

Can Postoperative Laryngeal Examination be Neglected in Thyroid and Parathyroid Patients With No Loss of Signal After Intraoperative Neuromonitoring?

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ABSTRACT:

Can postoperative laryngeal examination be neglected in thyroid and parathyroid patients with no loss of signal after intraoperative neuromonitoring?

Objective: We aimed to evaluate the necessity and the worthiness of postoperative vocal cord examination in cases with no loss of signal during intraoperative nerve monitoring (IONM) in thyroid and parathyroid surgery.

Material and Methods: We retrospectively evaluated cases that had no loss of signal during intraoperative nerve monitoring in cases who underwent thyroid and parathyroid surgery in our endocrine surgery unit, between January 2014 - January 2017.

Results: A total of 171 patients were analyzed who had no loss of signal during IONM. It was observed that 94 of the patients (55%) had at least one previous surgery and 77 (45%) underwent their first operation. Ninety-one patients were monitored with continuous-IONM and 80 with intermittent-IONM. All patients' preoperative and postoperative laryngeal examinations were identical and no postoperative vocal cord problems were observed.

Conclusion: The signal from the vagus nerve is sufficiently sensitive to show the postoperative vocal cord functions after resection in patients having no loss of signal during IONM. We support the idea that postoperative vocal cord examination may be neglected in these patients.

Keywords: Intraoperative nerve monitoring, standardizations, thyroidectomy, vocal cord examination

ÖZET:

İntraoperatif nöromonitörizasyon uygulaması sonrası, sinyal kaybı yaşanmayan tiroid ve paratiroid hastalarında postoperatif laringeal muayene ihmal edilebilir mi?

Amaç: Tiroid ve paratiroid bezlerinin cerrahisinde, intraoperatif nöromonitörizasyon (İONM) uygulaması sırasında sinyal kaybı yaşanmayan olgularda postoperatif vokal kord bakısının gerekliliğini ve standardizasyon-daki yerini irdelemeyi amaçladık.

Gereç ve Yöntemler: Kliniğimizin endokrin cerrahisi bölümünde, Ocak 2014-Ocak 2017 tarihleri arasında, İONM uygulanmış ve sinyal kaybı yaşanmamış tiroidektomi ve paratiroidektomi hastaları geriye dönük olarak incelendi.

Bulgular: İONM eşliğinde sinyal kaybı saptanmayan 171 hasta ele alındı. Hastaların 94'ünün (%55) en az bir kere ameliyat geçirdiği, 77'sinin (%45) ise ilk ameliyatı olduğu gözlemlendi. Hastalardan 91'ine sürekli, 80 hastaya ise aralıklı İONM uygulandı. Tüm hastaların ameliyat öncesi larinks muayeneleri ile ameliyat sonrası larinks muayenelerinin aynı olduğu, ameliyat sonrası dönemde hiç bir hastada vokal kord sorunu olmadığı gözlemlendi.

Sonuç: İONM uygulanan ve sinyal kaybı olmayan olgularda rezeksiyon sonrası nervus vagustan alınan sinyal postoperatif vokal kord fonksiyonlarını göstermede yeterince duyarlıdır. Bu hastalara postoperatif vokal kord bakısının ihmal edilebileceği kanısındayız.

Anahtar kelimeler: İntraoperatif nöromonitörizasyon, standardizasyonlar, tiroidektomi, vokal kord bakısı

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INTRODUCTION

Thyroid gland surgery is an important part of general surgery practice. In parallel to the technological developments in auxiliary equipment used in the operating room, as well as day-to-day scientific developments and experience since Theodor Kocher, the pioneer of the thyroid gland surgeon, the morbidity and mortality gradually decreased. One of the most feared complications during thyroidectomy or parathyroidectomy operations is recurrent laryngeal nerve (RLN) injury. Temporary paralysis of the RLN following thyroidectomy is seen in 2.2% (0.4-3.9) and permanent paralysis in 1.6% (0-3.6) (1,2). Some factors may increase the risk of RLN paralysis. These factors are mainly the secondary surgeries performed for recurrent cases, cancer surgeries, extended surgical interventions, revision or completion surgeries, secondary surgeries due to postoperative early bleeding complications, and surgical interventions to be applied to patients who had previously received radiotherapy in the head and neck region. The causes of RLN paralysis after thyroidectomy include partial or complete cut of the nerve, stress, crushing, thermal damage due to cauterization, development of ischemia due to impaired vascularization, suture that has remained in the tissue (3).

The finding and identification of RLN during thyroidectomy has been an accepted method for less vocal cord morbidity since the early 1900's. In each case, the search for the nerve and its presentation are accepted as the gold standard (5,6). Intraoperative neuromonitoring (IONM) is an adjunctive procedure that is widely used perioperatively for the identification

of motor nerves in areas such as neurosurgery, orthopedics, plastic surgery and otorhinolaryngology. IONM in thyroidectomy has been proposed to define RLN and reduce the risk of vocal paralysis. Thomusch et al. showed that using the IONM demonstrated a significant reduction in postoperative transient and permanent nerve damage (6). Barczynski et al. (7) demonstrated that IONM reduced the rate of RLN paralysis by 2.9% in the high-risk group of patients, and by 0.9% in low-risk patients. In the light of these scientific data, IONM application has become more frequently used in thyroidectomy operations. Standardization studies have been carried out in order to provide effective and accurate use of the IONM application and create a common language (8,9). This standardization includes preoperative and postoperative laryngeal examination, peroperative nerve vagus and RLN stimulation (Table-1).

Electrophysiological return signal can be obtained numerically by IONM application. Values V1, R1, R2 and V2 are the values found in a classical electromyography (EMG). These values are the amplitude and latency values that make up an EMG wave. To mention that the nerve function is fully preserved, the values obtained postoperatively should be similar or close to the initial values. Otherwise a signal loss can be mentioned. Signal loss can be defined as a decrease in received amplitude below 100 µV or a complete loss of signal. However, more than 50% reduction in the initial vagus amplitude and more than 10% prolongation in the latency are warnings of signal loss (8,10). In the event of signal loss, postoperative vocal cord viewing (L2) is important. It has also been accepted that examining the vocal cord in the postoperative period is a standard part of the IONM (8,11).

Table-1: Steps of intraoperative neuromonitoring (IONM)

L1	Preoperative vocal cord examination
V1	Ipsilateral vagus stimulation before RLN dissection
R1	Stimulation of RLN at the time it's found in the tracheoesophageal Groove
R2	Stimulation of RLN at the most proximal location where it is dissected after the surgical thyroid procedure is completed
V2	Stimulation of vagus after surgery is completed (It is the most sensitive test in predicting postoperative vocal cord function)
L2	Postoperative vocal cord examination

Postoperative vocal cord viewing must be performed in patients with IONM and signal loss. Is it necessary to view vocal cord postoperatively in cases with no signal loss? Can L2 in IONM be removed from standardization in cases where there is no signal loss? In this study, we aimed to investigate the necessity of postoperative vocal cord viewing following thyroid gland and parathyroid gland surgery in patients without IONM signal loss.

MATERIAL AND METHODS

Cases of thyroidectomy and parathyroidectomy without signal loss in IONM in endocrine surgery department of our clinic between January 2014 and January 2017 were included in the study. Demographic data, preoperative diagnosis, type of operation, type of IONM application, preoperative and postoperative vocal cord viewings were retrospectively evaluated.

In our clinic, IONM is applied selectively and each patient is informed about the preoperative system and possible problems. Since the neuromuscular blocking agents would affect the monitoring system, the patients who were to undergo ION were informed to the anesthesia team one day before the operation. Prior to intubation, the appropriate electrode was glued to the appropriate region of the intubation tube by the surgical team. Avalanche XT® (Dr. Langer Medical GmbH, Waldkirch, Germany) device was used for the IONM. Very low doses of non-depolarizing neuromuscular agents (rocuronium, atracurium 0.3 mg/kg) were used to facilitate intubation. Total intravenous anesthesia technique with propofol and remifentanyl was used for continuing anesthesia. In order to

determine the correct placement of the intubation tube, the direct viewing and connections were completed and then tapping was performed with a finger on the midline cricoid or thyroid cartilage. In addition, respiratory variation fluctuations were observed on the monitor.

Nerve stimulation was performed with a bipolar probe with 1 mA current. After questioning the causes of false signal loss such as tube malpositioning, equipment dysfunction, fluid pooling, and inappropriate neuromuscular use, the received amplitude value reduced below 100 µV, complete loss of the signal, the original vagus amplitude to be reduced by more than 50% and elongation of latency more than 10% were all considered as signal loss or a stimulant for signal loss. V1, R1, R2 and V2 values were recorded in all cases.

V2 was recorded immediately before the midline muscles were closed, after the entire resection was completed and the hemostasis was checked. The approval was obtained for our study by the ethics committee for clinical research of our faculty.

RESULTS

A total of 171 patients were studied, including 125 women (73%) and 46 men (27%). The mean age was 51 (21-85) years. It was observed that 94 of the patients (55%) had at least one operation and 77 (45%) had their first operation. Surgical indications are listed in Table-2. The most common surgery was total thyroidectomy (60%) (Table-3).

Ninety one patients (53%) had continuous IONM and 80 patients (47%) had intermittent IONM application. Preoperative vocal cord viewing (L1) was normal in 158 patients (92%), 11 (7%) patients

Table-2: Indications for surgery

Recurrent multinodular goiter	40 (23.3%)
Multinodular goiter	35 (20.5%)
Completion surgery in thyroid cancer	30 (17.5%)
Thyroid cancer or cancer possibility (First surgery)	29 (17%)
Recurrent thyroid cancer	14 (8%)
Graves' disease	11 (6.4%)
Parathyroid adenomas (recurrence, persistent or thyroidectomized cases)	9 (5%)
Toxic multinodular goiter	2 (1%)
Recurrent Graves' disease	1 (0.5%)

Table-3: Surgical types

Total thyroidectomy	102 (60%)
Completion thyroidectomy	22 (12.8%)
Completion thyroidectomy, central and lateral lymph node dissection	11 (6.4%)
Total thyroidectomy and central lymph node dissection	8 (4.6%)
Total thyroidectomy, central and lateral lymph node dissection	5 (3%)
Central lymph node dissection	5 (3%)
Hemithyroidectomy	4 (2.3%)
Completion thyroidectomy and central lymph node dissection	3 (1.7%)
Central lymph node dissection and lateral 'berry picking' surgery	1 (0.5%)
Subtotal thyroidectomy	1 (0.5%)
Parathyroidectomy	9 (5%)

Table-4: Intraoperative amplitude values

	n (%)	Right V2 (µV)	Left V2 (µV)
Female	125 (73%)	640 (520-1280)	670 (540-1360)
Male	46 (27%)	720 (560-1540)	730 (580-1580)
Total	171 (100%)	660 (520-1540)	685 (540-1580)

had unilateral paralysis in the vocal cord and 2 (1%) patients had movement restriction. In the postoperative vocal cord viewing (L2), the laryngeal examination of all patients was observed to be identical to the preoperative vocal cord viewing (L1). In addition, in 7 of 11 patients with vocal cord paralysis detected in the preoperative period were observed to have no V2 signal on the paralytic side. The V2 amplitude values of these patients were evaluated on the non-paralyzed side (Table-4). In the other 4 patients, the V2 signal was not checked because the paralytic side was not treated.

CONCLUSION

Intraoperative nerve monitoring application is being used more frequently every day in thyroidectomy or parathyroidectomy operations. This increased use brought together certain standardizations. The International IONM Study Group published a guideline for this standardization (8). This guide has been supported by many other studies (9). This standardization includes preoperative and postoperative laryngeal examination, preoperative nerve vagus and RLN stimulation.

The IONM is used to navigate the RLN during surgery, as well as to confirm that the nerve function is preserved. Electrophysiologic return (reception of

V2 signal) from the vagus nerve, especially after resection, is considered to be the most sensitive method to demonstrate postoperative vocal cord function (8,9). Although there is an electrophysiologic reception signal, there is a possibility of vocal paralysis at the postoperative laryngeal viewing. One of the most common reasons for this 'false negativity' condition is the reception of only the R2 signal after resection. It should not be forgotten that a signal can be received from the distal part of the wound in Type 1 (segmentary) type injury that occurs in the RLN. This leads to false negativity and can be avoided simply by receiving the V2 signal. Another common cause is to continue the procedures that can cause RLS injury, such as bleeding control, after V2 signal is received. To prevent such a possibility, as in this study, the V2 signal should be recorded and received immediately before the midline muscles are closed, after the entire resection procedure has been completed and bleeding has been checked. In addition, the development of laryngeal edema due to intubation or dislocation of arytenoid cartilage may also be among the causes of false negativity. However, as noted in the guidelines of the IONM group, all of the vocal cord paralysis that can occur in cases where the V2 signal is normally taken are transient states that do not cause severe symptoms.

The recent guideline of the American Thyroid

Association (ATA) suggests that the postoperative vocal cord viewing should be performed in patients with altered voice. Even without the IONM, there is no proposal to apply vocal cord viewing to all to all postoperative patients without voice alteration (12). Many sources also suggest that the vocal cord viewing after thyroidectomy to be performed in the presence of dysphagia or dysphonia (13,14). For this reason, postoperative vocal cord viewing (L2 in the standard) can be considered as an extra procedure when V2 signal is received without any problems and there is no loss of signal. Sensitivity of the vocal cord viewing is an examination method that is dependent on the person who is performing and also affected by the laryngeal reflexes of the patient

during the examination. Although it is a non-invasive procedure, there are patients who do not tolerate this examination and do not want it to be performed. Tolerance to this examination is especially low for patients with anxiety; this condition reduces both the reliability of the examination and creates an unnecessary loss of work due to the prolongation of the procedure.

In conclusion, we believe that the V2 signal is sensitive enough to show the postoperative vocal cord functions in patients who are applied IONM and showing no signal loss. We believe that it is unnecessary to perform postoperative vocal cord viewing and that L2 (postoperative vocal cord viewing) can be overlooked in standardization.

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