Intraoperative Monitoring and Preservation of Anatomic Integrity of Palsied Recurrent Laryngeal Nerve is Extremely Meaningful During Redo Thyroid Surgery

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ABSTRACT

Redo thyroid surgery on patients with unilateral recurrent laryngeal nerve (RLN) palsy certainly poses a great surgical challenge. We present a case of a patient with unilateral vocal cord (VC) palsy who underwent redo thyroid surgery under intraoperative neuromonitoring. The patient's normal speaking voice was maintained after the primary surgery, even though preoperative laryngoscopy showed an immobile right VC with a normal structure. During reoperation, surgical exploration revealed the anatomical integrity of palsied RLN with extralaryngeal terminal bifurcation. The electrophysiological stimulation of the vagus nerve and palsied RLN generated wave amplitudes (V1: 242, R1: 347, R2: 352 and V2: 152 μV). Despite positive amplitudes, postoperative laryngoscopy confirmed RLN palsy and corresponding VC paralysis but preserved the structure of the immobile VC. Even palsied RLN should be monitored during redo surgery. A positive signal delineates at least partial neural transmission despite VC palsy. The preservation of anatomical integrity of palsied RLN for eventual partial conductivity may be vital in preserving the normal structure of VC and maintaining the patient's voice despite its immobility.

Key Words: *Surgery, Redo thyroidectomy, Recurrent laryngeal nerve injury, Vocal cord palsy.*

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INTRODUCTION

Redo surgery of the enlarged thyroid remnant is surgically challenging because of distortion of the anatomy and scarring from the prior surgery. The recurrent laryngeal nerve (RLN) palsy may occur after all types of thyroid surgery but mostly during reoperations.[1] Visual identification and total exposure of RLN are mandatory during surgery to prevent nerve injury and preserve nerve integrity. Intraoperative nerve monitoring (IONM) is a widely accepted adjunctive method for the visual identification of RLN during surgery. The electrophysiological identification of the nerve and verification of its motor integrity are useful for the objective prediction of postoperative prognosis. Despite meticulous techniques and proper surgical care, RLN injury occurs, albeit uncommonly, during primary thyroidectomy. Surgery for recurrent goitre carries an increased risk of VC palsy.[1-3] Performing redo thyroid surgery for recurrent goitre on patients with unilateral permanent VC palsy after prior thyroidectomy is certainly one of the most important surgical challenges.

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A patient with unilateral permanent RLN and VC palsy underwent redo thyroid surgery for recurrent goitre under the guidance of IONM. We present our preoperative, intraoperative and postoperative results along with the results of electrophysiological monitoring of palsied nerve during thyroid reoperation.

CASE REPORT

A 34-year woman presented with the complaint of a large mass on the anterior neck. She had undergone thyroidectomy 18 years earlier. She was admitted with the diagnosis of recurrent goitre. She had a normal speaking voice during physical examination, which showed a large asymmetrical mass located on the right side of the anterior neck. A large, mobile and round nodule was palpated. The serum levels of thyroid-stimulating hormone, free thyroxin (FT_4) and autoantibodies were normal. A thyroid ultrasound scan showed an enlarged thyroid with a retrosternal extension on the right side, containing several isoechoic solid nodules, of which the largest was 55 × 33 × 28 mm. It showed a 19 × 9 × 8 mm heterogeneous thyroid tissue remnant on the left side. Cytological analysis revealed benign cytology after fine needle aspiration. Thyroid surgery was indicated for recurrent goitre. Despite normal speech, preoperative laryngoscopy showed right VC palsy without atrophy. Redo thyroid surgery was performed under the guidance of IONM using the NIM 3.0 monitoring system (Medtronic Xomed, Jacksonville, FL, USA). The stimulus was set at 1 mA for nerve stimu-

lation and the amplitude threshold was set at 100 μV for recording. Thyroid surgery was performed on the right lobe, where RLN palsy was detected after the initial surgery. In the early period of the surgery, the vagus nerve (V1) was first stimulated in the neurovascular bundle, and an amplitude of 242 μV was recorded. After dissection and medial mobilisation of the right lobe, the right RLN was identified and stimulated (R1), and an amplitude of 347 μV was recorded. The cervical part of the RLN was fully exposed, further demonstrating that it was visually intact. The thyroid tissue was totally removed with complementary right lobectomy. The anatomic integrity of the palsied right RLN with extralaryngeal terminal bifurcation was carefully preserved during the redo surgery (Figure 1). Post-dissection stimulation of the right RLN (R2) and vagus nerve (V2) generated amplitudes of 319 and 152 μV, respectively. The preoperative right VC palsy after the initial surgery was confirmed by postoperative laryngoscopy after the redo surgery. The patient was discharged on the second postoperative day. A normal serum hormone level was maintained with 100 μg LT_4/day. Pathological examination revealed benign nodular colloid goitre. In the follow-up, the patient maintained a steady state of speaking voice.

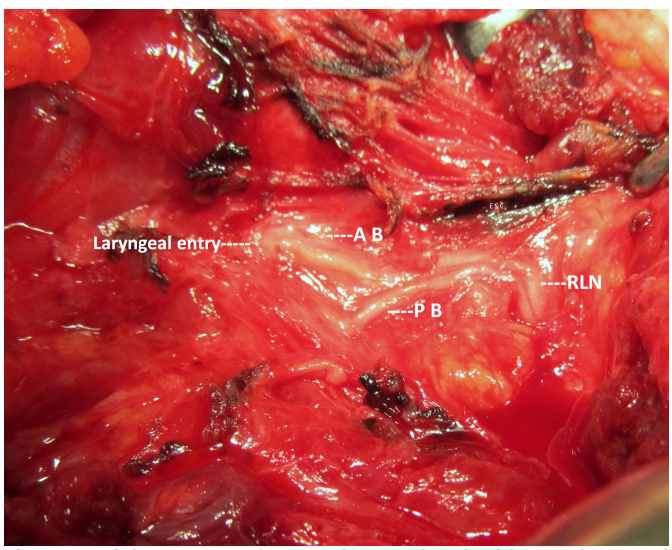

Figure 1: Right recurrent laryngeal nerve (RLN) with extralaryngeal terminal bifurcation in patient with right vocal cord palsy. Both nerve branches are visually intact, and anatomic integrity is preserved. Anterior (AB) and posterior branches (PB) enter separately into the larynx.

DISCUSSION

Nowadays, total resection of thyroid tissue is the preferred surgical treatment for surgical pathologies of the thyroid gland. Total thyroidectomy is an operation with a low incidence of permanent complications, which avoids future recurrences and re-operations.[4] The subtotal resection of the gland carries a high risk of recurrent goitre many years after primary surgery. In the case of recurrent surgical pathology, scarred and disturbed anatomy requires a complicated dissection during the redo surgery that may increase the risk of surgical complications. Displacement of RLN and scar tissue from the previous neck surgery is a risk factor in reoperations.[5]

Injury to RLN is the most feared complication of thyroid surgery. The prevalence of RLN injury in reoperative thyroid surgery is much higher than that in primary surgery.[1,3] Sometimes, recurrent goitre occurs in patients with unilateral permanent RLN palsy after subtotal resection at initial surgery. In this report, the right VC was palsied and immobile after initial surgery; however, our intraoperative findings showed that the anatomic integrity of palsied RLN was preserved.

IONM is a widely accepted method of assessing the function of the laryngeal nerves. Wong *et al*. and Sun *et al*. reported that the use of IONM decreased the rate of overall RLN palsy.[6,7] Therefore, it is associated with a reduction in RLN injury in thyroid re-operations. Despite laryngoscopic unilateral VC palsy, we identified, exposed and electrophysiologically monitored the palsied RLN in redo surgery. We can comment that the use of IONM offers greater advantages in certain circumstances. In our patient, palsied RLN was found to be visually intact. This finding shows that the visual integrity of the RLN does not ensure functional integrity; therefore, electrophysiological nerve monitoring is required to assure a postoperative neural prognosis. Anatomic integrity of RLN may be asymptomatic in some patients with unilateral VC palsy, and the patient may have a normal speaking voice related to the degree of partial injury, residual nerve function, structure, and position of VCs and partial neural conductivity. In contrast, the voice weakens when palsied and atrophic VC loses contact with the contralateral cord, thereby causing a glottal gap while speaking.[2,8] Partial injuries due to various causes (crushing, compression, thermal, *etc*.) are more common than complete transection. As an important advantage, IONM assists in detecting the presence of injury to RLN and nerve palsy during surgery. Redo thyroid surgery should be performed under the guidance of IONM.[2,6,7,9]

Preoperative laryngoscopy reported that palsied VC was structurally normal in our patient. The IONM of RLN also revealed positive electrophysiological results. We found mild conductivity in the right RLN of the patient despite the palsied right VC. According to IONM, we can comment on whether the conductivity of RLN to the laryngeal musculature was partially preserved. These monitoring results clearly explain the laryngoscopic normal structure in a non-atrophic VC despite its immobility. We can also comment that residual electric transmission in RLN is weaker for the proper functioning of the VC but helps in preserving its structure. Incomplete RLN injury after thyroid surgery may cause non-atrophic VC palsy. In IONM, VC paralysis without atrophy showed a recordable RLN amplitude.[10] Laryngoscopy and IONM results explained a normal speaking voice of our patient. Mild neural conductivity preserved the normal structure of the immobile VC, which provides glottal closure, creating a normal voice. Osce *et al*. reported that despite hoarseness, loss of pitch, and VC paralysis showed by laryngoscopy, palsied RLN was identified and preserved.[9] They concluded that thyroid surgery, even, in patients with preoperative VC paralysis should be performed with caution and the use of IONM.

Partial electrophysiological conductivity may be recorded in the RLN of patients with laryngoscopic VC palsy; this positive result means residual transmission in the RLN to the laryngeal muscles. The normal structure of VC, glottal closure and a normal speaking voice may be preserved despite VC palsy if RLN retains partial transmission. In the present case, electrophysiological stimulation of the right RLN showed that the nerve retained mild electrical transmission to laryngeal muscles; thus, atrophy in the immobile VC was prevented by partial conductivity. Preoperative laryngoscopy, intraoperative full exposure of the RLN, and nerve monitoring properly established anatomy and function of the RLNs and VCs in the patient with VC palsy undergoing redo surgery. Intuitively, surgeons may assume that the preservation of a palsied RLN in patients with pre-existing VC paralysis is not meaningful.[9] Contrary to this belief, preservation of the visually intact nerve is significantly beneficial for residual neural conductivity. Both preoperative laryngoscopy and IONM are required for an accurate and objective evaluation of RLN conductivity, laryngeal muscle activity, VC function and anatomic structure of VC, even in the case of a palsied nerve. Monitoring and preserving the anatomic integrity of palsied RLN may be extremely meaningful for the steady state of a normal speaking voice.

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