

## Appraisal of External Branch of Superior Laryngeal Nerve in Every Thyroid Surgery

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Superior laryngeal nerve (SLN) is a branch of vagus nerve in the neck. It is further divided into internal and external branches. Both components are equally important in the preservation of laryngeal function which is to protect the lower airway from intrusion of any foreign material, as well as producing good quality of voice. The internal branch supplies mucosal sensation of the supraglottic region down to the level of vocal cord. Thus, its function is very critical in sustaining the cough reflex as an afferent fiber to detect any penetration to the larynx. However, this branch (internal laryngeal nerve) is less susceptible to injury during thyroid surgery.

The external branch of SLN (EBSLN) supplies one of the important intrinsic muscles of the larynx, the cricothyroid. From its origin at 2-3 cm above the superior pole, the nerve descends medial to the carotid sheath adjacent to the pharynx (along the inferior constrictor muscle). It enters the larynx through the deep surface of cricothyroid muscle [1]. Besides cricothyroid, EBSLN also supplies the inferior constrictor muscle, and contributes to the pharyngeal plexus which supply the pharynx and palate.

As far as the laryngeal function is concerned, action or stimulation of this nerve will cause lengthening of the cricothyroid muscle, thus tensioning of the vocal cord. A tension vocal cord is a pre requisite for pitch elevation. It is very critical especially for professional voice users, for example singers, teachers and broadcasters.

The EBSLN has a close relationship with the superior pole of the thyroid gland; makes it prone to iatrogenic injury during thyroidectomy. The caliber of the nerve also is smaller and sometimes not readily identified as compared to the recurrent laryngeal nerve (RLN). Most surgeons tend to avoid rather than to expose and identify the external laryngeal nerve. However, injury to the EBSLN during thyroid surgery is not uncommon. Unlike the RLN injury, the incidence of EBSLN injury in thyroid surgery is not as well documented. Many of them are unidentified and under-reported attributed probably due to poor clinical sign [2,3]. Among the reported rate, the incidence varies greatly from 0.3% to 58% [2,4]. The subtle changes only can be appreciated by using 70 degree rigid laryngoscopy or videostroboscopy. The post operative laryngoscopic examination is not a standard investigation following thyroidectomy in many centers, unless for research purposes.

Cernea had described the variations of the EBSLN into 3 types, with reference to the crossing it make at the superior thyroid pedicle from superior thyroid pole [5]. Type 1 is described as the nerve crossing the pedicle more than 1 cm above the superior pole. Owing to this description, the standard teaching of ligating the superior thyroid vessels as near to the gland is justified. This will avoid injury to the nerve in majority of cases even without identifying the structure. Type 2A is when the nerve crosses the pedicle within 1 cm above the superior pole whereby Type 2B is when it crosses at the or lower than superior pole level. The latter type is the commonest form of variations that is at increased risk of injury.

With the advent of intraoperative neuromonitoring (IONM), identification of this nerve or at least the near-course of the nerve is

readily made. Thus, the instrument can be used to help in searching for the nerve, or avoiding ligation and section of structures containing it. The identification rate of EBSLN using IONM can be as high as 83% as compared to direct visualization in which detected the nerve in only 34% of patients [6]. In a 3-arm randomized study, effective prevention of iatrogenic EBSLN lesions during thyroidectomies was noted to be achieved only by the intraoperative identification of the nerve with the nerve stimulator [5]. However, Aina and Hisham concluded from their series that exposure of cricothyroid space is the most important surgical step in searching the laryngeal nerve as compared to the use of IONM which was regarded only as the helping tool in cases where there is uncertainty whether a structure is the nerve [7].

We conducted as study at local hospital to see the rate of possible iatrogenic injury to the EBSLN by the clinical examination using laryngoscopic examination and evaluation of voice quality after thyroid surgery. Forty two patients were divided into two groups; study (optical identification) and control (using IONM) groups based on Random Number Table. All types of thyroidectomies performed in the period of study from 2008 to 2010, were intraoperatively observed and documented. The exclusion criteria are anaplastic thyroid carcinoma, Grave's disease, completion thyroidectomy, presence of cervical lymphadenopathy and abnormal vocal cord function pre-operatively. The rate of EBSLN injury was noted to be 2%, which occurred in the study group (without IONM) [8]. It carries significant impact to the individual patient although it is statistically low.

The objective voice measurements that can be used to assess the voice post operatively include acoustic measures, aerodynamic measures, and assessment of functional disability [9]. Other option of investigations to suggest the integrity of the EBSLN are laryngeal electromyography (LEMG) and imaging (MRI is superior to CT in EBSLN injury) [9]. At present there is still no agreement on the laryngoscopic features that can be considered as pathognomonic of unilateral EBSLN paralysis [9]. The laryngoscopic and stroboscopic manifestations that often mentioned in the literature are oblique glottis, mild bowing, sluggish abduction and adduction of the ipsilateral vocal fold on repetitive phonatory tasks, asymmetrical, irregular or a periodic vocal fold vibration, and reduced vocal fold amplitude [10]. Deviation of the petiole of the epiglottis to the side of cricothyroid weakness during extreme high pitch voice is a relatively new diagnostic laryngoscopic sign of EBSLN injury [10].

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Weak cough is not expected in EBSLN, unlike in the RLN palsy because only mild bowing of the vocal cord with a small phonation gap. Suspected EBSLN paralysis at clinical presentation and stroboscopy can be confirmed with laryngeal EMG [11]. If intraoperatively the EBSLN is identified and preserved, post operative paralysis symptoms can be considered as neuropraxia.

Neuropraxia can be allowed to recover with speech therapy within 6 months. Post operative changes which persist more than 6 months are regarded as permanent palsy [6]. The lesion, once occurred permanently is difficult to be corrected surgically, as compared to the RLN whereby medialization thyroplasty has become the preferred surgical treatment with immediate effect. Thus identification EBSLN intra operative either by meticulous surgical dissection in the cricothyroid space or using IONM or combination of both is of great importance in preserving sustainability of laryngeal function post operatively.

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