Editorial

Monitored transoral endoscopic thyroidectomy

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I read with interest the article by Dionigi *et al.* "*Monitored transoral endoscopic thyroidectomy via long monopolar stimulation probe*", published on *Journal of Visualized Surgery* (1). The article is very interesting, well written and innovative, introducing the use of neuromonitoring in the new technique of transoral thyroidectomy (1).

The transoral endoscopic approach is an application to thyroidectomy of the natural orifice surgery in order to obtain an excellent aesthetic result (2-5). It is an emerging experimental alternative to traditional surgery that eliminates visible skin incisions and scars because it uses an endoscope passed through the mouth into the thyroid (6). This technique has been demonstrated to be feasible in cadaver, porcine models and in patients (7). However, it still has several technical issues, including a different method of dissection, reduced surgical space, and bad visibility, which make it difficult to identify and preserve the recurrent laryngeal nerve (RLN) (3). Current instrumentation and technology make this approach technically difficult and place a high risk on the mental nerve (7). Moreover, endoscopic instruments may not be sufficient to control bleeding in live patients who bleed easily (6). For all these reasons, it is suggested that transoral thyroidectomy should be performed only in reference centers for endocrine and endoscopic surgery (5). However, if transoral endoscopic thyroidectomy with a vestibular approach (TOETVA) is compared to bilateral axillo-breast and transaxillary endoscopic approaches, it should be noted that these require a longer and more difficult dissection to reach the thyroid, whereas TOETVA provides a more direct access (8). The results are encouraging (9), while the risk for sensory changes in the area around the lower lip persisted (6).

Indications for TOETVA are a thyroid diameter not larger than 10 cm, a thyroid volume not larger than 45 mL, a nodule size not larger than 50 mm, diagnosis of benign tumor, cyst, uninodular or multinodular goiter, diagnosis of follicular lesions, and preoperative diagnosis of papillary microcarcinoma without lymph node or distant metastasis (1,9-12). Exclusion criteria are contraindications to general anesthesia, previous irradiation of the head, neck or upper mediastinum, previous neck operations, recurrent goiter, thyroid volume greater than 45 mL, main nodule size larger than 50 mm, tracheal or esophageal infiltration, lymph node or distant metastases, preoperative RLN palsy (RLNP), hyperthyroidism, and oral abscesses (1,10).

RLN injury is the most frequent and feared complication after TOETVA and in previous clinical studies there was only a slight improvement (4). One of the greater problems with TOETVA is the difficulty in using nerve monitoring systems.

Intraoperative neuromonitoring (IONM) during thyroidectomy is widely accepted in addition to the visual identification of the RLN (3,13), allowing to detect RLN anatomic variations, to predict the outcome of the vocal cord function, and elucidating RLN injury mechanism (3). RLNP is the most frequent and severe complication after thyroidectomy and it is the main reason of medico legal controversies after endocrine surgery (14). There are two main mechanisms of RLNP: the transections of the RLN and lesions without transection such as heat, stretch, and

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compression. Most RLNP are transient and occur as a result of heat, stretch and compression injuries (3). IONM allows the surgeon to visualize the electrophysiological signals as the surgery goes on. If IONM should be done routinely or selectively is currently a hot topic of discussion (5). Despite the use of IONM is steadily and strongly increasing, the literature review and the clinical experience confirms that there is a lack of uniformity in applications of and results from IONM in different centers (13,15). It is extremely important to follow a standardized technique of IONM that consists in identifying and monitoring both the vagus nerve and the RLNs before and after resection (V1, V2, R1, R2) (1,15).

There remains the problem of RLN injuries that occur during the interval between the nerve stimulations of intermittent IONM (3,16,17). Since most of the intraoperative RLN lesions are related to the combination of medial thyroid traction and RLN dissection (3,16,17), the aim of the surgical research should be a simple and safe procedure for a real-time monitoring of nerve function (3). Continuous IONM (C-IONM) contributes continuous RLN function report, which is useful in complex procedures, especially as in endoscopic and robotic thyroidectomy (18). C-IONM provides a real-time monitoring of RLN function during thyroid mobilization and RLN dissection, and it can prevent non-transection RLNP (3).

IONM, which was demonstrated to be effective and widely used in conventional open thyroid surgery, however, has never been performed in transoral surgery to identify RLN in the previous literature (4).

Witzel and Benhidjeb (19) first tested the feasibility of intermittent IONM for the RLN in a porcine model in TOETVA, in 2009. Authors proved IONM to be a performable procedure in living swine with a long stimulating probe (5,18,19).

The major advantage of implementing IONM in transoral thyroid surgery is identifying RLN and confirming its integrity (4). Currently, visual identification of RLN is considered the gold standard in prevention of RLNP; IONM is recommended to help in identifying nerves and preventing misidentification of any other nerve-like structure in high-risk patients during thyroid surgery (4). Furthermore, it is well-known that visual identification does not offer surgeons an adequate information on the function of visually intact nerves (4). The use of IONM for transoral thyroid surgery can be considered useful and feasible with the benefit of decreasing the rate of RLN injuries, especially in the case of low volume surgeons (1,4). However, for a more appropriate assessment on the use of IONM in lowering the rates of RLN complications larger series will be needed (1). IONM allows the surgeon to operate with greater safety and serenity during first approach with TOETVA (1).

As for the C-IONM, its use is much more complicated in TOETVA. C-IONM was feasible in TOETVA in porcine models, but simplification of electrode design and application is needed (18). A recent article reports on C-IONM feasibility in transoral endoscopic procedures in humans (3). In this report (3), authors state that the use of C-IONM is reliable and safe during transoral endoscopic thyroidectomies and may help in the early detection of adverse electromyographic mutations, thus preventing RLNP. This procedure can be challenging endoscopically, time-consuming or even harmful to the nerve and vessels while positioning the accessory and at removal of the electrode (18). Furthermore, C-IONM accessory should be versatile because the position of the vagus nerve in relation to the common carotid artery and the internal jugular vein in humans is very changeable (18). In relation to the features of C-IONM electrodes available currently for thyroid surgery, none of these seem to be easy to apply in TOETVA (18).

Dionigi *et al.* (1) report that monitored TOETVA with the long stimulating probe is feasible and secure. There were no cases of interference of IONM equipment with other endoscopic instruments. In their opinion, the advantages of using this technique are that IONM facilitates the RLN identification, allows monitoring of the RLN function, and allows corrective action during thyroid dissection, while using energy-based devices, and during thyroid retraction (1). In particular, retraction of thyroid using forceps can cause excessive traction and subsequent functional RLNP (1). IONM allows evaluation of the RLN function by stimulation of the vagus nerve on one side before continuing the operation moving to the contralateral lobe (1,20,21). This is obviously particularly relevant for bilateral interventions (1). In fact, when there is a loss of the electromyographic signal after the resection of the first lobe, many authors suggest to stop the surgery and to remove the contralateral lobe in a second operation, in order to avoid bilateral RLNP (14,20). According to most surgeons staged thyroidectomy is recommended in patients with bilateral benign thyroid disease, although some believe it is also acceptable in procedure performed for cancer (20,22). However, the topic is still much debated, also considering the poor positive predictive value of IONM (15,20).

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Moreover, monitored TOETVA is tricky and requires perfect standardization and a thorough knowledge of the system. So, it is not recommended to use IONM for the first time with TOETVA, without previous experience of nerve monitoring in open thyroidectomies (1).

The feasibility of the use of the IONM during TOETVA demonstrated by Dionigi *et al.* is particularly important also for medico legal reasons that have become so important in this type of surgery (23). Moreover, the possibility of using IONM during TOETVA can reassure the surgeon that experience a new and complex technique with a completely different surgical approach.

In conclusion, Dionigi *et al.* (1) demonstrate that monitored TOETVA is reliable and secure in RLN identification and RLN function evaluation. The results will have to be confirmed by other larger studies.

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Footnote

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

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