ORIGINAL ARTICLE

Results of injurious laryngeal recurrent in thyroid surgery with the use of the neurostimulator

Resultados de lesión del nervio laríngeo recurrente en cirugía de tiroides con el uso del neuroestimulador

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Abstract

Background: *Intermittent intraoperative neuromonitoring of the recurrent laryngeal nerve is the ideal complement in thyroid surgeries, decreasing thyroid injuries.* **Objective:** *The objective of the study is to analyze the prevalence of recurrent laryngeal nerve injuries with the use and without the use of neuromonitoring in thyroid surgery.* **Methods:** *This was an observational, descriptive, and retrospective study, in which a total of 571 patients were included between the years 2012 and 2018. Of which 180 neuromonitoring was used and 391 were not used.* **Results:** *Of the 180 patients who underwent total thyroidectomy with the use of neuromonitoring, we had a total of 8 (4.4%) transient paralysis and 2 (1.1%) definitive. Without the use of neuromonitoring, we obtain 12 (3%) transient paralysis and 7 (1.85%) definitive.* **Conclusions:** *We believe that the use of neuromonitoring complementary to surgery should be used routinely to the usual technique. Moreover, we also obtain significant results regarding the reduction of recurrent laryngeal nerve injuries with the use of intraoperative neuromonitoring.*

Keywords:*Postiroidectomy complications. Injury recurrent laryngeal nerve. Neurostimulator*

Resumen

Antecedentes: *La neuromonitorización intraoperatoria intermitente del nervio laríngeo recurrente es el complemento ideal en las cirugías tiroideas, ya que disminuye las lesiones.* **Objetivo:** *Analizar la prevalencia de lesiones del nervio laríngeo recurrente con y sin el uso de neuromonitorización en cirugía de tiroides.* **Métodos:** *Estudio observacional, descriptivo y retrospectivo, en el que se incluyeron 571 pacientes entre los años 2012 y 2018. De ellos, en 180 se utilizó neuromonitorización y en 391 no.* **Resultados:** *De los 180 pacientes que se sometieron a tiroidectomía total con neuromonitorización hubo 8 (4.4%) parálisis transitorias y 2 (1.1%) parálisis definitivas. Sin el uso de neuromonitorización hubo 12 (3%) parálisis transitorias y 7 (1.85%) definitivas.* **Conclusiones:** *Creemos que la neuromonitorización debe usarse sistemáticamente con la técnica habitual. Obtenemos resultados significativos con respecto a la reducción de las lesiones del nervio laríngeo recurrente con el uso de neuromonitorización intraoperatoria.*

Palabras clave: *Complicaciones postiroidectomía. Lesión nervio laríngeo recurrente. Neuroestimulador.*

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Introduction

Recurrent laryngeal nerve (RLN) injury and secondary hypoparathyroidism are the most significant complications of thyroid surgery, with great impact on patient quality of life and medical-legal implications.

RLN, due to its vulnerability, is susceptible to injuries of great associated functional consequences, such as voice alterations and even symptoms of dysphagia with aspiration, and in case of bilateral injuries, respiratory failure requiring tracheostomy can even occur[1]. It is also interpreted as a quality indicator that depends both on thyroid disease and the type of resection, as well as on the training and experience of the surgeon[2].

In another vein, there are technical complications during the intervention that result from the pathology itself or from anomalies that can affect nerve integrity: traumatic maneuvers prematurely performed by traction, mainly in gland mobilization; ischemia caused by stretching or even by skeletonization of the nerve; ligatures made too close to the gland; nerve sectioning in extreme situations in which the nerve has not been correctly identified or has been confused with another structure, usually vascular, and especially in dangerous circumstances due to the volume of the thyroid gland and its position with regard to the inferior thyroid artery; or infiltrative cancers with adhesions close to Berry's ligament[3].

From Kocher to modern thyroidectomy description, surgeons try to reduce the complications associated with injury to the anatomical structures involved in this surgery, with fundamental contributions for improving the technique, in particular with the recommendation to always identify the RLN[4,5].

Over the past two decades, devices have been created for better intraoperative hemostasis control, which offer the possibility of maintaining a more bloodless operating field and thus facilitate the identification of anatomical structures close to the thyroid gland and, therefore, of nerve structures.

It should be borne in mind that there is another risk of complications that depend on the type of hemostatic sealant, which are those injuries caused by electrothermal diffusion of heat or contact, as well as by heat generated by vibration of the active film that emanates from hemostatic devices.

Neuromonitoring, in clinical practice, has been introduced over the past two decades, although some devices were created in the 1970s. At present, after years of controversy, but highlighting the advantages of RLN visual identification during thyroidectomy, neuromonitoring is considered to be the ideal complement to the standard method in thyroidectomy and is being used in the United States by 53% of general surgeons and 65% of otorhinolaryngologists; in Europe, 92% of German surgeons use it systematically, as recommended by the guidelines of their country[6]. The American Academy of Otolaryngology–Head and Neck Surgery considers that it is especially useful in bilateral thyroid surgeries, second-look thyroid surgeries, and surgery for previous RLN palsy[7].

The main risk factors for RLN injury are a history of dysphonia, cervical reoperations, Graves-Basedow disease, cancer, lymph node dissection, and endothoracic goiter; these cases involve the presence of nerves at risk[7].

The incidence of RLN injury is higher in non-specialized centers, but an average frequency of transient palsy after thyroidectomy of < 10.9% is generally accepted. On the other hand, the rate of permanent palsy in experienced teams with higher number of treated cases is 0.3-0.5%, and up to 3% if there is nerve at risk[7].

The purpose of this study was to analyze neuromonitoring efficacy in thyroid surgery and to compare RLN injury rates with and without the use of neuromonitoring.

Methods

A retrospective, descriptive, and observational study was carried out, in which the results of RLN intermittent intraoperative neuromonitoring were analyzed in patients operated on for thyroid disease during the 2012-2018 period. All cases were operated by the same team of surgeons specialized in endocrine surgery, and in all procedures were the same surgical technique employed. In patients in whom neuromonitoring was used, orotracheal intubation was performed with the Medtronic® endotracheal tube, which has surface electrodes integrated; in those cases where it was not used, a normal endotracheal tube was placed.

We considered permanent injury when palsy of some vocal cords (paramedian position of some vocal cords) was observed by indirect laryngoscopy 6 months after the intervention. All patients were examined in visits 1 week, 1 month, and 6 months after surgery.

Surgical technique

Patients were placed in supine position with mild cervical hyperextension. Anterior cervicotomy was

performed at Kocher's tie, with opening of the planes and mucocutaneous flaps formation. The incision was made at midline without sectioning of the pre-thyroid musculature. Dissection and medialization of the thyroid gland were performed, with visualization of both RLNs before complete sectioning of the gland. In cases where laryngeal nerve intraoperative monitoring (LNIOM) was used, its functioning was verified with the neuromonitoring team.

Statistical analysis

For statistical analysis, we used the SPSS program, version 17. Quantitative variables were described using the mean, standard deviation, and range. For qualitative variables, absolute frequencies were obtained, expressed as percentages.

For comparison of the prevalence of lesions, the Chi-square test was used. For all analyses, the level of statistical significance was established at 5%, α-value = 0.05.

Results

Between 2012 and 2018, 571 patients were operated on, all with total thyroidectomy. Among them, laryngeal nerve intraoperative monitoring (LNIOM) was used in 180 and in 391, it was not used. The criterion for the use of neurostimulator was, in the first place, its availability, since at the beginning of 2015, we only had a limited number and thus it was used in total thyroidectomies with risk factors, such as thyroid cancer diagnosis, lymph node dissection, or cervical reoperation (Fig. 1).

Of the 571 patients, 85.3% were women. As for age, the mean was 46.6 years (range: 41.6-47.9) and the median was 47 years.

If we analyze the incidence of palsy in both groups, 20 patients (3.4%) had transient palsy and 9 patients (1.5%) had permanent palsy. Analyzing the groups separately, with the use of LNIOM, there were 8 (4.4%) transient and 2 (1.1%) permanent palsies, and without the use of LNIOM, there were 12 (3%) transient and 7 (1.85%) permanent palsies. If we compare both groups from the statistical point of view, no statistically significant difference between transient and permanent palsy is observed (Table 1).

When we analyze the permanent lesions by subgroups, we see that both permanent palsies with the use of LNIOM were associated with total thyroidectomy procedures with the central lymph node dissection due to papillary carcinoma (nerve at risk) and permanent lesions without using LNIOM were in three total thyroidectomy procedures for papillary carcinoma (nerve at risk), one total thyroidectomy with sternotomy for endothoracic goiter and three total thyroidectomies for multinodular goiter (Table 2).

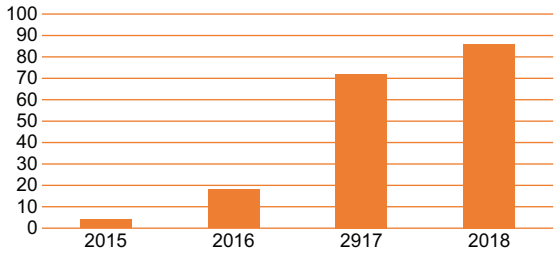

Figure 1. *Evolution with the use of neurostimulator.*

Table 1. Recurrent laryngeal nerve injury results

Palsy	With LNIOM	Without LNIOM	p
Transient	8 (4.4%)	12 (3%)	0.406
Permanent	2 (1.1%)	7 (1.85%)	0.545
Total	10 (5.5%)	19 (4.85%)	

LNIOM: laryngeal nerve intraoperative monitoring.

Table 2. Permanent palsy results

Permanent palsy	With LNIOM	Without LNIOM
High-risk nerve	2 (1.1%)	
Low-risk nerve	4 (1.02%)	3 (0.77%)

LNIOM: Laryngeal nerve intraoperative monitoring.

Patients were examined in control visits 1 week, 1 month, and 6 months after surgery, with no differences between the use or not of neurostimulation in subsequent recovery being found.

Discussion

Neuromonitoring has not been universalized due to its initial cost, but it becomes an indispensable technical aid in centers specialized in thyroid surgery[7,8].

Intermittently-performed intraoperative neuromonitoring allows the construction of the RLN location map during the execution of the surgical technique, in a complementary way to the mandatory anatomical identification of the nerve during dissection, which

allows to trace the route and path of its branches (mapping) and provide a functional evaluation.

The technical-surgical challenge occurs when there is divergence, since anatomical preservation of the nerve is not equivalent to its functional integrity, which is why, in clinical practice, paralysis can exist even though the nerve is observed to be anatomically intact. This does not occur when LNIOM is used and vocal cords contraction is detected, in the form of action potentials.

We can highlight the study carried out by Barczyński et al.[9], in which they analyzed a sample of 1000 patients in a randomized clinical trial (500 patients at each group) with and without neuromonitoring. The authors conclude that the number of transient palsies was lower with the use of LNIOM, with a statistically significant difference; however, there were no differences in terms of permanent palsy (0.8 vs. 1.2%).

They analyzed low-risk subgroups among those in which they found no statistical differences in none of the palsy types, but they did it when there were nerves at risk. This randomized and clinical trial with a fairly large sample supports our results.

In our study, we can conclude that neuromonitoring is useful for reducing RLN injuries, both transient and permanent palsy. In nerves at risk, its usefulness is even greater.

As previously mentioned described, the use of LNIOM was introduced in our department in 2015, and every year, it was applied to more patients, until practically from 2017 onward, it is systematically used in patients who are to undergo total thyroidectomy, whatever the thyroid disease is. In addition to neurostimulator intraoperative use, we usually propose RLN visual identification, which we later verify with LNIOM.

There is another study that we can highlight, carried out by Stark et al.[10], which reveals that the use of neurostimulation cannot reduce the risk of RLN injury, and that although it is useful, it does not replace visual identification of the nerve.

In summary, we can say that there are many studies with regard to neurostimulation, some that support its systematic use and others that analyze its use, but most authors agree that it is an essential complementary tool in thyroid surgery.

Conclusions

Based on our results, although there are no statistically significant differences in transient and permanent RLN injuries reduction with the use of neuromonitoring, we can see that there is a significant trend regarding the use of LNIOM. We consider that intraoperative neuromonitoring is of great help for RLN identification, with visual identification always being complemented. According to our results, the patients who can obtain the most benefits are those who have nerves at risk. Further randomized studies are needed for global standardization.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this research.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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