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Stage Thyroidectomy:An Historical Perspective

Ettore Caruso, Antonella Pino, Alessandro Pontin, Gianlorenzo Dionigi

Division for Endocrine and Minimally Invasive SurgeryDepartment of Human Pathology in Adulthood and Childhood "G. Barresi", University of Messina, Messina, Italy,

Abstract

The visual identification of the nerve is still today the standard technique in thyroid surgery. Although the systematic use of the intraoperative neuromonitoring (IONM) of the NLR has not demonstrated a statistically significant reduction in NLR lesions yet, IONM has been conclusive in the case of complex anatomy (re-operation, voluminous goiter, thyroid carcinoma) and in functional integrity of the NLR.The application of the IONM allowed to reconsider the two-phase thyroidectomy procedure in order to prevent bilateral lesions to the NLR. This method makes it possible to evaluate the possibility of proceeding safely to the completion of total thyroidectomy after resection of the dominant lobe and to decide, if necessary, to delay the resection of the second lobe at a later time, as in the case of injury or dysfunction of the NLR after lobectomy. The systematic application of IONM may lead the surgeon to modify the operative strategy in the presence of LOS from the NLR ensuring an almost zero incidence of bilateral paralysis of the NLR.It is necessary to define specific application guidelines, for the management of problems related to employment as in tumor pathology.

Keywords Stage thyroidectomy; Thyroid diseases; Intraoperative neuromonitoring (IONM)
Introducing Member: Gianlorenzo Dionigi
Corresponding AuthorGianlorenzoDionigi - gdionigi@unime.it

Introduction

Stage thyroidectomy is defined as a gland resection performed at two different times: the operation is at first limited to excision of the dominant lobe, the second side is removed later.

In 1929, Pemberton first described modifications of the operative procedure that would improve the patient's condition at a reduced risk in "*Exophthalmic goiter. Indication for the stage-operation*" (1). This can be accomplished by resection of the gland in two stages (1). "*The operative risk of lobectomy is definitely less than that of subtotal thyroidectomy, for the surgical trauma and the chances of technical errors are just half those of the latter … If the patient can endure lobectomy, the resulting improvement will be so significant that the second lobe can be resected later at a greatly diminished hazard*" (1). Other reports of the stage procedure can be appraised from Porta (1811), Blizzard, Billroth, Wolfler, Kocher and Mayo (early 1900) in the treatment of both benign and malignant thyroid disease (1).

Intraoperative neuromonitoring (IONM) has gained widespread acceptance as an adjunct to the gold standard of visual recurrent laryngeal nerve (RLN) identification. However, it remains unclear whether IONM improves the clinical outcome of thyroidectomy in terms of preserved

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RLN function (2). The uncertainty in the literature concerning the merit of IONM, led to the analysis of other possible benefits, for example, for the surgical strategy to prevent bilateral RLN injury associated with total thyroidectomy, and the stage procedure has been recently reconsidered due to the increased application of IONM (3-5).

De facto, possible consequences of a loss of signal (LOS) of the RLN on the initially operated side should lead to a careful consideration of the optimal timing of surgery on the contralateral side. With LOS, the surgeon must consider that the ipsilateral nerve is injured at least temporarily; this permits considering whether it is important and in the patient's best interest to perform surgery on the contralateral side on the same day given the intraoperative information of potential ipsilateral paralysis (2-5). According to Goretzki (3), a failed IONM stimulation of the RLN after resection of the first thyroid lobe is specific enough to reconsider the surgical strategy in patients with bilateral thyroid disease to surely prevent bilateral RLN palsy. In fact, in 85% with known nerve injury, and in 56% with negative IONM stimulation on the side of the initial dissection, the surgical strategy was changed with no postoperative bilateral RLN palsy. This contrasts with the 17% bilateral RLN palsy ($p < 0.05$), when surgeons were not aware of a preexisting or highly likely nerve injury on the first side of thyroid dissection. Moreover, after LOS on the first side of resection in bilateral goiter, more than 93% of surgeons declared their willingness to change the resection plan for the contralateral side to avoid the risk of bilateral RLN palsy, resulting in discontinuation of surgery (84%), or undertaking a less extensive resection for completion of the other side than originally planned (9%) (4). Departments with the heaviest institutional caseload reportedly changed their surgical plans more often than those with a lower institutional volume (4). Likewise, departments that routinely employed vagal stimulation and recording of electromyography (EMG) responses abstained from continuing the resection on the unaffected side more frequently than those that did not (4, 5).The review of the Literatureraiseseveral considerations for debate.

Troubleshooting algorithms.

The first observation is relative to IONM troubleshooting algorithms. Given the potential impact that LOS may have on the surgical plan (i.e. aborting the second side surgery), it is critical that the surgeon who uses IONM is perfectly experienced in LOS troubleshooting algorithms (2). With correct application of a detailed LOS troubleshooting algorithm, the rate of a negative signal at the end of surgery becomes reduced, and the incidence of postoperative vocal cord paralysis in this group becomes substantially higher. The International IONM study group recommends adding either laryngeal twitch and contralateral vagal nerve stimulation assessments to the noted

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EMG data (2). If the noted EMG data is present, and there is either no laryngeal twitch but contralateral vagal nerve response with stimulation, then the surgeon must consider this to be a true LOS and that nerve injury has occurred.

First the dominant thyroid lobe side.

It is appropriate to begin thyroidectomy from the dominant side. Unfortunately, not all surgeons start the surgical procedure with the dominant lobe. By definition, the dominant lobe is the larger thyroid lobe, the lobe affected by a suspected or proven tumor, the side with a hyperfunctioning hot nodule, and in a multinodular goiter the lobe with larger and/or the greater number of nodules, or the lobe causing compression symptoms. This approach allows at least a prompt control and monitoring of the disease that led to the indication for surgery by the endocrinologist.

Safety of completion thyroidectomy.

The analysis of morbidity of those patients who undergo completion thyroidectomy following the stage procedure revealed no additional surgical or anesthesiological complications (6).

Cancer.

Does the surgeon have to stop the operation in case of LOS following completion of the first side for malignant disease? The main types of thyroid cancer not only differ regarding morphology, pathogenesis, genetics, and pathophysiology, but also concerning tumor biology, metastatic behavior and prognosis (7). Differentiated thyroid carcinomas have an acceptable prognosis despite local invasion and distant metastases (7). Knowledge of these features is the basis of the surgical concept of stage thyroidectomy even in thyroid cancer management. Radioiodine therapy, thyroid hormone substitution/suppression therapy with monitoring of thyroid status and strict follow-up is suggested while waiting to perform an eventual completion thyroidectomy. Perhaps, a possible exception of a two-stage thyroidectomy might be a proven bilateral thyroid malignancy and metastases in a high-risk patient. Further guidelines are needed to define the indications of stage procedure in cancer patients.

Multidisciplinary decision.

The decision to stage the surgical procedure should be discussed with the anesthesiologist and the endocrinologist. The surgeon(s) must interact with the anesthesiologist to discuss potential risks and to decide if the patient with LOS on the first side should have or should not have a second anesthesia at a later time point. It is true today that the duration of surgery, the competency of the team (surgeon and anesthesia providers), and especially the level of peri-operative care improved significantly in the last years, decreasing the risk associated with repeated anesthesia (8). As for the endocrinologist, a second option of treatment for the remnant contralateral lobe can be

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considered (medical treatment): for example, in the case of Graves' disease, the remnant contralateral lobe may be amenable to radioiodine ablation if it is relatively small.

Timing of completion thyroidectomy.

It is important to decide the timing for completion thyroidectomy. In most cases, substantial improvement in laryngeal function and condition was achieved with specific treatment, after vocal function exercises, voice therapy, or vocal cord surgery (2, 9). Thus, one may move forward with contralateral surgery when postoperative laryngoscopy confirms (a) resolution of neuropraxia, typically in 6 to 8 weeks in many mild cases; or (b) in case of a rare permanent paralysis, an improvement of the respiratory tract is achieved spontaneous or by bulk injections, surgery or a combination of treatments (in addition, the patient may be better prepared for the completion surgery with preventive peri-operative medical cortisone treatment).

Informed consent.

IONM is mentioned in the preoperative informed consent for primary and secondary interventions. If the patient is informed about the use of IONM, she/he should also be informed about the consequences of intraoperative LOS. The possibility to stage the procedure in case of a LOS on the initially operated side must be specified in the preoperative informed consent. Patients must be informed about the possibility of staging the intervention in case of a LOS, in order to maintain patient autonomy and with emphasis on shared decision making. Most patients perfectly agree with this concept and understand the clear benefit in deciding on a two-step approach in case of a LOS on the initially operated side.

Costs.

The additional expense of a two-stage procedure is of concern. A staged thyroidectomy can lead to increase in health care costs because two hospitalizations are required to complete the intervention. This factor could potentially diminish the cost/benefit ratio associated with a staged thyroidectomy if the cost for the initial total thyroidectomy is significantly lower than the cost for two hemithyroidectomies performed at two different times. Reporting accurate costs of thyroidectomy, the associated complications and innovations is also important as this would help to a possible re-evaluation of a staged procedure. A future analysis should account possible post-discharge consequences of uni- and bilateral RLN injuries including speech and/or medical therapy, repeat laryngeal exams, and even vocal cord surgery and law claims (10).

Healthcare system.

Undoubtedly, not all healthcare systems will readily accept two surgical procedures and\or two admissions for thyroidectomy. These geographic differences must be considered.

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Medicolegal issues.

In a malpractice analysis, IONM provides important prognostic information regarding ipsilateral vocal cord function at the completion of the initial side of the surgery. IONM allows the surgeon to stage the contralateral surgery if RLN damage is diagnosed, thereby avoiding the potential for bilateral vocal cord paralysis (11). If IONM is used, the surgeon must consider the result and eventually stop the operation. If not otherwise indicated, the operation has to be stopped in case of benign disease. If the surgeon proceeds, the reasons must be clearly defined (e. g. malignant bilateral disease, severe patients' co-morbidity).IONM should be systematically used in thyroid surgery. However, it is time to develop specific guidelines that consider all the variables listed above.

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