The role of intraoperative neural monitoring versus identification alone on post-thyroidectomy true vocal cord palsy

Tiroidektomi sonrası gerçek vokal kord palsisinde tek başına direk bakıya karşı in-traoperatif nöral monitörizasyonun rolü

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ÖZET

GİRİŞ ve AMAÇ: Amaç: Tiroid cerrahisinin en kritik ve istenmeyen, yaşam kalitesini önemli ölçüde azaltabilen komplikasyonu rekürren laringeal sinir felcidir. İntraoperatif nöromonitorizasyonu (IONM), rekürren laringeal sinir hasarını önlemek için yeni bir teknik olarak tanıtılmış olmasına rağmen, IONM'nin yararları hala tartışmalıdır. Bu çalışmanın amacı, tiroid cerrahisinin postoperatif komplikasyon oranlarını intraoperatif nöral izlemeli kulanılan veya kullanılmayan vakalarda literatür eşliğinde tartışmaktır.

YÖNTEM ve GEREÇLER: Hastalar iki gruba ayrıldı; IONM kullanılan grup (Grup 1, n: 72) ve IONM grubu olmayan geleneksel direkt görsel teknik kullanılan grup (Grup 2, n: 276). Yaş, cinsiyet, preoperatif tanı, ultrasonografik bulgular, ameliyat türü, ameliyat süresi, postoperatif kalsiyum, parathormon düzeyleri ve erken postoperatif komplikasyonlar kaydedildi.

BULGULAR: İki grup arasında yaş, cinsiyet, ameliyat tipi, hastanede kalış süresi, postoperatif kalsiyum, parathormon düzeyleri ve preoperatif tanı açısından anlamlı fark yoktu. Postoperatif kanama ve ses kısıklığı sırasıyla 6 (% 2.2) hastada ve 3 (% 1.1) hastada grup 2'de belirlendi. Bununla birlikte postoperatif kanama ve ses kısıklığı 1.grupta 1 hastada belirlendi. Hipokalsemi, grup 1'de 9 (% 12.5), grup 2'de 48 (% 17.4) hastada (p= 0.24) belirlendi.

TARTIŞMA ve SONUÇ: IONM'nin postoperatif komplikasyon oranları üzerine anlamlı bir etkisi saptamadık.

Anahtar Kelimeler: Tiroid cerrahisi, intraoperatif nöral izleme, vokal kord yaralanması

ABSTRACT

INTRODUCTION: The most critical and undesirable complication of thyroid surgery is recurrent laryngeal nerve palsy which can be significantly deteriorate the quality of life. Although intraoperative neu-romonitoring (IONM) has been introduced as a new technique to prevent recurrent laryngeal nerve damage, the benefits of IONM are still controversial. The aim of this study was to dis-cuss the postoperative complication rates of thyroid surgery with and without intraoperative neural monitoring in the context of the literature.

METHODS: The patients were divided into two groups; IONM used group (Group 1, n: 72) and conven-tional direct visual technique without IONM group (Group 2, n: 276). Age, sex, preoperative diagnosis, ultrasonographic findings, type of surgery, duration of surgery, postoperative calci-um, parathormone levels, and early postoperative complications were recorded.

RESULTS: There was no significant difference between two groups regarding age, gender, operation type, total hospitalization period, postoperative calcium, parathormone levels, and preopera-tive diagnoses. Postoperative bleeding and hoarseness were determined in 6 (2.2%) patients and 3 (1.1%) patients in group 2 respectively. However postoperative bleeding and hoarseness were determined in 1 patient in group 1. Hypocalcemia was determined in 9 (12.5%) patients in group 1 and in 48 (17.4%) patients in group 2 (p= 0.24).

DISCUSSION AND CONCLUSION: We did not determine a significant effect of IONM on postoperative complication rates.

Keywords: Thyroid surgery, intraoperative neural monitoring, vocal cord injury

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INTRODUCTION

The indications to thyroid surgery and the extent of the initial thyroid resection influence postoperative outcomes. Nowadays, more and more, total thyroidectomy seems to be the best surgical treatment option in most thyroid pathologies[1]. The main complication associated with thyroid surgery is recurrent laryngeal nerve palsy(RLNP), hematoma and hypocalcemia[2]. Recurrent laryngeal nerve (RLN) injury causes transient or permanent vocal cord paralysis; impaired cord mobility results in postoperative dyspnea, dysphagia and / or dysphonia [3]. Gold standard to avoid neural injury is RLN identification during thyroid dissection[4]. However, finding theRLN intraoperatively is not always so easy and can ~~even~~beeven challenging in some cases[4]. Intraoperative neural monitoring (IONM) has been described as a novel technique to avoid RLN injury, and by the way it also increases the comfort and confidence of surgeons during surgery [5, 6].IONM also helps the surgeon to identify and verify the functional integrity of the RLN and has gained acceptance among surgeons during thyroid operations[3, 7, 8]. However there is no agreed consensus on the use of IONM. The American Academy of Otorhinolaryngology and Head and Neck Surgery, German Association of Endocrine Surgeons and the International Neural Monitoring Study Group advice the IONM usage in all thyroid surgeries to maintain sound quality during thyroid surgery but the American Head and Neck Society advises its usage only for patients with thyroid cancer [9, 10].However as thyroid surgery evolves, the use of IONM has become widely accepted as a valuable adjunct to the gold standard method of visual identification and dissection of the RLN [11]. The debate with whether usage of IONM can lead to decreased numbers of RLNP is still exists and continued to be the troublesof numerous authors and specialists worldwide [11-13]. There is no proof, statistically at least, of reduced incidence in RLNP, in the current literature, with the use of IONM versus visual identification alone[11].The aim of the study was to investigate whether the use of IONM can minimize the risk of complication rates in comparison with visual RLN identification.

MATERIALS AND METHODS

This study was performed in Derince education and research hospital.The study was approved by the local ethics committee. The data of348 patients who had thyroid surgeries betweenJanuary 2013 and June 2018inwere retrospectively evaluated. Patients operated with IONM were classified as Group 1(IONM group 1, n: 72); patients operated with conventional direct visualtechnique without IONM were classified as Group 2 (Non-IONM group, n: 276).All patients were operatedunder general anesthesia with endotracheal intubation in a single department withan experienced surgeon.Additional muscle relaxants were used only patients in group 2.Patients who had missing data, younger than 18 years of age, pregnant women and patients with a history of laryngeal or thyroidal surgery were excluded from study. From the patient records, age, gender, preoperative diagnoses, ultrasonographic findings, operation type and duration, postoperative calcium and parathormone levels on the first postoperative day, total hospitalization duration, early postoperative complications (bleeding, hoarseness, hypocalcemia, re-operation requirement) were recorded. Calcium levels less than 8.5 mg/dl were accepted as hypocalcemia.

In Group 1, patients were operated using the Nerve Integrity Monitor (NIM) (Dr Langer Medical, Germany). During intubation, an endotracheal tube with an integrated surface electrode was placed between the vocal folds by the anesthesiologist under direct vision. Neuromonitoring began after the dissolution of the muscle relaxant effect. Repetitive 1-mA-2-mA stimulation of RLN was performed with a

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standard intermittent monopolar probe. Appropriate stimulation was identified by both the audible alarm of the NIM system and the observation of a recognizable EMG waveform (> 100 μV for RLN).Intraoperative signal loss was not observed in cases.

Statistical Analysis

Statistical analyses were performed with SPSS 21.0 for Windows. The normal distribution conformity was assessed by using the Kolmogorov-Smirnov Test.In descriptive statistics, the categorical variables were expressed as number and percentage and the numerical variables were expressed as mean, and standard deviation. The normally distributed numerical variables were compared with Student's t-test. If the numerical variables were not normally distributed, Mann-Whitney U-test was performed. In comparison of categorical variables, Chi-square test was performed. P<0.05 was considered statistically significant.

RESULTS

There was nosignificant difference between two groups regarding age and gender. In group 1, the nodule diameter was significantly shorter than the group 2 (p=0.001). Operation type, total hospitalization period, postoperative calcium and parathormone levels were similar between two groups (Table 1). Preoperative diagnosis was multinodular goiter (MNG) in 60 (83.3%), Toxic multinodular Goiter (TMNG) in 11 (15.3%) andpapillary cancer in 1 (1.4%) of the patients in IONM group. In group 2, the preoperative diagnosis was MNG in 206 (76.8%) patients, TMNG in 54 (19.5%) patients, toxic solitary nodule in 9 (3.2%) patients, papillary cancer in 3 (1.1%) patients and graves in 4 (1.4%) patients. There was nosignificant difference between two groups regarding the preoperative diagnoses (p= 0.13).General characteristics and operative findings of study are summarized in Table 1.

Early postoperative complications that took place during hospitalization of the patients were recorded (Table 2). Postoperative bleeding was determined in 6 (2.2%) patients (p=0.57) and hoarseness was determined in 3 (1.1%) patients in group 2. However postoperative bleeding or hoarseness was determined in 1 patient ingroup 1. Hypocalcemia was determined in 9 (12.5%) patients and in 48 (17.4%) patients in group 1 and 2 respectively (p= 0.24) (Table 2).

Pathologic results were 9(12.5%) patients in group 1 and 41(14.8%) patients in group 2 as thyroid cancer. The patients with malign pathology in IONM group, hypocalcaemia was seen in one patient while other complications were not reported. On the other hand, in non-IONM group postoperative bleeding was determined in 1 patient, hypocalcemia in 6 patients and re-operation requirement in 1 patient. In that subgroup of patients with malign pathology, there was not any significant difference regarding complication rates between IONM and non-IONM groups.

DISCUSSION

The present study assessing the incidence and evolution of postoperative results after thyroid surgery with or without IONM. Though RLN injury is one of the most frightening and serious complication due to loss of quality of life andlabor, hypocalcemia is the most frequent complicationin thyroid surgery[14, 15]. Therisk of vocal cord paresis due to iatrogenic RLN injury in non-complex thyroid operations is as low as 0.1%[16].Therefore, IONM is not recommended for routine use due to the low risk of permanent RLN damage and it was suggested to be mainly used in in difficult thyroid surgery, in particular in redo surgery, thyroid cancers and Graves' disease operations, where the risk of RLN injury is extremely high[17]. However use of IONM in thyroid surgery has gradually become a widely acceptedadjunct in thyroid surgery for it is the

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only method that provides the surgeon intraoperative information regarding nerve's identification and functional integrity[11]. Therefore, it supplements the gold standard method of visual identification with valuable information about nerves anatomical integrity and functional ability. Whether its use decreases theRLNP incidence still remains controversial [11, 12].Joliat et al reported that the incidence of vocal cord paresis after thyroidectomy was 8.3% and among those 91% were transient and intraoperative RLN injury was one of the main risk factors for permanent injuries after thyroidectomy [9].In a prospective study with IONM usage, RLN was identified in 92% of the cases and early nerve injury occurred in 3.7% of the cases while 1.1% of them were permanent[18].Bergenfelz et alinvestigated that the risk of postoperative vocal cord palsy with and without IONM in 5252 patients who undergone thyroidectomy, the permanent vocal cord palsy was determined in 1.2% of patients[19]. They reported that, the use of IONM was not associated with a decreased risk of early vocal cord palsy but decreased the risk of permanent vocal cord palsy. In another recent retrospective study on 627 patients, reported that IONM had no impact on the rate of permanent RLN injury during thyroidectomy[20].Similarly, Kadakia et al. reportedthat intraoperativemonitoring during thyroidectomy was not prevent RLN injury[21].On the other hand, Wojtczak et alanalyzed the voice outcomes with self-assessment questionnaires of 40 patients after thyroidectomy with IONM and reported that neuromonitoring was beneficial for patients to improve voice quality[8].In our study the overall rate of hoarseness after thyroid surgery was about 1.2% and there was not any significant difference between two groups regarding the rate of hoarseness.Similar with our study, Demiryas et alcompared the postoperative complication rates during thyroid surgery with or without IONM usage and reported that although there was not a significant difference between two groups regarding the rates of unilateral RLN paralysis, hematoma or suture reaction; hypocalcemia was significantly less commonand the operation time was significantly shorter in IONM performed group[3].

In a study conducted by Higgins et al. on patients who were re-operated for thyroid diseases, they found nosignificant difference regarding the operation time and RLNP rates in operations performed with or without IONM [22]. In our study, we did not determine any significant difference regarding the rates of hypocalcemia, postoperative bleeding, or re-operation requirement between patients operated with or without IONM. In addition, we found that nerve monitoring did not have a significant effect on the duration of operation.

In a systematic review by Wong et al. evaluated the role of IONM in reducing RLNP during high-risk thyroidectomies such as re-operation, thyroidectomy for malignancy, thyrotoxicosis or retrosternal goiter and reported that compared with visual identification alone IONM had lower rates of RLNP[6].Baek et alanalyzed the voice outcomes in patients who had undergone IONM thyroidectomy for papillary thyroid carcinoma and reported that IONM was an effective method to reduce temporary phonation alteration after thyroidsurgery[23].In our study in patients with malign pathology, there was not any significant difference regarding complication rates between IONM and non-IONM groups. We did not determine any positive effects of IONM on thyroid operations for malign pathology regarding complication rates or operation time.

There are some limitations of this study that should be expressed. The main limitation of this study is its retrospective design, low number of high-risk thyroidectomies, andpatients in the IONM group. It will be more useful to evaluate the effect of IONMinlarger sample size study

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which was classified according to preoperative diagnosis and types of surgery.

In conclusion, we did not determine a significant effect of IONM usage on postoperative complication ratesor operation time in thyroid surgeries. Especially the rate of RLNP after thyroid operations is not high; the risk factors for RLNP should be defined clearly and in that group the outcomes of IONM usage should be investigated.

Conflict of interest: None.

Table 1: General characteristics and operative findings of study participants

	IONM group (n:72)	**Non-IONM group (n:276)**	**p**
Gender (M/F)	16/56	50/226	0.61
Age	53.82±13.83	51.40±12.85	0.14
Nodule diameter			
1-2 cm	29	70	**0.001**
2-3 cm	23	90	
3-4 cm	7	54	
>4 cm	13	62	
Operation			
Bilateral total thyroidectomy	68	246	0.37
Lobectomy +isthmectomy	2	17	
Complementary thyroidectomy	2	10	
Central neck dissection	0	3	
Operation time (min)	60.84± 6.43	61.50 ± 6.63	0.45
Calcium (mg/dl)	8.42 ± 0.76	8.36 ± 0. .81	0.71
PTH	74.12 ±16.21	71.17 ±12.25	0.64
Hospitalization (days)	1.25 ± 0.43	1.19 ± 0.39	0.33

M: Male, F:Female, PTH: Parathyroid hormone

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Table 2: Postoperative complications

	IONM group (n:72)	Non-IONM group (n:276)	p
Postoperative bleeding	1 (1.4%)	6 (2.2%)	0.57
Hoarseness	1 (1.4%)	3 (1.1%)	0.34
Hypocalcemia	9 (12.5%)	48 (17.4%)	0.24
Re-operation requirement	1 (1.4%)	5 (1.8%)	0.51

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