Nerve Monitoring During Thyroid and Parathyroid Surgery

Johnny Cappiello*

ENT Department, GSD Istituto Clinico S. Anna, Italy

Routine identification of the recurrent laryngeal nerve (RLN) with or without intraoperative neuromonitoring (IONM) has decreased the rates of temporary or permanent palsy, ranging from 6 to 1% of cases in more experienced centers, in which trained surgeons perform more than 100 procedures per year, out of these criteria the percentage of neural injuries exceed 10%, particularly in reoperative cases. Undoubtedly RLN palsy still occur with routinely identification, even combined with IONM, although most cases were temporary. The reported causes of RLN injury results from transection, clamping, stretching, electro-thermal injury, ligature entrapment or ischemia, but the actual causes of RLN palsy, especially in those with visual integrity, are still not well understood. A recent review meta-analysis showed no statistically significant difference in the incidence of RLN palsy when using IONM versus visualization alone (VA) during thyroidectomy [1], however these results must be approached with caution, as they were mainly based on data coming from non-randomized observational studies.

Instead of these data IONM during thyroid and parathyroid surgery has gained widespread acceptance as an adjunct to the gold standard of VA, as obtained only by visual or magnification by loops or endoscopes like MIVAT, adding a new functional dynamic source of information during surgery. In the United States and in Europe this approach is routinely employed both from young, general surgical and otolaryngology trained surgeons in approximately 45-50% of procedures. Despite this increasingly broad use of IONM, review of the literature confirms there is little uniformity in nerve monitoring across different centers, like systematic use of laryngeal exam, different recording electrodes with a variety of different stimulation. Monitoring systems also vary, particularly when depicting the laryngeal EMG waveform, others providing only an audio tone or with a combination of visual shape waveform and audio tones. Another issue of debate is no standard algorithms for endotracheal tube placement, cooperation with the anesthesiologist for tube management, cuff pressure and design, and type of anesthesia. Management of loss of signal (LOS) is often troubleshooting, in regard to waveform, amplitude and latency systemic evaluation often related to the basic modes of IONM application. For these reasons every center that will apply the correct use of IONM should attain to the International Neural Monitoring Study Group [2], as a standard guideline statement, for a continuous and systematic application of IONM during surgery to avoid any bias on collecting data for future studies.

The study group believes that neural monitoring could be performed routinely in every procedure, given that in cases of nerve at risk or in difficult cases cannot always be predicted preoperatively. Suggestion for his application is mainly in improvement on RLN identification time, reduction of temporary vocal cord palsy (VCP) rates and avoidance of bilateral VCP through prognostication of postoperative vocal cord function, changing the resection plan for the contralateral side when a ipsilateral LOS is evident. A special utility is so for bilateral surgery, in revision thyroid surgery and particularly in the setting of an existing RLN paralysis, revealing a significantly reduced amplitude of ipsilateral vagus nerve (VN) and RLN, indicating retained nerve conductivity despite vocal cord (VC) immobility.

Regarding the unexpected VCP is frequent in cases where RLN is bifurcated, particularly prone to injury if the bifurcation occurs near the ligament of Berry. In this scenario the anterior branch (motor) is stretched forward by the ligament, the posterior branch (sensory) can be mistaken for the entire RLN, which leads to injury of the anterior branch. Another risk in this anatomical region is that the distal course of the RLN may become subject to stretch injury at the relative tethering point at the ligament of Berry, because the thyroid gland is dissected and medially rotated from its cervical attachment. This evenscence is encountered especially in patients with large goiters, Grave’s disease, thyroiditis or thyroid cancer with extracapsular spread. Despite utility of intermittent IONM such a format could potentially allow the RLN to be at risk for damage in-between stimulation, suggesting the current IONM formats are limited in an ability to prevent neural injury. The advantage of continuous intraoperative neuromonitoring (CIONM) is that it has the potential to monitor the entire VN and RLN functional integrity in real time throughout surgery and could identify EMG signals associated with early impending injury states. A prospective multicenter study [3] on CIONM did not result in stimulation-evoked nerve injury or intraoperative adverse cardiac, pulmonary, or gastrointestinal effects due to VN stimulation providing real-time RLN evaluation during surgical maneuvers. Combined events and LOS were related to the development of VCP, demonstrating an utility in identifying real-time adverse
concordant amplitude and latency changes, which can prompt modification of the associated surgical maneuver and may prevent RLN paralysis during thyroidectomy.

In modern approach to thyroidectomy another point of issue, often forgotten or not considered, is the identification and preservation of the external branch of the superior laryngeal nerve (EBSLN), where its injury during dissection and ligation of the superior thyroid vessels can occur up to 58% of patients. EBSLN injury leads in dysfunction of the cricothyroid muscle, that if not important like VCP related to RLN injury, results in altered fundamental frequency of the voice, a deterioration in voice performance in producing high-frequency sounds and reduced vocal projection. This can be particularly significant for those using their voice professionally. Moreover its injury can be difficult to identify intraoperatively and to detect during routine postoperative laryngoscopy. In this light the routine use of IONM can help to sensitize surgeons to preserve function also of the EBSLN, as a completion of the RLN integrity, according to the International Neural Monitoring Study Group standards guideline [4], to obtain best results and collect prospective monitoring data useful for future randomized controlled studies.

REFERENCES


