.

Authorship Contributions

Concept: Y.T., K.Ç.; Design: K.Ç., H.E.S.; Supervision: Y.T., O.A.; Fundings: K.Ç., H.E.S.; Materials: O.A., Y.T.; Data: O.A., Y.T.; Analysis: K.Ç., H.E.S.; Literature search: O.A., Y.T.; Writing: O.A., Y.T., K.Ç.; Critical revision: K.Ç., H.E.S.

Conflict of Interest

None declared.

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Tiroid Cerrahisinde Branşlaşmanın Ameliyat Sonrası Komplikasyonlar Üzerine Etkisi

Amaç: Cerrahin tecrübe ve volümü ile tiroid cerrahisinin ameliyat sonrası sonuçları arasındaki ilişki son yıllarda literatürde yaygın olarak tartışılan güncel bir konudur. Bu çalışmamızda, kliniğimizde branşlaşma öncesi ve sonrası dönemlerde gerçekleştirilmiş olan tiroidektomi ameliyatlarının komplikasyon oranlarını karşılaştırmayı ve branşlaşmanın tiroid cerrahisi sonuçları üzerine etkisini değerlendirmeyi amaçladık.

Gereç ve Yöntem: Çalışma, Nisan 2013–Mart 2017 tarihleri arasında tek bir üçüncü basamak referans hastanede benign ve malign tiroid hastalıkları nedeniyle boyun diseksiyonu olan veya olmayan tiroidektomi yapılmış hastaları içermektedir. Hastalar kliniğimizde branşlaşma öncesi (BÖ grubu) ve branşlaşma sonrası (BS grubu) olmak üzere iki gruba ayrıldı. Gruplar yaş, cinsiyet, operasyon türü, ameliyat sonrası hipokalsemi, insidental paratiroidektomi, rekürren larengal sinir yaralanması ve ameliyat sonrası kanama/hematoma açısından karşılaştırıldı.

Bulgular: Branşlaşmaya gidilmeden önceki (BÖ) yıllarda 367 (%47), branşlaşma sonrası (BS) iki yılda 409 (%53) olmak üzere toplam 776 tiroid hastası ameliyat edildi. Gruplar arasında Ca^{2+} açısından anlamlı fark olmadığı, PTH seviyesinin ise Grup BÖ'de anlamlı ölçüde daha düşük olduğu gözlemlendi (sırasıyla, $p=0.2$ ve $p=0.02$). Grup BS'de anlamlı ölçüde daha az ameliyat sonrası geçici hipokalsemi geliştiği görüldü ($p<0.001$). İnsidental paratiroidektomi oranı BÖ grubunda anlamlı ölçüde daha yüksekti ($p<0.01$). Grup BÖ'de 15 (%4), Grup BS'de 2 (%0.5) hastada ameliyat sonrası geçici ses kısıklığı geliştiği görüldü. Çalışmamızda toplam 12 hastada tek taraflı vokal kord paralizisi geliştiği ve bu olguların tamamının Grup BÖ'de olduğu görüldü ($p<0.01$). Gruplar arasında kanama açısından istatistiksel anlamlı bir fark yoktu ($p=0.5$).

Sonuç: Bu çalışmadan elde ettiğimiz veriler tiroid cerrahisinde branşlaşmanın hipokalsemi, insidental paratiroidektomi ve rekürren larengal sinir yaralanması komplikasyonlarını anlamlı ölçüde azalttığını göstermektedir.

Anahtar Sözcükler: Ameliyat sonrası komplikasyonlar; branşlaşma; tiroidektomi.