ORIGINAL ARTICLE

Selective Intraoperative Nerve Monitoring for High-risk Thyroidectomy

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Abstract

Aim: To compare early postoperative voice outcome between visual nerve identification (VNI) and selective intraoperative nerve monitoring (IONM) in high-risk thyroidectomy operations.

Materials and methods: All patients undergoing high-risk thyroidectomy operations for thyroid cancer, thyrotoxicosis, and reoperative completion between January 2018 and June 2019 were retrospectively evaluated. Demographic information, type of operation (hemithyroidectomy/reoperation/total thyroidectomy), and nature of thyroid disease were assessed. Comparisons were made between VNI and IONM groups on postoperative clinical hoarseness, endoscopically confirmed recurrent laryngeal nerve (RLN) injury, and the operating time between the VNI group and IONM group. Subgroup analyses were also carried out.

Results: Fifty-eight patients with 94 nerves at risk were included in the analysis. Forty-seven patients (81.0%) underwent thyroidectomy with VNI, while 11 patients (19.0%) had IONM. Thirty-six procedures (62.1%) were total thyroidectomy and 22 (37.9%) were hemithyroidectomy. Six patients received concomitant cervical lymph node dissection (10.3%). Indications for surgery included 43 thyroid carcinoma (74.1%) and 15 thyrotoxicosis (25.9%); and of which, 22 (37.9%) were reoperations. Demographics were comparable between the assessed groups. Postoperative clinical hoarseness per nerve at risk was significantly lower in the IONM group compared to the VNI group (0 vs 19.4%, $p = 0.046$). Endoscopically confirmed recurrent laryngeal nerve injury in IONM group was apparently lower, without statistical significance (0 vs 10.4% $p = 0.176$).

Conclusion: Our data demonstrated that the use of IONM in selected high-risk thyroidectomy surgery significantly reduced early postoperative clinical hoarseness compared to the routine VNI.

Clinical significance: The use of IONM in selected high-risk thyroidectomy may improve early postoperative voice outcome.

Keywords: Intraoperative nerve monitoring, Neuromonitoring, Recurrent laryngeal nerve, Recurrent laryngeal nerve palsy, RLN palsy, Thyroid, Thyroid cancer, Thyroid surgery.

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Introduction

Intraoperative nerve monitoring (IONM) is currently adopted by up to 80% of head and neck surgeons and over 50% of general surgeons performing thyroidectomy surgery in USA.[1–3] In spite of the popularity, contemporary role of IONM in thyroid surgery remains unclear. Meta-analyses conducted by Higgins et al. and Pisanu et al. demonstrated no substantial difference in the rates of transient, total, or persistent vocal fold palsy.[4,5] In a study on functional outcome after recurrent laryngeal nerve (RLN) monitoring, Dralle et al. identified primary thyroidectomy for cancer and reoperations as risk factors for RLN paralysis.[6] These risk factors were coherent with the findings of our thyroidectomy data of the past decade. In addition, we observed an escalated risk of RLN palsy in operations on toxic goiters. This study was initiated to conduct focused comparison of IONM and visual nerve identification (VNI) results in high-risk thyroidectomy comprising cytologically proven thyroid cancer (Bethesda grade VI), thyrotoxicosis, and reoperation procedures.

Materials and Methods

All patients with preoperative intact RLN function undergoing high-risk thyroidectomy operations including thyroid cancer, thyrotoxicosis, and reoperation between January 2018 and June 2019 were retrospectively evaluated. Patients were stratified into VNI and IONM groups for comparison. All patients with preoperative RLN palsy confirmed by endoscopy were excluded from the analysis. NIM 2.0/3.0 system® (Medtronic Xomed Surgical Products, Jacksonville, FL) was used for all cases with IONM. Stimulation was detected at 0.5–1.5 mA. Demographic information, type of operation (hemithyroidectomy/reoperation/total thyroidectomy), and nature of thyroid disease were assessed. Postoperative assessment was performed for clinical hoarseness as reported by patients prior to discharge and on clinical follow-ups at 2–8-week intervals. All patients with subjective hoarseness had flexible laryngoscopy assessment of RLN status on day 14–21 postoperation. Comparisons were conducted on clinical hoarseness and endoscopically confirmed postoperative RLN injury and operating time between the VNI group and IONM group. Subgroup analyses were carried out for the cancer group, thyrotoxicosis group, and reoperation groups, respectively.

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Statistical Analysis

The data were analyzed using Statistical Package for Social Sciences software version 20.0. Categorical variables were analyzed by Chi-square (univariate) and binary logistic regression (multivariate) tests. The Fisher exact test was applied to assess the level of significance, wherever the values were 5 or less. A p value of <0.05 was considered as statistically significant.

Results

Fifty-eight patients with 94 nerves at risk were included in the analysis. Forty-seven patients (81.0%) underwent thyroidectomy with VNI, while 11 patients (19.0%) had IONM. Indications of surgery included 43 thyroid carcinoma (74.1%) and 15 thyrotoxicosis (25.9%) and among which 22 were reoperations (37.9%). Thirty-six procedures (62.1%) were total thyroidectomy and 22 (37.9%) were hemithyroidectomy. Six patients received concomitant cervical lymph node dissection (10.3%). Mean patient age, sex, and comorbidities were comparable between the assessed groups. No patient in the IONM group had intraoperative electromyography (EMG) signal loss on the final check prior to wound closure. Postoperative clinical hoarseness per nerve at risk was significantly lower in the IONM group compared to the VNI group (0 vs 19.4%, $p = 0.046$). Endoscopically confirmed recurrent laryngeal nerve injury in IONM group was apparently lower without statistical significance (0 vs 10.4% $p = 0.176$). No significant difference in operative time was observed between the two groups (Table 1). Subgroup analyses of cancer group and thyrotoxicosis group showed no significant difference in clinical hoarseness or RLN palsy (Tables 2 and 3). No patients undergoing reoperation with or without IONM had postoperative hoarseness or RLN palsy.

Table 1: Overall voice outcome under selective intraoperative nerve monitoring policy

	Routine visual identification (n = 62) (%)	*Intraoperative nerve monitoring (n = 20) (%)*	*p value*
Postoperative hoarseness	19.4	0	0.046
Endoscopically confirmed RLN palsy	10.4	0	0.176

Table 2: Voice outcome of thyroid carcinoma

	Routine visual identification (n = 50) (%)	*Intraoperative nerve monitoring (n = 14) (%)*	*p value*
Postoperative hoarseness	12 ($n = 6$)	0 ($n = 0$)	0.173
Endoscopically confirmed RLN palsy	6 ($n = 3$)	0 ($n = 0$)	0.348

Table 3: Voice outcome of thyrotoxicosis

	Routine visual identification (n = 24) (%)	*Intraoperative nerve monitoring (n = 6) (%)*	*p value*
Postoperative hoarseness	25 ($n = 6$)	0 ($n = 0$)	0.171
Endoscopically confirmed RLN palsy	16.7 ($n = 4$)	0 ($n = 0$)	0.283

Discussion

Thyroid surgeons across the world are currently working in progress to forge a consensus on the ideal application of IONM in the practice of thyroid surgery. Pisanu et al. analyzed 20 trials that included 23,152 participants and showed marginal benefits, with overall RLN palsy rates for IONM (3.5%) vs visualization alone (3.7%).[5] Deniwar et al. observed several advantages of IONM over traditional nerve visualization alone: first, IONM may help prevent bilateral RLN injury by allowing surgeons to stage the surgery when the signal is lost on the initial side, thus avoiding the need for tracheostomy.[7] Second, IONM can properly prognosticate postoperative nerve function, which is difficult to detect by visual identification, as most of injured nerves appear intact. Third, neuromonitoring can detect anatomical variation and abnormal courses of the nerves which are at higher risk of injury if not detected. Their group proposed that higher risk patients, including cancer patients, patients with prior surgery and scarring, and patients with large goiters, may benefit the most from IONM.[6] Insufficient data in the contemporary literature can be found to substantiate the claims. Wong et al. reviewed 10 articles in a meta-analysis of IONM in high-risk thyroidectomy and concluded selective use of IONM during high-risk thyroidectomy decreased the rate of overall RLN palsy.[8] Nonetheless, majority of the included studies were retrospective and observational, limiting the power of the analysis. Definition of "high risk" was also found to be nonstandardized with variable combinations of cancer, thyrotoxicosis, reoperation, and retrosternal goiter, many of which were subgroup analyses.

In this study, we conducted a focused evaluation of high-risk patients receiving IONM. We detected statistical difference in postthyroidectomy hoarseness rate and an empirical reduction in recurrent laryngeal nerve injury rate. There were several identifiable limitations for this study. First, technical variability was present as operations were performed by five different surgeons in a high-volume center. Only one of the five surgeons met the standards of a high-volume surgeon.[9,10] Compliance rate of using IONM in high-risk cases was 68%. Noncompliance was attributed to surgeons' preference, anesthetists' predilection, and device availability. Inclusion criteria of cancer was stringent, as we only included Bethesda VI grading in our IONM selection process. This could lead to underselection of cancer patients whose cytological grading was V or below but diagnosed of thyroid carcinoma in specimen histology. Permanent nerve injury was not evaluated in this study as some patients have not been followed up for 12 months to detect spontaneous recovery. We chose days 14–21 as the standard timing to perform endoscopic assessment of vocal cord to allow intubation related vocal cord injury to subside. Selective neck lymph node dissection was performed on 13.6% of patients who underwent thyroidectomy for cancer, and statistical analysis showed no confounding effect on the risk of nerve injury. On subgroup analyses of cancer, thyrotoxicosis, and reoperation, no standalone escalated risk was detected on each subgroup. Our data showed that carrying out intraoperative maneuvers for detecting nerve signal did not significantly increase the operative time. From our observation, the prospects of improving voice outcome with the use of IONM appears to be promising. We believe that further research focused on high-risk thyroidectomy will better define the

high-risk groups for IONM to delineate its benefits and guide future developments in thyroidectomy practice.

Conclusion

Our data demonstrated that use of IONM in selected high-risk thyroidectomy surgery significantly reduced postoperative clinical hoarseness compared to routine VNI.

Clinical Significance

Use of IONM in selected high-risk thyroidectomy may improve postoperative vocal cord outcome.

References

1. Al-Qurayshi Z, Randolph GW, Alshehri M, et al. Analysis of variations in the use of intraoperative nerve monitoring in thyroid surgery. JAMA Otolaryngol Head Neck Surg 2016;142(6):584–589. DOI: 10.1001/jamaoto.2016.0412.
2. Ho Y, Carr MM, Goldenberg D. Trends in intraoperative neural monitoring for thyroid and parathyroid surgery amongst otolaryngologists and general surgeons. Eur Arch Otorhinolaryngol 2013;270(9):2525–2530. DOI: 10.1007/s00405-013-2359-6.
3. Singer MC, Rosenfeld RM, Sundaram K. Laryngeal nerve monitoring: current utilization among head and neck surgeons. Otolaryngol Head Neck Surg 2012;146(6):895–899. DOI: 10.1177/0194599812439278.
4. Higgins TS, Gupta R, Ketcham AS, et al. Recurrent laryngeal nerve monitoring vs identification alone on post-thyroidectomy true vocal fold palsy: a meta-analysis. Laryngoscope 2011;121(5):1009–1017. DOI: 10.1002/lary.21578.
5. Pisanu A, Porceddu G, Podda M, et al. Systematic review with meta-analysis of studies comparing intraoperative neuromonitoring of recurrent laryngeal nerves vs visualization alone during thyroidectomy. J Surg Res 2014;188(1):152–161. DOI: 10.1016/j.jss.2013.12.022.
6. Dralle H, Sekulla C, Haerting J, et al. Risk factors of paralysis and functional outcome after recurrent laryngeal nerve monitoring in thyroid surgery. Surgery 2004;136(6):1310–1322. DOI: 10.1016/j.surg.2004.07.018.
7. Deniwar A, Bhatia P, Kandil E. Electrophysiological neuromonitoring of the laryngeal nerves in thyroid and parathyroid surgery: a review. World J Exp Med 2015;5(2):120–123. DOI: 10.5493/wjem.v5.i2.120.
8. Wong KP, Mak KL, Wong CKH, et al. Systematic review and meta-analysis on intra-operative neuro-monitoring in high-risk thyroidectomy. Int J Surg 2017;38:21–30. DOI: 10.1016/j.ijsu.2016.12.039.
9. Melfa G, Porello C, Cocorullo G, et al. Surgeon volume and hospital volume in endocrine neck surgery: how many procedures are needed for reaching a safety level and acceptable costs? A systematic narrative review. G Chir 2018;39(1):5–11. DOI: 10.11138/gchir/2018.39.1.005.
10. Adam MA, Thomas S, Youngwirth L, et al. Is there a minimum number of thyroidectomies a surgeon should perform to optimize patient outcomes? Ann Surg 2017;265(2):402–407. DOI: 10.1097/SLA.0000000000001688.