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ORIGINAL CONTRIBUTIONS

THE EXTERNAL LARYNGEAL NERVE IN THYROID SURGERY: THE 'NO MORE NEGLECTED' NERVE

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ABSTRACT

***AIMS:** To describe a novel surgical technique of 'lateralization' of superior pole to identify and save external branch of superior laryngeal nerve (EBSLN) during thyroidectomy. **SETTINGS AND DESIGN:** Prospective, nonrandomized at a tertiary care hospital in a specialized unit. **MATERIAL AND METHODS:** Over 30 months, 46 patients underwent thyroidectomy using technique of 1) 'Lateralization' of upper pole and dissection of avascular cricothyroid space 2) identification of EBSLN 3) skeletonization and individual ligation of superior thyroid vessels. Identified nerves were classified according to Cernea's classification. Outcomes were number of nerves identified, number of 'at risk' nerves' bilateral asymmetry and incidence of injury assessed by subjective interview and indirect laryngoscopy. **RESULTS:** Of the 78 dissected superior poles, nerves could be identified in 72 (92.31%). There were 22 (28.2%) type I, 42 (53.54%) IIa and 8 (10.25%) IIb 'at risk' nerves. In 32 patients with bilateral dissections, asymmetry of nerve was noted in 15%. Injury to nerve was not recorded in any of the patients. Average weight of glands was 69.59 g. Thyroidectomy was performed for benign disease in 28, malignancy in 4 and thyrotoxicosis in 14 patients. **CONCLUSIONS:** With technique of 'lateralization' and 'skeletonization and individual ligation of the superior vessels,' EBSLN identification increases and injury can be prevented. These results relate to the utilization of specific surgical technique and it is reasonable to expect that most surgeons, once familiar with the technique, should be able to achieve similar outcomes.*

***Key words:** External branch of superior laryngeal nerve, thyroidectomy*

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The complications of thyroidectomy are hemorrhage, recurrent or superior laryngeal nerve palsy and hypocalcemia. Iatrogenic lesions of external branch of superior laryngeal nerve (EBSLN) during thyroidectomies are not infrequent due to the possibility of anatomic variations of relationships of this nerve with superior thyroid vessels. Palsy of EBSLN during thyroid surgery is an important complication reported with varying frequency. Reported risk of EBSLN injury varies from 0.3 to 13%.[2] The most famous and frequently quoted case of superior laryngeal nerve injury was that of operatic soprano Amelita Galli-Curci,[2] which was subsequently questioned.

Since injury to EBSLN may cause only subtle changes and requires detailed analysis to document it, it was frequently overlooked. Following an objective, reproducible classification of the nerves' anatomical variations by Cernea *et al*[3] in 1992, there was resurgence in interest and documentation of various techniques for nerve preservation.

Methods that have been individually described to safeguard the nerve include accurate dissection in cricothyroid space,[4] skeletonization and individual ligation of superior thyroid vessels adjacent to capsule of gland, identification of nerve before ligation of superior pole and use of a nerve stimulator[14] or intraoperative neuromonitoring.[5-6] This prospective nonrandomized study is aimed to assess the feasibility of minimizing risk of EBSLN injury during thyroid surgery by combining the technique of 'lateralization' of the superior thyroid pole with all the other methods described during every dissection.

MATERIALS AND METHODS

This is a prospective nonrandomized study conducted on 46 patients undergoing various types of thyroidectomies with 'lateralization' of the superior pole during July 1995 to December 1997. Exclusion criteria were previous neck irradiation, previous laryngeal or thyroid surgery or any other cervical exploration. All patients underwent a detailed voice evaluation, including weakness or fatigue after use, inability to reach high pitch or change in fundamental speaking frequency, preoperatively and on the 10th postoperative day. They were also subjected to an indirect laryngoscopy at the same time. The signs of EBSLN injury on indirect laryngoscopy were taken as rotation of posterior glottis towards side of the lesion and bowing and displacement of affected vocal cord.

Surgical procedure was standardized to avoid operational bias. Surgeries were performed by senior endocrine surgeons as well as surgical trainees. If a patient had a total thyroidectomy, each side of the gland was considered as a separate unit. Briefly, thyroid was exposed after elevation of the platysma flap superiorly and inferiorly via a low transverse collar incision. Strap muscles were divided in midline and elevated from the underlying gland. After ligation of middle thyroid vein and complete medial rotation of lobe, superior pole preparation was begun. Keeping close to capsule of gland and dissecting both laterally and at the junction of superior thyroid pole with upper border of isthmus, the entire pole was encircled and taped. With gentle traction on this tape,

further facilitated by application of a hemostat at lateral border of the pole, 'lateralization' of the pole was achieved. Careful dissection in avascular cricothyroid space was then begun and an attempt was made to identify nerve in this space. However, we did not persist with extensive dissection for identification of the nerve. Capsular dissection, skeletonization and individual ligation of superior polar vessels were then carried out [Figures 1 and 2].

Nerves were classified as per classification proposed by Cernea *et al* [Figure 3].

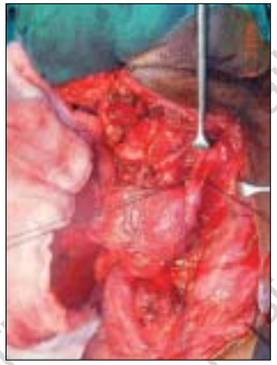

Figure 1: 'Lateralization' of left pole and EBSLN is seen in the avascular cricothyroid space

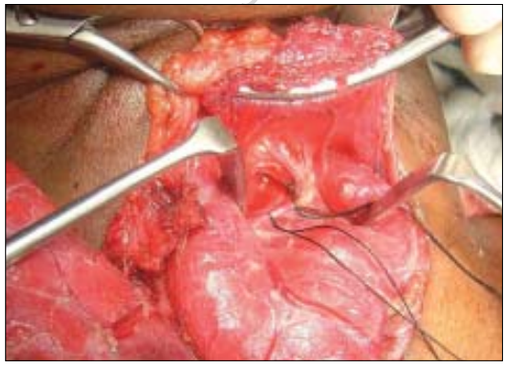

Figure 2: Individual ligation of superior pole vessels. EBSLN is seen in cricothyroid space

Main outcome measures were number of intraoperatively identified nerves and incidence of EBSLN injury. Other outcomes assessed were type of nerve, number of 'at risk' nerves, presence of bilateral asymmetry, weight and pathology of the glands.

RESULTS

Male to female ratio was 4:1. Mean age was 38.26 years (range: 15-75). Total of 78 superior polar dissections were carried out. Thirty-two patients had bilateral dissection (total) and 14 had unilateral dissection (hemithyroidectomy). Five patients (15%) had asymmetrical nerves.

Thirty-eight patients had benign disease, 4 had malignancy and 14 had toxic goiter. Gland weight is not available in 4 patients. In the remaining, mean weight was 69.59 g (12-300 g). Nerve could not be identified in 6 (7.69%) dissections. In this subgroup, gland weight ranged from 25 to 160 g. Pathologies were one papillary carcinoma, two multinodular goiters and one Grave's disease.

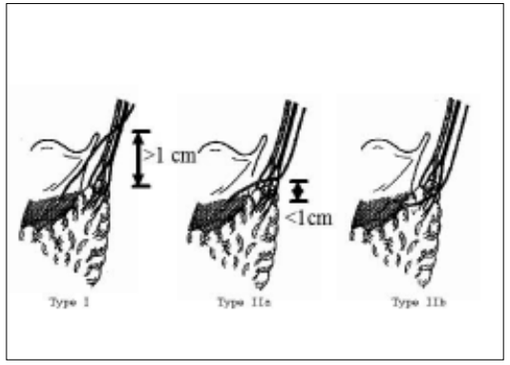

Figure 3: Cernea classification of EBSLN (Reference 3)

Type I nerves were present in 22 (28.2%), type IIa in 42 (53.84%) and Type IIb 'at risk' nerves in 8 (10.25%) patients. There were no patients with EBSLN injury in this study, as determined by patient interview and IDL.

DISCUSSION

The external laryngeal nerve arises together with internal branch from superior laryngeal branch of vagus nerve, deep to internal carotid artery at C3 level, cranial to bifurcation of common carotid artery, descends deep to superior thyroid artery, crosses the potential avascular cricothyroid space and enters cricothyroid muscle along with cricothyroid artery. The EBSLN is the sole motor supply to cricothyroid muscle, which is a tensor of vocal cord.[1] Cernea *et al*[3] were the first to describe an objective classification. A fourth type of nerve was found by Kirner *et al*,[7] in which the nerve does not cross superior thyroid artery but runs dorsal to it until it has ramified.

The percentage of high risk EBSLN has been reported to range from 15 to 68%.[9] In our study, 21.79% of the nerves were type IIb 'at risk' nerves, which is comparable with most of the previous anatomical studies.

The reported incidence of superior laryngeal nerve injury from thyroidectomy varies widely, ranging from 0.9% to as high as 58% in Jansonn's[10] series. Damage to EBSLN results in easy fatigue during phonation, difficulties in high pitch or singing voice and alteration in the fundamental speaking frequency, especially in women or professional singers. We did not have any injury to the nerve by following our technique of preparation of the superior pole. Rate of intraoperative nerve identification has been reported to vary from 10 to 80%.[7] In our study, we had positive identification of 92.31%. While methods for intraoperative identification of nerve have included use of 2.5x magnification loupe and nerve stimulator or neuromonitoring using a bipolar electrode in cricothyroid muscle during nerve stimulation,[7,8,11] Aina and Hisham[12] have reported lack of any added benefit of nerve stimulator in identifying type II nerves which are low lying and vulnerable. Bellantone *et al*[15] have questioned the need for routine identification of the EBSLN based on their study of 289 thyroidectomies. Page *et al*[13] in a study of 50 thyroidectomies also feel that systematic search for EBSLN is not useful. In a previous study by the same group[14] on cadaveric dissections, they described branches from the EBSLN to the thyroid gland in 70% cases and these are at risk during thyroidectomy. However, this anatomic variation has not been observed by us. We relied on visual identification alone due to lack of equipment. As a protocol, we spend only few minutes in an attempt to identify the EBSLN in the cricothyroid space after lateralization of the superior pedicle. We do not believe in extensive dissection for EBSLN like we do for recurrent nerves. It is important to be precise in the technique of dissection and individual ligation of superior thyroid vessels. Bipolar coagulation on cricothyroid muscle even can injure muscle and EBSLN as well and should be avoided. 'Medial thyroid avascular space' is not so 'avascular' because there is constantly a small pedicule destined to the cricothyroid muscle that must be ligatured.

Detailed phoniatric evaluation using several specific phonic times and measuring vocal frequencies, electromyography of the cricothyroid muscle and laryngeal videostrobolaryngoscopy and spectrography[5-8,12] have all been described for objective evaluation of EBSLN and cricothyroid muscle function postoperatively. Due to lack of requisite equipment and costs involved, we have relied on a detailed subjective interview on day 10 postoperatively along with indirect laryngoscopy for identification of EBSLN injury. Since none of our patients had recurrent laryngeal nerve injury either, this confounding factor was eliminated.

CONCLUSION

By using a combined technique of 'lateralization' of the superior thyroid pole as described by us, along with careful dissection in avascular cricothyroid space and intraoperative nerve identification and capsular dissection, skeletonization and individual ligation of superior polar vessels, it is possible to increase the rate of nerve identification and avoid nerve injury, even in the absence of sophisticated equipment.

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