Need of intraoperative laryngeal nerve monitoring in head and neck surgeries

Recurrent laryngeal nerve (RLN) and external branch of superior laryngeal nerve injuries associated with thyroid and parathyroid surgeries may lead to complications such as stridor, dyspnea, and voice changes. Traditionally, visualizations of vocal cords in the perioperative period have remained the sole method to identify intraoperative nerves injuries. The availability of intraoperative laryngeal nerve monitoring (IOLNM) and its added advantages of guided and graded surgical resection has been validated as a new tool in thyroid surgeries in many studies.\[1\]

However, owing to the low incidence of RLN injuries, most of the studies are underpowered and routine use of IOLNM remains controversial. In 2011, International Neural Monitoring Study Group standardized the use of IOLNM to identify nerve injuries as an adjunct to conventional direct visualization.\[2\] Identification of RLN and superior laryngeal nerves by IOLNM was associated with better preservation of short- and long-term voice function.\[3\]

IOLNM can be done by electromyography during which the electrodes are placed adjacent to vocal cords by needling of cricothyroid. There has been evolution of new noninvasive methods of vagal nerve monitoring during neck endocrine surgeries.\[4\] Noninvasive method averts the need of intraoperative vagal electrodes and solely depends on endotracheal electrodes to stimulate laryngeal mucosa and elicit laryngeal adductor reflex (LAR) whose response is continuously monitored intraoperatively. LAR monitoring detects the entire vagal reflex arc and has an advantage of preventing vagal nerve injury during surgery of neck.

These electrodes can be either attached to the surface of endotracheal tube (ETT) or specialized ETT with embedded electrodes can be used.\[5\] The embedded electrodes increase the outer diameter of ETT, an orotracheal intubation, and may make it difficult to rail road the ETT over the fiberoptic bronchoscope.

IOLNM during endoscopic thyroidectomies is done by placing a percutaneous neural monitoring probe through the tract made by 18G syringe after ultrasound scanning of the neck to prevent any vessel injury.\[6\] This described technique had no instances of probe malpositioning and interferences with other endoscopic instruments. Percutaneous IOLNM improves quality dissection and safety in endoscopic procedures. It has also added advantages of laryngeal nerve mapping and identification, assessment of information about nerve function and prognosis, maintains the standardization of monitoring technique, and provides confidence during thyroidectomies.

During monitoring, loss of signal (LOS) is defined as decrease in nerve amplitude to 100 µV from a baseline amplitude of more than 500 µV with suprathreshold vagal stimulation and is subdivided into segmental, focal type 1, and global type 2.\[7,8\] IOLNM can facilitate staged thyroidectomies and prevent bilateral RLN injuries whenever a LOS is detected intraoperatively on one side.\[6,7\] IOLNM has also been a useful adjunct in identifying abnormal nerves such as non-RLN and prevented its damage intraoperatively and hence postoperative complications.\[9\]

IOLNM has also been applied in central nerve dissections to identify RLN, but even with IOLNM RLN palsy may occur during exposure of the laryngeal nerves during central neck dissection.\[10\] However, owing to rarity of nerve injuries in central nerve dissection, a large-scale study is required to further validate the effect of IOLNM.

Re-exploitation surgeries, large malignancies, and post radiation surgical neck dissection are associated with higher incidence of nerve injuries and many surgical organizations have suggested routine use of IOLNM.\[10-14\]

RLN monitoring during thyroidectomies and other cervical procedures in special populations of children and adolescent groups facilitated the identification of RLN and predicted postoperative nerve paresis.\[15\]

Even with the widespread applications of IOLNM, many authors have not supported the use of this technique owing to its limitations. IOLNM has not decreased the operative time and has shown to increase the cost of surgery. In some studies, the technique has not been proven to prevent postoperative nerve paresis compared with gold standard nerve visualization.\[16\] There are also disparities with the use of IOLNM among various centers, ethnic groups, and surgeons’ choice.\[17\]

A large meta-analysis to know the protective effects of IOLNM in thyroid surgery can reduce the incidence of transient, total, or permanent RLN injuries during thyroidectomies. The result of meta-analysis also recommends its use in bilateral surgeries and malignant cases, but insisted the need of further exploration of use of IOLNM in re-exploitation cases.\[18\]
There has been evolution and advancement of surgical technique to improve short and long-term surgical outcome in neck surgeries over years. Although IOLNM use has been controversial among various clinicians, many centers have incorporated it in routine patient care. Despite its limitations and conflicting results in routine thyroid surgeries, there is enough evidence to support its use during complicated neck surgeries such as large malignancies, preoperative nerve paresis, and postradiation neck explorations.

Nishkarsh Gupta, Abhishek Kumar, Anju Gupta
Department of Onco-Anesthesiology and Palliative Medicine, All India Institute of Medical Science, 1Department of Anesthesiology, VMMC and Safdarjung Hospital, AIIMS, New Delhi, India

Address for correspondence: Dr. Nishkarsh Gupta, 437 Pocket A, Sarita Vihar, New Delhi · 110 076, India.
E-mail: drnishkarsh@rediffmail.com

References
1. Rulli F, Ambrogio V, Dionigi G, Amirhassankhani S, Mineo TC, Ottaviani F, et al. Meta-analysis of recurrent laryngeal nerve injury in thyroid surgery with or without intraoperative nerve monitoring. Acta Otorhinolaryngol Ital 2014;34:223-9.
2. Randolph GW, Dralle H. International Intraoperative Monitoring Study Group, Abdullah H, Barczyński M, Bellanuente R, et al. Electrophysiologic recurrent laryngeal nerve monitoring during thyroid and parathyroid surgery: International standards guideline statement. Laryngoscope 2011;121(Suppl 1):S1-S16.
3. Masuoka H, Miyachi A, Higashiyama T, Yabuta T, Fukushima M, Ito Y, et al. Prospective randomized study on injury of the external branch of the superior laryngeal nerve during thyroidectomy comparing intraoperative nerve monitoring and conventional technique. Head Neck 2015;37:1456-60.
4. Sinclair CF, Téllez MJ, Ullkatan S. Noninvasive, tube-based, continuous vagal nerve monitoring using the laryngeal adductor reflex: Feasibility study of 134 nerves at risk. Head & Neck 2014;36:1379-90.
5. Barczyński M, Randolph GW, Cernea CR, Dralle H, Dionigi G, Alesina PF, et al. External branch of the superior laryngeal nerve monitoring during thyroid and parathyroid surgery: International Neural Monitoring Study Group standards guideline statement. Laryngoscope 2013;123(Suppl. 4):S1-14.
6. Zhang D, Fu Q, Dionigi G, Wang T, Xin J, Zhang J, et al. Intraoperative neural monitoring in endoscopic thyroidectomy via bilateral areola approach. Surg Laparosc Endosc Percutan Tech 2018;28:303-8, doi: 10.1097/SLE.0000000000000542.
7. Tewari A, Samy RN, Castle J, Frye TM, Habeck ME, Mohamed M. Intraoperative neurophysiological monitoring of the laryngeal nerves during anterior neck surgery: A review. Ann Otol Rhinol Laryngol 2017;126:67-72.
8. Liddy W, Barber SR, Cinquepalmi M, Lin BM, Patricio S, Kyriazidis N, et al. The electrophysiology of thyroid surgery: Electrophysiologic and muscular responses with stimulation of the vagus nerve, recurrent laryngeal nerve, and external branch of the superior laryngeal nerve. Laryngoscope 2017;127:764-71.
9. Gurleyik G, Torun M, Gurleyik E. Nonrecurrrent laryngeal nerve: Precise detection by electrophysiological nerve monitoring. Cureus 2018;10:e2670. DOI 10.7759/cureus. 2670.
10. Anuwong A, LavaZZa M, Kim HY, Wu CW, Rausei S, Pappalardo V, et al. Recurrent laryngeal nerve management in thyroid surgery: Consequences of routine visualization, application of intermittent, standardized and continuous nerve monitoring. Updates Surg 2016;68:331-41.
11. Chandrasekhar SS, Randolph GW, Seidman MD, Rosenfeld RM, Angelos P, Barkmeier-Kraemer J, et al. Clinical practice guideline: Improving voice outcomes after thyroid surgery. Otolaryngol Head Neck Surg 2013;148:S1-37.
12. Mosholt TJ, Clerici T, Dralle H, Frilling A, Goretzki PE, Hermann MM, et al. German Association of Endocrine Surgeons practice guidelines for the surgical treatment of benign thyroid disease. Langenbecks Arch Surg 2011;396:639-49.
13. Shindo MKE, Caruana SM, Kandil E, McCaffrey JC, Orloff LA, Porterfield JR, et al. Management of locally invasive well differentiated thyroid cancer: An evidence based American head and neck society consensus statement. Head Neck 2014;36:1379-90.
14. Marianowski, R., Marie, J.P. Monitorage du nerf laryngé inférieur dans la chirurgie thyroïdienne. In: Rapport SFORL, Pérès S, Garrel R. Pathologies chirurgicales de la glande thyroïde; 2012. p. 325-6.
15. White WM, Randolph GW, Hartnick CJ, Cunningham MJ. Recurrent laryngeal nerve monitoring during thyroidectomy and related cervical procedures in the pediatric population. Arch Otolaryngol Head Neck Surg 2009;135:88-94.
16. Gremillion G, Fatakia A, Dornelles A, Amedee RG. Intraoperative recurrent laryngeal nerve monitoring in thyroid surgery: Is it worth the cost? The Ochsner J 2012;12:363-6.
17. Al-Quarayshi Z, Randolph GW, Alshehri M, Kandil E. Analysis of variations in the use of intraoperative nerve monitoring in thyroid surgery. JAMA Otolaryngol Head Neck Surg 2016;142:584-9.
18. Bai B, Chen W. Protective effects of intraoperative nerve monitoring (IONM) for recurrent laryngeal nerve injury in thyroidectomy: Meta-analysis. Sci Rep 2018;8:7761.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.