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The Use of Intra-Operative Nerve Monitoring (IONM) in Thyroid Surgery to Reduce Recurrent Laryngeal Nerve Injury

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ABSTRACT

Objectives: To assess the relation between use of Intraoperative nerve monitoring (IONM) in thyroid surgery and the prevalence of RLN injury, and to assess its significance of IONM in reduction of RLN injury among patients who underwent thyroid surgery.

Background: Recurrent laryngeal nerve (RLN) palsy is one of the big concerns for surgeons during thyroid surgery. Surgeons tried to find ways to identify this nerve and preserve it. The most popularly used way is the use of Intraoperative nerve monitoring (IONM).

Methods: In this retrospective study, we collected the data for all cases that underwent thyroid surgery in Security Forces Hospital (SFH), Riyadh, Saudi Arabia during the period of 2010 to 2012. We divided participants to two groups, those who used IONM and those who did not used IONM. The statistical Package for Social Sciences (SPSS, version 22) was utilized for data entry and analysis. Categorical variables were described by frequencies and percentages. Descriptive analysis involving Chi-square test was used to test significance of association between categorical variables. The level of significance was set at $P< 0.05$.

Results: Post-operation RLN injury was higher in those who underwent thyroid surgery without IONM, but the difference was insignificant (p=0.460). Three of those patients who underwent the surgery without IONM has RLN injury (3.1%), and no RLN injury reported of those who underwent surgery with IONM (0%).

Conclusion: IONM could help in identifying the RLN and preserving it from injury. Although, in this study there were insignificant correlations between RLN injury and IONM. Further researches on a larger-scales is recommended to get more informative results and allow better comparison.

Keywords: Recurrent laryngeal nerve; intraoperative nerve monitoring; thyroid; surgery; complications.

INTRODUCTION

The advances that achieved in thyroid surgical techniques during the last few decades only declined the risk for recurrent laryngeal nerve (RLN) injury but did not lead to its disappearance [(1)]. The incidence of RLN paralysis ranged between 1% and 20%, depending on the type of thyroid disease, surgical technique, the resection extension, and the surgeon's experience [(2-5)]. RLN injury, if unilateral can diminish quality of life as it leads to some symptoms related to voice impairment and subsequent limitations in physical, social, psychological and communication functioning, whereas bilateral RLN injury can lead to airway obstruction which is life-threatening [(6)]. In recent years, intraoperative monitoring of recurrent laryngeal nerve (RLN) has become a practice commonly performed in thyroid surgery and has gained more acceptance as an addition to the gold standard visual nerve identification [(2, 4, 7-9)]. It is designed to visualize the RLN as well as to allow assessment of its function intraoperatively. In addition, it can be used to explore the prognosis of patients who develop paralysis of RLN. [(10, 11)] Numerous studies have failed to document that intraoperative monitoring of RLN significantly decreases the risk of paralysis. [(12-15)] On the other hand, other studies have reported a decrease in incidence of transient RLN paralysis when RLN monitoring is utilized compared to simple identification of the nerve visually [(2, 10)]. It has been documented that the use of RLN monitoring is associated with increased setup time cost of equipment [(11)]. The aim of the current study was to assess the hypothesis that the use of intra-operative nerve monitoring (IONM) in thyroid surgery can reduce the prevalence of RLN injury in comparison with thyroid surgery with RLN visual identification alone.

SUBJECTS AND METHODS

The present study is a retrospective cohort study of patients who underwent thyroid surgery at the Security Forces Hospital (SFH), Riyadh, Kingdom of Saudi Arabia throughout the period of January 1st 2010 to December 31st 2012. Using the MR viewer system data was collected. All operated thyroid cases (n=137)

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during the study period were included and divided into two groups. The first group had RLN monitoring (n=40) and the second group had no RLN monitoring (n=97). Pre-operative and post-operative laryngoscope was performed for the first group. All intubations were performed using glidescope to confirm the position of the tube and the sensor relation to the vocal cords. No muscle relaxant was given to the patients. Vagus nerve was stimulated at the beginning of the procedure for each case; RLN should be identified by visualization and stimulation of the nerve at 0.5 – 0.7 Am. Complete circle after removal of the thyroid has to be checked and confirmed at the end. Data included patient`s age and gender, histopathology, type of surgery, intraoperative complications, immediate and late post-operative complications the protocol of this study was approved by the Research and Ethics Committee at SFH, Riyadh.

Data are presented as frequency and percentages. The statistical Package for Social Sciences (SPSS, version 22) was utilized for data entry and analysis. Categorical variables were described by frequencies and percentages. Descriptive analysis involving Chi-square test was used to test significance of association between categorical variables. The level of significance was set at $P< 0.05$.

RESULTS

Almost the majority of participants had no intra or post-operational complications. More than half of the thyroid surgeries were lobectomies (54.7%). All cases underwent histopathology after surgery and the mostly defined histopathology was papillary adenocarcinoma (40.1%), followed by nodular goiter (37.9%). Three of those patients who underwent the surgery without IONM has RLN injury (3.1%), and no RLN injury reported of those who underwent surgery with IONM (0%).

Post-operation RLN injury was higher in those who underwent thyroid surgery without IONM, but the difference was insignificant (p=0.460). There was statistically insignificant difference between those with IONM and intraoperative, immediate, and late postoperative complications (bleeding, voice change, hypocalcemia, and wound infection), also, there was statistically insignificant difference between those with IONM and the type of operation and histopathology result as shown in table 1.

Table 1: Factors associated with recurrent laryngeal nerve monitoring.

Character	RLN monitoring		p-value
	Yes N=40	No N=97	
Intra-operative complications			
None (n=126)	35 (87.5)	91 (93.8)	0.138
Bleeding (n=11)	5 (12.5)	6 (6.2)	
Immediate post-operative complications			
None (n=124)	37 (92.5)	87 (89.6)	
Voice change (n=6)	1 (2.5)	5 (5.2)	0.786
Hypocalcemia (n=7)	2 (5.0)	5 (5.2)	
Late post-operative complications			
None (n=131)	40 (100)	91 (93.8)	
Voice change (n=3)	0 (0.0)	3 (3.1)	0.460
Hypocalcemia (n=1)	0 (0.0)	1 (1.0)	
Wound infection (n=2)	0 (0.0)	2 (2.1)	
Type of operation			
Lobectomy (n=75)	20 (50.0)	55 (56.7)	
Near total thyroidectomy (n=15)	3 (7.5)	12 (12.4)	0.529
Total thyroidectomy (n=43)	16 (40.0)	27 (27.8)	
Subtotal thyroidectomy (n=4)	1 (2.5)	3 (3.1)	
Histopathology			
Nodular goiter (n=52)	15 (37.5)	37 (38.1)	
Papillary carcinoma (n=55)	21 (52.5)	34 (35.1)	
Follicular carcinoma (n=2)	1 (2.5)	1 (1.0)	0.193
Hyperplastic nodule (n=9)	1 (2.5)	8 (8.2)	
Hyperplastic (n=16)	2 (5.0)	14 (14.5)	
Follicular adenoma (n=3)	0 (0.0)	3 (3.1)	

DISCUSSION

Because recurrent laryngeal nerve palsy is not uncommon complication of thyroid surgery despite advancement in surgical techniques, it would be recommended to perform an accurate diagnosis using elastography and biomolecular investigations to avoid surgical procedures potentially at risk [12, 13]. **RLN** palsy leads to respirator and voice disorders depending mainly on its degree which consequently impacts quality of life of victims and could lead to creating medico-legal problems to the surgeon [14]. Numerous factors contribute to recurrent laryngeal nerve palsy, including the underlying health problem, the extent of surgical resection as well as the surgeon`s experience [15-17]. RLN should be visualized during surgery in order to stimulate it during monitoring and as visualization of the nerve formulates an essential factor to ensure its preservation [18, 19]. IONM enhances visual identification of the nerve, allowing more accurate dissection and verification of its integrity, which reduces the risk of injury [14]. The current study assessed the use of intra-operative nerve monitoring (IONM) in thyroid surgery and reduction of the prevalence of RLN injury. Three of those patients who underwent the surgery without IONM has RLN injury (3.1%), and no RLN injury reported of those who underwent surgery with IONM (0%). Post-operation RLN injury was higher in those who underwent thyroid surgery without IONM, but the difference was insignificant (p=0.460). There was statistically insignificant difference between those with IONM and intraoperative, immediate, and late postoperative complications (bleeding, voice change, hypocalcemia, and wound infection), also, there was statistically insignificant difference between those with IONM and the type of operation and histopathology result. This insignificant difference most probably, due to the relatively small sample size included in the present survey. Thus, further investigation with inclusion of larger sample size is recommended to test our research hypothesis more definitely. Around the world, a considerable percentage of surgeons are using IONM in all cases of thyroid and parathyroid surgery whereas some others using it only in patients considered at risk of RLN damage. On the other hand, many surgeons preferring direct visualization of the nerve. It has been documented that there is no overwhelming scientific evidence of the actual benefits of IONM in RLN preservation [14]. A recent published meta-analysis confirmed the influence of IONM on preventing transient RLN injury; however, it did not confirm any impact on permanent palsy. They attributed this discrepancy to the fact that transient injury happens more commonly than permanent damage and leads in the majority of cases to complete recovery and normal vocal cord function in the long term [14]. Our point of view is that IONM can improve results in some situations such as re-operative surgery or existence of anatomic variations; however, the small sample size as in our case does not allow a statistically significant evaluation. In addition, exceptional situations are not always predictable pre-operatively. In conclusion, the technique of IONM in thyroid surgery, although not significant, reduced recurrent laryngeal nerve palsy compared to visual identification alone. Further multi-center research on a larger-scale is recommended to get more informative results and allow better comparison.

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