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Research Article

Innovations in Monitoring of Recurrent Laryngeal Nerve in Thyroidectomy Surgeries

Hasan Zafer ACAR[a*], Alper BOZ[b]

[a]Girne American University, Faculty of Medical, General Surgery Department, TRNC
[b]Ortaca Yücelen Hospital, General Surgery Department, Türkiye

ORCID[a]: 0000-0001-6435-8720
ORCID[b]: 0000-0002-2482-8430

Corresponding Author e-mail: hzacar@mail.com

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ABSTRACT: One of the most common complications in thyroidectomy operations is recurrent laryngeal nerve damage. Intraoperative neural monitoring has an important contribution to reduce these complications. In our study, we briefly reviewed the innovations related to this method in recent years. According to the results of our study, innovations in intraoperative neural monitoring and anesthesia in thyroidectomy and some surgeries performed in areas close to the recurrent laryngeal nerve have led to this practice being more effective and cost-effective.

KEYWORDS: Thyroidectomy Surgery, Recurrence Laryngeal Nerve, Monitoring.

1. INTRODUCTION

One of the most common complications in thyroidectomy surgeries is recurrent laryngeal nerve (RLN) injury [1]. Intraoperative neuromuscular monitoring (IONM) method used in these cases to reduce RLN damage rates is significantly effective, and important innovations have been introduced in this regard in recent years. In our study, we will briefly review the important ones among these innovations.

In a study conducted by Duong et al. with the data obtained from the national database, they reported that IONM was performed in 4269 out of 6942 thyroidectomy cases, and severe RLN injury was statistically significantly less common in patients who underwent IONM [2]. IONM method is very effective in reducing morbidity, since RLN damage is common in operations such as esophagectomy, cervical discectomy, lymph node dissection performed in the neck region apart from thyroidectomy operations:

In a prospective study by Çomşalı et al., it was reported that in 166 neck dissection cases, more lymph node dissection could be performed in the IONM group, and recurrence damage was less common [3]. In a meta-analysis conducted by Chen et al., it was reported that performing IONM in patients undergoing esophagectomy is beneficial in preventing RLN damage and pneumonia, and is a method that enables the removal of more lymph nodes in cancer patients [4].

In a study by Niljianskul et al., it was shown that performing IONM with an EMG endotracheal tube in anterior cervical discectomy and fusion surgeries may reduce the risk of RLN injury [5]. In a retrospective study conducted by Türk et al., monitoring was performed with thyroid cartilage needle (TCN) electrodes in 775 cases out of 885 IONM cases, and with endotracheal tube surface electrodes (ETS) in 110 cases. All amplitudes were high in the IONM system in both methods, however it has been reported that TCN electrodes are 20 times cheaper than ETS electrodes, so they should be preferred [6].

In a study by Peng et al., EMG recordings were made with modified arytenoid muscle electrodes in 122 cases, and it was reported that this method is easy to apply, effective and reliable for IONM[7].In a study by Lee et al., they compared the method of applying adhesive skin electrodes in IONM with an EMG endotracheal tube in 39 cases of thyroidectomy with the risk of RLN damage, and reported that although the signal amplitudes were statistically significantly lower, the adhesive skin electrodes could be used safely for IONM during thyroidectomy[8].

In a prospective clinical study, the authors divided 50 patients who underwent total thyroidectomy into 2 groups. In the first group, they only performed optical magnification (OM) to see the RLN in the operation area better, and they applied IONM in

the other group. As a result of the study, no statistically significant difference was found between the two groups in terms of RLN injury. The authors reported that applying both methods together is the most appropriate method [9].

In a study by Fu et al., they reported that performing thyroidectomy with IONM with the sternocleidomastoid intermuscular approach is more suitable for the absence of RLN damage than the anterior cervical approach, and also provides better cosmetic results due to not cutting the anterior cervical muscles [10].

Sometimes false signal loss may occur when performing IONM during thyroidectomy operations. In their study, Kong et al. reported that when direct RLN stimulation is performed with portable devices, it can be revealed more accurately whether the signal loss is true or false compared to IONM [11]. In a recent study, the effects of continuous or intermittent IONM in thyroidectomy operations were investigated. According to the results obtained in the study, both methods have been shown to be effective in preventing RLN damage in thyroidectomy and parathyroidectomy operations [12].

Using adhesive skin electrodes for IONM is an effective method. In the animal experiment and clinical studies by Shin et al., a study was conducted on where the adhesive skin electrodes should be attached in order to obtain the best results. According to the results obtained in the study, it has been shown that sticking the adhesive electrodes right next to the thyroid cartilage gives the best results for monitoring [13].

In a clinical study conducted by Baychorov et al., it was reported that the combined use of IONM and percutaneous larynx ultrasonography methods is the most effective method to prevent and evaluate RLN paralysis in thyroidectomy operations [14].

Hassan et al. developed a protocol called Abu Dhabi Neural Mapping (ADNM) in order to identify nonrecurrent laryngeal nerves and prevent hoarseness in minimally invasive thyroidectomy surgeries, and reported that the application of this protocol in operations is effective [15]. In a study by Tseng et al., the reliability of the quantum molecular resonance device was tested while performing continuous IONM during thyroidectomy in pigs, and it was reported that these devices should be used with care to avoid RLN injury [16].

In a study by Ling et al., direct transcrycothyroid electromyographic monitoring was performed for IONM in 50 thyroidectomy cases, unilateral RLN palsy was observed in only 10 cases, and it was reported that this method was effective and feasible for IONM in thyroidectomy surgeries [17].

In recent years, some innovations regarding anesthesia techniques have been reported during thyroidectomy operations performed with IONM:

In a study conducted by Kriege et al., methods such as videoryngoscopy and conventional direct laryngoscopy were compared to control the surface electrodes in order to prevent the decrease of intraoperative nerve signal quality in patients who underwent thyroidectomy and IONM, and videoryngoscopy was shown to be more effective [18].

In a study by Hsieh et al. reported that IONM in thyroidectomy operations decreases complication rates, but two important issues should be considered during anesthesia. First, they reported that the surface electrodes should contact the endotracheal tube sufficiently during monitoring, so that neuromonitoring signals can be received regularly, and secondly, routine neuromuscular blocking is required in order to provide sufficient signal stimulations [19]. In a controlled clinical study conducted by Oh et al., 20 of 40 thyroidectomy cases who underwent IONM were given neostigmine immediately after tracheal intubation, while the other group was given only saline. According to the results obtained in the study, neuromuscular blockade for IONM was immediately reversible in the neostigmine group [20].

In a study by Li et al., 40 thyroidectomy cases who underwent IONM were divided into 2 groups, and positive EMG signal durations were compared by giving profofol-based total intravenous anesthesia (TIVA) to the first group and combined intravenous and sevoflurane-based anesthesia to the other group. According to the results obtained in the study, it was shown that the duration of positive EMG signal emergence was longer in the group given combined intravenous and sevoflurane anesthesia compared to the TIVA group [21].

In a study by Li et al., it was shown that IONM reduces the risk of RLN palsy, but that neuromuscular blocking drugs used during the operation can endanger EMG responses, and when cisatracurium at a dose of 2xED95 is used for this purpose, better intubation conditions can be achieved than 1xED95, and the IONM process is not impaired [22] .

In a study conducted by Graceffa et al., in patients who underwent IONM during thyroidectomy, signal return was statistically significantly higher in patients who were given a single dose of steroid and escin, compared to those who were not given EMG signal loss [23].

4. CONCLUSIONS

According to the results of our mini-review, the application of IONM in other operations performed in the neck region close to the RLN, such as thyroidectomy, reduces the rates of RLN damage. Innovations in IONM in recent years have allowed IONM to be implemented more effectively and cost-effectively.

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