Editorial

Intraoperative monitoring in minimally invasive endocrine surgery from minimally invasive video-assisted technique to transoral endoscopic thyroidectomy vestibular approach

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In the last years a series of transoral thyroid and parathyroid surgery via a vestibular approach have been published and most of them have been carried out in Asia, where this procedure is growing in popularity due to cultural reasons (1). In the Western world, more and more surgeons are employing this approach. A number of clinical research centers are trying to define the proper technique and the indications for this procedure. As for any new procedure, comparison with prior techniques, rigorous safety and reproducibility testing are mandatory. The results from these studies show how highly skilled surgeons, well versed in thyroid, parathyroid and video-assisted surgery, are required to properly execute this delicate procedure (2).

Recently, mini-invasive techniques for thyroid surgery have developed considerably, especially after the invention of the minimally invasive video-assisted technique (MIVAT), introduced in the Western world by Miccoli *et al.* (3). As for any new technique, reproducibility and safety must be proven). As mentioned before, these novel approaches must be compared with both the traditional and mini-invasive ones to determine the inclusion criteria and incidence of adverse events (4-7).

The use of intraoperative neuromonitoring (IONM) during thyroid surgery is increasing. This system allows for added safety during the execution of a thyroidectomy as it aids in both the identification of nearby nerves and in the isolation of the recurrent laryngeal nerve (RLN) by evaluating its functional and anatomical integrity. The use of IONM might reduce RLN injury after thyroidectomy surgery (8-12). We strongly encourage the routine use of IONM for bilateral procedures and for malignancy removal.

Cooperation between surgeons and anesthesiologists is paramount for the correct execution of the IONM procedure. A correct positioning of the endotracheal tube, with the use of the appropriate drugs, avoids false positives signals secondary to tube displacement and/or misplacement and pharmacological interferences on cordal motility. In fact, the misplacement of the endotracheal surface electrodes can result in erroneous IONM with an increased risk of RLN injury. Lu *et al.* analyzed 105 patients undergoing elective thyroid surgery. The middle of the exposed electrodes of the endotracheal tube were placed adherent to the true vocal cords under direct laryngoscopy. The results of this study show how the mean depth of a correctly positioned endotracheal tube at the beginning of the operation could be a useful marker of electrodes displacement during surgery, allowing for a swift adjustment of the tube's depth (13).

A correct management of neuromuscular blockers (NMBAs) is pivotal for IONM. After a successful placement of the endotracheal tube, no further doses of non-depolarizing NMBAs should be administered. Depolarizing NMBA (i.e., succinylcholine) may still be administered at the risk of serious side effects (e.g., cardiac bradycardia and malignant hyperthermia). Non-depolarizing NMBAs, especially rocuronium, may also be employed for tracheal intubation if recovery of neuromuscular transmission with positive electromyogram (EMG) signals are obtained before commencing IONM.

This can be achieved either by waiting the correct amount of time for neuromuscular activity to completely recover or, just for rocuronium, by administering sugammadex (a selective agent that immediately and definitively reverses neuromuscular blockade) to antagonize the neuromuscular block and allow IONM (13).

All of the techniques mentioned above show the paramount importance of the synergy between the anesthesiologist and the surgical team when performing IONM. A precise endotracheal tube placement and optimal use of NMBAs are but a few of the many steps required for a successful procedure. A complete pre-operative evaluation and a swift management of post-operative adverse events (i.e., post-operative nausea and vomiting, pain control) are mandatory to ensure the best success rate of IONM (14).

In our practice, we collected 141 cases of MIVAT with the use of IONM (48 lobectomy) since September 2014, 234 nerve at risk. The incidence of transient cordial paresis was 0.8%, none of which was definitive.

The informed consent for these patients clearly stated which technique was chosen and that the neuromonitoring would be applied. Furthermore, the consent form reported the possibility of converting to a two-stage thyroidectomy in the event of loss of the signal after the first lobectomy to completely avoid the risk of bilateral nerve injury, in accordance with the IONM group statement. IONM requires the same surgical accesses and maneuvers as the conventional approach, without lengthening the operating time.

In high-volume centers, the association between searching for RLN and its functionality appears to be the most reliable and safest technique, with the operator perceiving an increased safety during the procedure. The use of the IONM in both the latest mini-invasive techniques and in the transoral endoscopic thyroidectomy vestibular approach (TOETVA) described by Dionigi *et al.*, where a long introducer probe is inserted in a lateral trocar, is associated with greater safety for both procedures and increases the perceived safety of the operator (15).

This technique allows to proceed with the isolation of the RLN without interfering with the other surgical instruments. Furthermore, it offers better control on those maneuvers that may result in excessive traction of the inferior laryngeal nerve. Correct placement of the neuromonitoring can also reproduce, with the TOETVA, the standardized search of V1, R1, R2, V2 (9).

It must be noted that the most frequent cause of inferior laryngeal nerve injury is excessive traction or heat spread insult from the use of energy devices.

The expert use of the IONM with the TOETVA is reported to be feasible, safe and capable of modifying the surgeon's intraoperative conduct while still complying with the standard safety criteria. High-volume centers must train surgeons and anesthesiologists specifically for these procedures in order to achieve the highest skill level.

In conclusion, TOETVA must be performed in high volume centers with great experience in thyroid surgery and well versed in clinical research in order to validate this method by abiding to strict inclusion criteria. Patients should always be properly informed on the trial phase reached by the procedure as well as all the relevant aspects surrounding the operation. Strict adherence to the approved technique yields the lowest surgical risk, the least invasiveness and the highest efficacy.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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