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Surgical Management of Pediatric Patients with Thyroid Disorders and Assessment of Complication Rates Associated with 43 Cases: A Single-Center Experience

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Öz

Pediatrik Tiroid Hastalarının Cerrahi Yönetimi ve Komplikasyon Oranlarının 43 Olgu Eşliğinde Değerlendirilmesi: Tek Merkez Deneyimi

Amaç: Bu çalışmada tiroid cerrahisi geçiren çocuk hastalardaki komplikasyon oranlarımızı ve bununla ilişkili olabilecek faktörleri araştırmayı amaçladık.
Gereç ve Yöntem: 2010 ile 2019 yılları arasında tiroid cerrahisi yapılan 19 yaşın altındaki hasta dosyaları geriye dönük incelendi. Hastaların demografik verileri, tiroid fonksiyon test sonuçları, ultrasonografi bulguları, kalsiyum değeri, lenf nodu metastazı durumu, yapılan ameliyat şekli, patoloji sonucu ve komplikasyonlar kaydedildi. Analizler IBM SPSS 20 istatistik analiz programı ile yapıldı. İstatistiksel anlamlılık düzeyi p<0,05 olarak alındı.
Bulgular: Çalışmadaki 43 hastanın 5'i (%11,6) erkek, 38'i (%88,4) kadın idi. Yaş ortalaması 16,7 (10-19) yıl idi. Ameliyat endikasyonları 25 hastada malignite veya malignite kuşkusu idi, 8 hastada bası veya kozmetik nedenler, 8 hastada toksik nodüler guatr, 2 hastada Basedow Graves idi. Ameliyat öncesi 10 hastada hipertiroidi, 33 hastada ise ötiroidi mevcuttu. 19 hastaya lobektomi, 24 hastaya total tiroidektomi yapıldı. 9 hastaya santral lenf nodu metastazı nedeniyle santral lenf nodu diseksiyonu yapıldı. Histopatolojik incelemede 16 (%37,2) hasta malign (Papiller karsinom), 27 (%62,8) hasta benign olarak rapor edildi. Ameliyat sonrası 11 (%25,5) hastada 6 aydan uzun sürmeyen hipokalsemi gelişti. Hipokalsemi gelişen grup ile hipokalsemi gelişmeyen grup arasında cinsiyet, yaş, ameliyat öncesi Ca+ (kalsiyum) değeri ve iatrojenik paratiroidektomi arasında herhangi bir ilişki saptanmadı (p>0,05). Total tiroidektomi yapılan hasta grubunda hipokalsemi görülme oranı lobektomi yapılan gruptan daha yüksekti (p<0,05). Santral diseksiyon yapılan grupta hipokalsemi gelişme oranı santral diseksiyon yapılmayan gruba göre daha yüksekti (p<0,05).
Sonuç: Çocuklarda, total tiroidektomi ve santral diseksiyon yapılan hastalarda postoperatif hipokalsemi için diseksiyon sırasında daha nazik ve dikkatli olunması komplikasyon riskini azaltacaktır.
Anahtar Kelimeler: Adölesan Tiroidektomi, Hipokalsemi, İatrojenik Paratiroidektomi

Abstract

Surgical Management of Pediatric Patients with Thyroid Disorders and Assessment of Complication Rates Associated with 43 Cases: A Single-Center Experience

Objective: In this study, we aimed to investigate complication rates and associated factors in pediatric patients who had undergone thyroid surgery.
Material and Methods: The charts of patients aged under 19 years who had undergone thyroid surgery between 2010 and 2019 were retrospectively investigated. Demographic data, thyroid function test results, ultrasonographic findings, the blood calcium level, status of lymph node metastasis, the type of surgery performed, results of the pathology report, and complications were recorded. The IBM SPSS 20 statistical software performed the statistical analysis. P<0.05 was considered statistically significant.
Results: Of 43 patients involved in the study, 5 (11.6%) were male, and 38 (88.4%) were female. The mean age was 16.7 (10-19) years. The surgical indications were the presence or suspicion of malignancy in 25 patients, compression or a cosmetic cause in 8 patients, toxic nodular goiter in 8 patients, and Basedow-Graves' Disease in 2 patients. Ten patients were hyperthyroid, and 33 patients were euthyroid preoperatively.
Lobectomy was performed in 19 patients, whereas total thyroidectomy was performed in 24 patients. I9 patients were found to undergo central lymph node dissection due to central lymph node metastasis.
Histopathological examination revealed a malignancy (papillary carcinoma) in 16 (37.2%) patients, and a benign condition in 27 (62.8%) patients. In the postoperative period, hypocalcemia lasting no longer than 6 months developed in 11 (25.5%) patients. No difference was determined between the group encountering hypocalcemia and the group without hypocalcemia regarding gender, age, preoperative Ca+ (calcium) value, and the iatrogenic parathyroidectomy rate (p> 0.05). The incidence of hypocalcemia was higher in the patient group who had undergone total thyroidectomy than the group with lobectomy (p<0.05). The development rate of hypocalcemia was higher in the patient group who had undergone central dissection when compared to those with no central dissection (p<0.05).
Conclusion: In pediatric patients who undergo total thyroidectomy and central dissection, performing the dissection more gently and meticulously will reduce the complication risk regarding postoperative hypocalcemia.
Keywords: Adolescent Thyroidectomy, Hypocalcemia, Iatrogenic Parathyroidectomy

1. INTRODUCTION

Diseases of the thyroid gland are rare in childhood. The most common thyroid disease is simple goiter, followed by thyroid nodules. Even though thyroid nodules are rarer compared to adults, the risk of malignancy is higher (1). The predicted incidence of thyroid nodules is 1-1.5% in children, whereas 13% in adults. The probability of a thyroid nodule being malignant is 5% in adults, whereas 22-26% in children. While thyroid cancer manifests itself as a thyroid nodule or a mass in adults, it is frequently encountered as cervical lymph nodes in children. Only 42% of childhood thyroid cancers are confined within the thyroid gland, whereas regional lymph nodes are involved in 46% of patients (1). The surgical indications for pediatric thyroid cancers are Graves' disease and thyroid nodules, either benign or malignant (1, 2). The risk of complications is higher in children undergoing thyroid surgery when compared to adults (3). It was reported that such risk elevation might have been related to the rarity of the disease in the pediatric age group and referral of these cases to low-volume centers performing 25-30 thyroid operations yearly (4, 5).

In this study, we aimed to investigate complication rates and associated factors in pediatric patients who had undergone thyroid surgery in our center.

2. MATERIAL AND METHODS

This study was conducted retrospectively investigating the charts of patients aged under 19 years who had undergone thyroid surgery between 2010 and 2019 in a tertiary university hospital.

Demographic data such as age and gender, thyroid function test results, fine-needle aspiration biopsy results, the diameter of the dominant nodule in ultrasonography, the preoperative blood calcium level, the status of lymph node metastasis, the type of surgery performed (lobectomy/total), the status of performing a central dissection, postoperative blood calcium level, results of the pathology report, the presence of iatrogenic parathyroidectomy, and complications such as postoperative vocal cord paralysis, hypocalcemia, and bleeding were recorded.

A blood calcium level below 8 mg/dl was considered hypocalcemia regarding the postoperative period. Hypocalcemia and vocal cord paralysis lasting less than six months postoperatively were considered temporary, and hypocalcemia lasting over six months as permanent. The patients were divided into two groups as benign and malignant according to their results in the pathology report. Risk factors for malignancy were investigated by comparing these two groups regarding age, gender, thyroid function tests, and the diameter of the dominant nodule in ultrasonography. The patients were divided into two groups as those developing and not developing postoperative hypocalcemia. Risk factors for postoperative hypocalcemia were investigated by comparing these two groups regarding parameters such as gender, age, thyroid function test results, the type of operation, the presence of central dissection, lymph node metastasis, and iatrogenic parathyroidectomy.

Statistical analysis was performed using IBM SPSS 20 statistical software. Data were presented as mean, standard deviation, median, minimum, maximum, percentage, and number. The normal distribution of continuous variables was tested using the Shapiro Wilk-W test when the sample size was <50, and with the Kolmogorov Smirnov test when the sample size was ≥50. In comparing two independent groups, the Independent Samples T-test was used when data conformed with a normal distribution, and the Mann-Whitney U test was preferred when data did not meet the requirements for a normal distribution. In 2x2 comparisons of categorical variables, the Pearson's Chi-square test was used when the expected value was (>5), the Chi-square Yates test when the expected value was between (3-5), and the Fisher's Exact test when the expected value was (<3). P <0.05 was considered statistically significant.

Ethical Declaration

Ethical approval was obtained from Atatürk University Clinical Research Ethical Committee with date 07.05.2020 and number 04/28, and Helsinki Declaration rules were followed to conduct this study.

3. RESULTS

Of 43 patients involved in the study, 5 (11.6%) were male, and 38 (88.4%) were female. The mean age was 16.7 (10-19) years. The fine needle biopsy revealed results as Category 2 (benign) in 18 patients, Category 3 (atypia of undetermined significance / follicular lesion of undetermined significance) in one patient, Category 4 (follicular neoplasm or suspicion of follicular neoplasm) in 15 patients, Category 5 (suspicion of malignancy) in one patient, and Category 6 (malignant) in eight patients according to Bethesda classification.

The surgical indications were the presence or suspicion of malignancy in 25 patients, compression or cosmetic causes in eight patients, toxic nodular goiter in eight patients, and Basedow-Graves's disease in two patients.

The preoperative thyroid function tests revealed hyperthyroidism in ten patients (two patients with Basedow-Graves' disease and eight patients with toxic nodular goiter), whereas 33 patients were euthyroid. The nodule diameter measured by ultrasonography was 20 (6-85) mm in

the benign group, whereas 19.5 (12.5-32) mm in the patient group diagnosed as a thyroid malignancy.

Nineteen patients underwent lobectomy, whereas total thyroidectomy was performed in 24 patients. Because central lymph node metastasis was present at the side ipsilateral with the tumor in nine patients, central lymph node dissection was performed. Frozen examination was not performed because fine needle aspiration biopsy was performed on all patients before surgery. Lobectomy was performed in patients with unilateral nodules and needle biopsy result of Bethesda 3-4.

The postoperative histopathological reports revealed a malignancy (papillary carcinoma) in 16 (37.2%) patients, whereas the result was benign in 27 (62.8%) patients. iatrogenic parathyroidectomy was determined in six patients. None of the patients reported having a malignant tumor had a family history or a head and neck exposure to radiation. When the benign and malignant patient groups were compared regarding age, gender, and the nodule diameter measured in ultrasonography, no significant difference was found between the two groups (p>0.05) (Table 1).

Table 1: Analysis related to malignancy

		Benign	Malign	P Values
Age (Year)		16,22±2,55	17,69±1,08	0,08
Gender	Male	3	2	1
	Female	24	14	
Nodule Diameter (mm)		26,56±17,86	19,07±4,63	0,385

Regarding postoperative complications, no vocal cord paralysis and bleeding were present. The postoperative blood Ca measurements revealed hypocalcemia in 11 (25.5%) patients, whereas 32 (74.5%) patients were normocalcemic. Hypocalcemia did not last longer than six months in patients developing hypocalcemia postoperatively.

The patient groups developing and not developing hypocalcemia were compared regarding age, gender, thyroid function tests, the preoperative Ca value, the type of operation (lobectomy/total thyroidectomy), the status of central lymph node dissection, the histopathological diagnosis (benign/malignant), and presence of iatrogenic parathyroidectomy. No difference was determined to be present between the group encountering hypocalcemia and the group without hypocalcemia regarding gender, age, preoperative Ca value, and the iatrogenic parathyroidectomy rate (p> 0.05). The rate of hypocalcemia development was significantly higher in the patient group with total thyroidectomy compared to the group with lobectomy (p<0.05). Besides, the incidence of hypocalcemia was significantly higher in the patients who had undergone central lymph node dissection compared to those with no central dissection (p<0.05) (Table 2).

Table 2: Analysis related to post-operative hypocalcemia

		Post-Operative Hypocalcemia		
		Yes	No	P Values
Age (Year)		16,82±2,27	16,75±2,24	0,8
Gender	Male	0	5	0,306
	Female	11	27	
Preoperative Ca^{+} value (mg/dl)		9,36±044	9,57±0,34	0,115
Type of Surgery	Lobectomy	0	19	0,001
	Total Thyroidectomy	11	13	
iatrogenic parathyroidectomy	Yes	2	9	0,637
	No	4	28	
Central dissection	Yes	5	4	0,034
	No	6	28	

4. DISCUSSION

Even though thyroid carcinoma is relatively rare in children and adolescents than adults, papillary thyroid carcinoma is the most common malignant tumor of the thyroid gland (6). Despite the high incidence of nodal and distant metastases of papillary thyroid carcinoma at the time of diagnosis in children, the 15-year survival rate is over 95% with an optimal thyroidectomy, excision of metastatic lymph nodes, and postoperative treatment (6). In our study also, all patients who had a malignant postoperative histopathological result had papillary cancer. Thyroid nodules in childhood are commonly seen in girls, and the thyroid nodules diagnosed at this age group have a high risk of malignancy. The information that one in every four thyroid nodules is malignant in children shows the importance of diagnosing rapidly and correctly (7). The incidence of thyroid cancer is 10-fold higher in adolescents than younger children, and in this age group, the female/male ratio is 5/1 (8, 9). Even though girls constituted most of the patients in our study (88.4%), we determined no difference regarding malignancy between the female and male genders. We also determined no significant relationship between age and incidence of malignancy.

In a study investigating 75 pediatric patients, the malignancy rate was reported as 29.3% (10). The malignancy rate of our study (37.2%) was determined to be higher when compared to the literature. The main reason for this result can be explained by the fact that most surgical indications in the study series consisted of the groups such as follicular neoplasm, malignancy, or suspicion of malignancy in fine-needle aspiration biopsy. In a study investigating a case series consisting of 314 patients, the increased nodule diameter was reported to be related to malignancy (11). Contrary to the results of that study, we did not determine any relationship between tumor diameter and ma-

lignancy in our study. Even though the number of patients in our study is small, we have the opinion that rather than assessing the tumor diameter alone, evaluating it together with other ultrasonographic features would be a correct approach for prediction of malignancy.

Studies have reported that the complication risk of surgeons performing more than 30 thyroid operations per year is lower (12). The complication rate following thyroidectomy varies between 11.6% and 41% in the pediatric population, mostly as temporary hypocalcemia (32.7%) (12, 13). In our study, no vocal cord paralysis or bleeding was identified. Experienced surgeons performing these operations in a high-volume center was suggested to be effective in the absence of such complications. The most significant complication was postoperative hypocalcemia in our study. 11 of 43 (25.5%) patients manifested hypocalcemia. None of these patients encountered permanent hypocalcemia. In studies conducted in the pediatric age group, post-thyroidectomy temporary hypocalcemia rate has been reported as 9.4-30%, and permanent hypocalcemia rate as 0.6-3.8% (14, 15). When we compared our study to the studies in the medical literature, we determined that our temporary hypocalcemia rate was consistent with the literature, whereas our rate of permanent hypocalcemia was lower. In a study investigating the results of total thyroidectomy in the pediatric age group, it was reported that while no relationships of age and gender were not present with postoperative hypocalcemia, the addition of central and/or lateral dissection to total thyroidectomy increased the incidence of postoperative hypocalcemia (16). A significant relationship between the number of intraoperatively preserved parathyroid glands and postoperative hypocalcemia was reported in the same study (16). In another study investigating the results of total thyroidectomy in the pediatric age group, it was reported that malignancy, central lymph node dissection, and iatrogenic parathyroidectomy were related to postoperative permanent hypoparathyroidism (17). In a study conducted with a large series and investigating the risk factors for hypoparathyroidism following total thyroidectomy in pediatric patients, significant relationships of central lymph node dissection and extra-thyroidal tumor extension with hypoparathyroidism were reported (18). In our study, the most significant risk factor for hypocalcemia following thyroidectomy was determined to be the extent of surgery performed in the patient. No significant relationships were found among age, gender, thyroid function tests, preoperative ca value, malignancy, and iatrogenic parathyroidectomy. Postoperative hypocalcemia was determined to be mainly related to total thyroidectomy and central lymph node dissection. When the results of our study are taken into consideration, it is seen that, rather than the number of remaining parathyroid glands, the glandular function is more determinative for hypocalcemia. When lobectomy and total thyroidectomy are compared, the presence of four parathyroid glands in the surgical site increases the exposure risk of these glands to trauma in total thyroidectomy. The circulations of the glands are impaired, and their functions are affected due to such surgical trauma. Even though the preservation of superior and inferior parathyroid glands during central neck dissection is essential, it may not always be possible. Accidental involvement of the inferior parathyroid glands to the dissection material or circulatory impairment and exposure to ischemia during dissection may predispose to postoperative hypocalcemia.

5. CONCLUSION

Total thyroidectomy and central lymph node dissection seem to be the most significant risk factors for postoperative hypocalcemia in the pediatric age group. More caution should be exercised for postoperative hypocalcemia, particularly in patients who have undergone total thyroidectomy or when central dissection has been added to the thyroidectomy procedure.

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