Monitoring the external branch of the superior laryngeal nerve in thyroid surgery

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The superior laryngeal nerve (SLN) is a division of the vagal nerve (VN). It derives from the inferior ganglion of VN (1,2).

All inbred laryngeal muscles apart the cricothyroid muscle (CTM) are moved by the recurrent laryngeal nerve (RLN) (3). The CTMs are galvanized by the SLN (1).

The SLN include of two ramifications: the internal, which furnish sensory properties to the laryngeal lamina, and the external branch of the superior laryngeal nerve (EBSLN), which animate the CTM (4).

Surgical management of the EBSLN during thyroidectomy is complex and opposite to conventional dissection of the RLN, utmost clinicians tended to renounce, rather than consistently denude, identify and monitor the EBSLN. There is an increasing consideration on the potential role of EBSLN estimation, monitoring, functional preservation and evaluation in thyroid and parathyroid surgery (1-5).

EBSLN is surgically relevant as it is in anatomical proximity to the superior thyroid vessels (STV), inferior constrictor muscle, cricothyroid muscle (CTM) and thyroid cartilage.

Optical recognition of the EBSLN is challenging, particularly in remedial surgery, apical lesions, or hemorrhage of the upper thyroid pole. Intraoperative neuromonitoring (IONM) has been proposed to coexist to vivid identification and to expedite localization and function preservation of the EBSLN while upper pole dissection and ligation.

In a recent survey from the International Neuromonitoring Study Group (INMSG) reveal that intermitted IONM was applied in RLN handling by 95% of 120 respondents. IONM was adopted for identification of the EBSLN by 26.3% of less-experienced *vs.* 68.4% of experienced surgeons (P=0.004). Interestingly 90% of survey feedbacks affirm that EBSLN localization is undeniable in voice professionals (3).

Furthermore, the "*External branch of the superior laryngeal nerve monitoring during thyroid and parathyroid surgery: International Neural Monitoring Study Group standards guideline statement*" was published by the INMSG in 2013, with the aim to describe a standardized approach for EBSLN monitoring, improve the practice of EBSLN monitoring, optimize the clinical utility of IONM technique (3).

EBSLN damage produces changes in voice projection and quality, alongside alterations in the high-pitched sounds production ability, modified frequency of voice, altered voice timbre, declension in voice conduct, contracted voice virtue projection, added deed to communicate (1,2). EBSLN dysfunction related symptoms may, in some cases, deeply and negatively influence the standard quality of life. These symptoms may be, of note, more noticeable with professional speakers.

Enhance future research on EBSLN is essential to optimize its control during upper thyroid pole dissection and to close the interval and gap between IONM results for the RLN and EBSLN, pre- and postoperative assessment of vocal cord (VC) mobility and voice quality indexes.

At the end of the surgical procedure, intraoperative EBSLN monitoring can provide postoperative neural function prognostication: in particular, after the EBSLN stimulation (performed in the most cranial EBSLN segment, i.e., cranially to the superior pole region surgically managed) a positive CTM twitch and EMG waveform are reliable evidence for functional EBSLN preservation.

RLN, EBSLN and VC structures and function are intimately related (1).

Infrequently, VC movement is defect-less, but voice ratio is slighted (1-5). For this reason, research towards neurophysiology and pathology of the EBSLN is up to date.

The complex neuroanatomy and physiology of VC and voice quality require a highly EBSLN knowledge, combined with an electrophysiological and clinical interpretation of the results before, during and after surgery.

The INMSG proposed the EBSLN mnemotechnic formula and steps for safe identification, dissection, preservation of the nerve:

(E) Expose the space hosting the EBSLN. EBSLN exposure can be enhanced by the transverse bisection of the laryngeal head muscle and the slight pull of the superior lobe via lateral and caudal direction (3).

(B) Blunt dissection within the avascular space between the CTM and the medial aspect of the superior pole allows visual identification of EBSLN located on the inferior constrictor muscle before its termination at the internal CTM (3).

(S) Continuously stimulating the tissues during ENSLN dissection. Stimulation of the tissues during the blunt dissection should be undertaken in order to facilitate optical localization of the EBSLN (3).

(L) Continually visualize for CTM contraction. The search for a positive CTM contraction is suggested during the delicate dissection of the tissues with the stimulation probe tip rather than expecting a positive EMG response on the monitor (3).

(N) Accompany anatomization using IONM mapping. When EBSLN is not identified but mapped in the surgical area, this technique should acquiesce maximization of the division level of the superior vessels to secure the intact functional continuity of the EBSLN provided by electrical nerve tests (3). Medially positive stimulation is obtained and then only the tissue is divided into the dissection of the superior pole, which stimulates negatively, laterally.

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