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SIDE EFFECTS OF ENDOCRINE TREATMENTS

Complications in thyroid resurgery: a single institutional experience on 233 patients from a whole series of 4,752 homogeneously treated patients

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Abstract The aim of this study was to examine a homogeneous, consecutive recent series of patients who underwent reoperation on the thyroid bed to assess the incidence of the complications commonly correlated with resurgery. We reviewed clinical charts of 233 patients who underwent resurgery taken from a total of 4,752 patients previously operated on for benign and malignant thyroid diseases from 2006 to 2010 by the same surgical team. We evaluated the incidence of postoperative hemorrhage, hypoparathyroidism, and recurrent laryngeal nerve (RLN) palsy. Analyses were done separately in relation to the type of the type of resurgery adopted: (A) monolateral completion; (B) bilateral completion, after monolateral (B1) or bilateral prior surgery (B2); and (C) lymph node dissection. We also separately analyzed patients according to their final histological diagnosis of benign or malignant disease. Regarding hemorrhage, 6/233 patients (2.5 %) underwent surgical revision of the thyroid within 12 h for postoperative hemorrhage. They included 2 (1.5 %) of the 129 monolateral reoperations (A), 3 (4 %) of the 74 bilateral reoperations (B), and 1 (3.3 %) of the 30 central dissections for nodal relapse (C). Transient and definitive postoperative hypoparathyroidism was recorded in 78 (36.4 %) and 7 (3.3 %) of the 214 eligible patients. Transient RLN palsy occurred in 21 RLNs at risk (7 %) and definitive RLN palsy in 5 (1.7 %). Elective total thyroidectomy cannot always be supported as an effective policy for preventing recurrences in patients with a single, benign node: lobectomy, preferably with extemporaneous histological examination, unquestionably represents the best minimal approach to thyroid resection.

Keywords Thyroid surgery · Benign diseases · Malignant diseases · Intraoperative complications · Resurgery

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Introduction

It is widely accepted that resurgery of thyroid diseases carries a greater risk of complications than primary surgery even when performed by skilled surgeons [1]. The term "resurgery" includes various procedures ranging from minimal operations to bilateral, extensive, and complex surgical operations including lymph node dissection. This may give rise to misunderstandings and influence "surgeons" attitudes, perhaps causing them to opt for more radical primary procedures that may not always be justifiable [1].

The aim of this study was to examine the incidence of the complications identified in a recent consecutive homogeneous series of patients who underwent resurgery for thyroid diseases, and to determine which thyroid

operations were more associated with complications. Knowledge of these complications may encourage surgeons to reconsider their aversion to resurgery, perhaps dispelling the opinion that total thyroidectomy should be the surgical treatment of choice even for single, benign nodes, and encouraging complete lobectomy as a more appropriate initial procedure for many patients.

We considered the incidence of postoperative hemorrhage, hypoparathyroidism, and recurrent laryngeal nerve (RLN) palsy in a series of 233 patients who underwent resurgery out of a total of 4,752 patients treated surgically for benign and malignant thyroid diseases from 2006 to 2010 by the same surgical team.

Materials and Methods

From 2006 to 2010, 4,752 procedures for thyroid diseases were performed at the same surgical center, including 3,524 (74.2 %) total thyroidectomies, 995 (20.9 %) lobectomies, and 233 (4.9 %) resurgery. All 4,752 operations were performed by the same leading surgeon (P.M.R.) except for 276 patients.

We consider total thyroid lobectomy (as distinct from nodulectomy or partial lobectomy) the total extracapsular removal of one lobe and the isthmus, leaving behind viable parathyroid glands and intact recurrent laryngeal and superior laryngeal nerves. On the other hand, we consider total thyroidectomy (as distinct from near total or subtotal thyroidectomy) simply a matter of performing a total thyroid lobectomy on both sides during the same operation.

Each procedure should be performed with a specific "game plan" in mind, progressing in a series of logical steps. Orderly, anatomically based steps are as follows: exposure of the thyroid gland; dissection of the upper pole and superior laryngeal nerve; dissection of the lateral aspect of the thyroid lobe, preserving the recurrent laryngeal nerve and parathyroid glands; and closure.

The patient is given general anesthesia and is placed in the supine position, with arms to the side and a support is placed transversely underneath the shoulders, thereby extending the neck. The neck extension must not be too extreme as it increases postoperative pain and discomfort.

The key to all successful surgery is adequate exposure. This is especially true during thyroid surgery. After skin preparation and draping, a collar incision is made in skin crease approximately 2 cm above suprasternal notch. The incision is carried through the platysma and subplatysmal flap is elevated on both sides, superiorly and inferiorly. Deep investing layer of fascia is divided in midline, and the strap muscles are retracted in midline from thyroid notch to the suprasternal notch so as to expose the thyroid gland completely.

First of all it is useful to define the midline. The upper border of the isthmus is dissected off the trachea by dividing the superior suspensory ligament with any of its vessels, and the midline is identified. If there is a pyramidal lobe present, it is at this stage it is mobilized and divided from the fibrous tissue of any remaining thyroglossal duct tract. Similarly, the midline below the isthmus is defined with division of any centrally placed inferior thyroid veins. The thyroidea ima artery exists in approximately 3 % of cases and may arise from the innominate artery or directly from the aorta. If present, it should be controlled and divided at this point.

The first major vein to be encountered at this stage is the middle thyroid vein, which must be divided before the lateral space is exposed. The gland is mobilized from surrounding soft tissue, the lateral space between the thyroid and the carotid sheath is opened, and the thyroid lobe is retracted medially.

Subsequently, upper pole of the thyroid gland is dissected. To remove the superior pole of the thyroid safety and completely, the overlying strap muscle is dissected off the gland, taking care not to enter the subcapsular veins, which may bleed profusely if lacerated. The superior pole is gradually separated from overlying muscle, and the space between the thyroid gland and cricothyroid muscle is opened.

Identification and dissection of this space are greatly assisted by traction of the thyroid in an inferior and lateral direction; once the medial and lateral borders of the superior pole have been mobilized, the superior pedicle is divided. To avoid injury to external branch of superior laryngeal nerve as it runs in Joll's triangle medial to upper pole, the vessels of the pedicle are ligated near the thyroid capsule. Boundaries of Joll's triangle are laterally upper pole of thyroid gland and vessels, superiorly attachment of strap muscles, and deep investing layer of fascia to thyroid cartilage, medially midline. Its floor is cricothyroid, and the contents are external laryngeal nerve running on cricothyroid muscle.

It is important to identify the superior parathyroid gland in this area (about 2 % of cases) and to preserve its blood supply before ligation of the posterior branch of the superior thyroid artery.

The thyroid gland is now retracted medially and elevated out of the wound. At this step, the recurrent laryngeal nerve (RLN) must be identified and preserved. Opening the cervical median strip, the RLN is looked for from the mediastinum to the larynx. To identify the RLN, it is useful to isolate and tract by a loop the inferior thyroid artery. The inferior parathyroid is individuated next to the inferior thyroid artery and it is preserved. The RLN is encountered in this region deeping the tubercle of Zuckerkandl which may be considered an allow pointing to the RLN, a constant anatomical landmark used to locate the RLN. The tubercle of Zuckerkandl is present in all

thyroid glands and is represented as a thickening where the ultimobranchial body fuses into the principal median thyroid process.

When enlarged, it may develop into a nodular process with the RLN passing medial to it in a fissure on the lateral tracheal surface. It is important that the plane of dissection continues along the surface of the tubercle elevating it progressively. The ligament of Berry and its surrounding terminal branches of the inferior thyroid artery can then be divided from the tracheal surface, and the gland is removed. After attaining complete haemostasis, drain is put and the wound is closed in layers.

Numerous innovative studies have found it more effective to use a cut-and-sew instrument such as the ultrasound dissector in thyroid surgery, both for the purposes of hemostasis and to contain the operating time. Using dissector causes more limited surgical trauma, probably because it bites the thyroid capsule between its jaws, unlike the traditional sutured ligatures or placement of clips.

Resurgery

We reviewed the clinical data for all 233 patients who underwent resurgery by the same surgeon (M.R.P.) and her team: for 18 patients (7.7 %) this was their third operation, and for 2 (0.8 %) it was their fourth; 165 patients (70.8 %) had been operated for the first time at other centers. The mean time elapsing between the previous operation and the resurgery was 219 months (18 years and 3 months), ranging from 1 day to 47 years. Our resurgery sample included 181 females (77.7 %) and 52 males (22.3 %), mean age = 56.25 years (range 16–83 years), and median age = 58.5 years.

Histology at the time of prior surgery had showed benign disease in 161 cases (69.1 %) and malignancies in 72 (30.9 %).

The indications for resurgery were benign disease in 121 patients (51.9 %): neck compression in 76 (62.8 %), and refractory hyperthyroidism in 45 (37.2 %). Malignancy was documented in 89 patients (79.5 %) and suspected in 23 (20.5 %), and was the indication for resurgery (49.1 %).

A monolateral completion lobectomy was performed in 129 patients (55.4 %), for presumed benign disease in 60 cases (46.5 %), and for suspected malignancy in 69 (53.5 %). A bilateral completion was performed in 74 patients (31.7 %), for presumed benign disease in 59 (79.7 %), and for suspected malignancy in 15 cases (20.3 %). A dissection for central nodal relapse was performed in 30 cases (12.9 %): monolaterally in 21 patients (70 %) and bilaterally in 9 (30 %).

At subsequent histology, the diagnosis of malignancy was confirmed in 113 out of 233 cases (48.5 %), which included 11 (9.2 %) of the 121 patients preoperatively recommended for resurgery for benign disease. For 120 patients (51.5 %), the final diagnosis was benign disease.

Nine patients were lost to follow-up. Of the 224 followed up patients, 123 (55 %) underwent a monolateral completion and at histology, 58 (47.1 %) of them had benign disease while 65 (52.9 %) malignant disease; 74 (33 %) had a bilateral completion procedure—after prior monolateral surgery in 56 cases (75.7 %) and bilateral procedures in the other 18 (24.3 %)—59 of these patients had benign disease and 15 had malignancies and 27 (12 %) underwent central dissection for nodal relapse, monolaterally in 20 cases and bilaterally in 7.

The incidence of postoperative hemorrhage was considered in all patients, while hypoparathyroidism and RLN palsy were assessed in the followed up patients and were eligible according to the criteria outlined below.

Our data were analyzed after separating the cases by surgical procedure used at resurgery as follows: (A) monolateral completion; (B) bilateral completion, after monolateral (B1) or bilateral prior surgery (B2); and (C) lymph node dissection. We also divided patients according to their final histological diagnosis of benign or malignant disease.

To assess hemorrhage, we considered all patients needing postoperative surgical revision for hemostasis. All 233 patients were eligible for this purpose.

To assess hypoparathyroidism, we assumed that patients with serum calcium levels below 2.10 mmol/l (normal range 2.10–2.55) on the 2nd postoperative day were considered cases of transient hypoparathyroidism and they were prudentially discharged with oral calcium and vitamin replacement therapy. Cases of hypoparathyroidism were considered definitive if they still needed this replacement therapy a year after resurgery. For the purposes of assessing hypoparathyroidism, 214 (95.5 %) of the 224 patients were considered eligible, while 10 were ruled out: 6 of these patients already had hypoparathyroidism from their previous surgery, and 4 patients underwent parathyroidectomy for prior hyperparathyroidism as part of their resurgery procedure.

RLN palsy was assessed by video laryngoscopy in the 224 followed up patients, with a total of 305 nerves at risk, 4 of which were not considered because of a documented monolateral palsy prior to resurgery due to their previous surgical treatment. Finally, RLN palsy was considered on 301 nerves at risk (98.7 %) and it was defined to be transient or definitive, depending on whether it had regressed or persisted at 1-year follow-up.

Results

Postoperative hemorrhage (based on 233 patients)

Six of the 233 patients (2.5 %) underwent surgical revision of the thyroid within 12 h for postoperative hemorrhage. They included 2 (1.5 %) of the 129 monolateral

reoperations (A), 3 (4 %) of the 74 bilateral reoperations (B), and 1 (3.3 %) of the 30 central dissections for nodal relapse (C) (Table 1). Correlated with histology, these cases of postoperative hemorrhage were 5 of the 120 patients (4.2 %) who underwent reoperation for benign disease, and 1 of the 113 (0.9 %) who had resurgery for malignancies.

Postoperative hypoparathyroidism (based on 214 patients)

Transient and definitive postoperative hypoparathyroidism were recorded in 78 (36.4 %) and 7 (3.3 %) of the 214 eligible patients, respectively, in particular in 39 (32.5 %) and 2 cases (1.7 %) in Group A (120 monolateral completions), 35 (48.6 %) and 4 (5.5 %) in Group B (72 bilateral completions), and 4 (18.2 %) and 1 (4.5 %) in Group C (22 lymph node dissection). In Group B, 24 (43.6 %) and 3 patients (5.5 %) in group B1, and 11 (64.7 %) and 1 (5.9 %) in group B2 experienced transient and definitive hypoparathyroidism, respectively (Table 2). Correlated with histology showed that 45 (39.8 %) and 4 (3.5 %) of the 113 patients who underwent resurgery for benign disease, and 33 (32.7 %) and 3 (3 %) of the 101 patients underwent resurgery for malignancies suffered from transient and definitive postoperative hypoparathyroidism, respectively (Table 2).

Postoperative recurrent nerve injury (based on 301 nerves at risk)

RLN function was analyzed for the 301 RLNs at risk: 123 after monolateral resurgery (group A), 145 after bilateral resurgery (group B), and 33 after lymph node dissection (group C).

Transient RLN palsy occurred in 21 RLNs at risk (7 %) and definitive RLN palsy in 5 (1.7 %).

Transient and definitive RLN palsy were diagnosed, respectively, in 6 (4.9 %) and 1 (0.8 %) patients in Group A, 14 (9.6 %) and 4 (2.7 %) in Group B [8 (7.2 %) and 1 (0.9 %) in Group B1 and 6 (17.1 %) and 3 (8.6 %) in Group B2], and 1 (3 %) and 0 in group C (Table 3). Correlated to histology, the cases of transient and definitive RLN palsy, respectively, involved 15 (8.7 %) and 3

Table 1 Incidence of postoperative hemorrhage in 233 patients

Number of patients	Total 233	Group A 129	Group B 74	Group C 30	Benignancies 120	Malignancies 113
Postoperative hemorrhage	6 (2.5 %)	2 (1.5 %)	3 (4 %) 2 (3.6 %) (B1) 1 (5.5 %) (B2)	1 (3.3 %)	5 (4.2 %)	1 (0.9 %)

Table 2 Incidence of postoperative hypoparathyroidism in 214 patients

Number of patients	Total 214	Group A 120	Group B 72	Group C 22	Benignancies 113	Malignancies 101
Transient hypoparathyroidism	78 (36.6 %)	39 (32.5 %)	35 (48.6 %) 24 (43.6 %) (B1) 11 (64.7 %) (B2)	4 (18.2 %)	45 (39 %)	33 (32.7 %)
Definitive hypoparathyroidism	7 (3.4 %)	2 (1.7 %)	4 (5.5 %) 3 (5.5 %) (B1) 1 (5.9 %) (B2)	1 (4.5 %)	4 (3.5 %)	3 (3 %)

Table 3 Incidence of RLN palsy in 301 nerves at risk

Nerves at risk	Total 301	Group A 123	Group B 145	Group C33	Benignancies 173	Malignancies 128
Transient RLN palsy	21 (7 %)	6 (4.9 %)	14 (9.6 %) 8 (7.2 %) (B1) 6 (17.1 %) (B2)	1 (3 %)	15 (8.7 %)	6 (4.7 %)
Definitive RLN palsy	5 (1.7 %)	1 (0.8 %)	4 (2.7 %) 1 (0.9 %) (B1) 3 (8.6 %) (B2)	0 (0 %)	3 (1.7 %)	2 (1.6 %)

(1.7 %) of the 173 RLNs at risk in patients who had resurgery for benign disease, and 6 (4.7 %) and 2 (1.6 %) of the 128 RLNs at risk in patients reoperated for malignancies (Table 3).

Discussion

Theodor Kocher, surgeon and Nobel laureate, has influenced thyroid surgery all over the world. He reduced mortality in thyroid surgery not only with the hemostats bearing his name, but also thanks to his realization that bilateral preservation of thyroid tissue prevents cachexia, parathyroid tetany, and bilateral recurrent nerve paralysis [2]. On the other hand, the high recurrence rates after subtotal thyroidectomy with the need for resurgery and the high incidence of complications have reversed the surgical trend in favor of a more radical approach, i.e., total thyroidectomy as the treatment of choice at primary surgery, even for single and benign nodes. Total thyroidectomy is not without complications [1, 2], but allows to avoid resurgery in the majority of cases, therefore, reducing the total number of complications and the psychological aversion of patients toward a second-neck operation.

In literature, the incidence of transient hypoparathyroidism after reoperation has been reported to range from 0.6 [2] to 39 % [3], and the incidence of permanent hypoparathyroidism between 0 [4] and 7.6 % [3].

Similarly, the incidence of transient RLN palsy after reoperation has been reported to range from 0 [5, 6] to 22.2 % [7], and the rates of definitive RLN palsy after resurgery has been reported to range between 0 [4–6, 8] and 17.8 % [7].

The nodular goiter covers a spectrum from the uninodular or multinodular goiter to cysts and follicular lesions. The principal problem in nodular goiter is to decide if the surgical treatment is necessary and in these cases to individualize the principal alternative therapies other than surgery.

131-I therapy in toxic nodular goiter and percutaneous ethanol injection therapy (PEIT) in toxic nodule or cystic lesion are the principal alternative therapies in case of failure of the pharmacological treatment. Except the cystic lesion and the autonomous adenoma in which the preoperative diagnosis may conclude for benignity, in multinodular goiter the preoperative diagnosis could not be conclusive. US and fine needle aspiration cytology (FNAC) permit to avoid surgical treatment in case of the absence of symptoms of compression or of hyperthyroidism.

In case of surgical treatment, the next question regards the extension of surgery. At surgery, the frozen section analysis in case of hemithyroidectomy is of aid to rule out malignancy and to prevent the reoperation. The surgical treatment of choice in case of uninodular goiter is lobectomy, total thyroidectomy, or near total thyroidectomy is the correct treatment of bilateral goiter.

The follicular lesion (FL) or Hurthle cell neoplasm carries a 20–30 % risk of malignancy. FNAC cannot be diagnostic in FL because specific criteria are required for the diagnosis of follicular carcinoma particularly the unequivocal demonstration of capsular penetration and vascular invasion. Many molecular markers such as Galectin-3, BRAF, and RAS have been evaluated to improve diagnostic accuracy; however, hemithyroidectomy is generally accepted as the minimum procedure for diagnosing follicular thyroid nodules. The principal reason is the need to remove the lesion with the capsule intact as the final diagnosis of cancer relies on careful examination of the entire capsule for vascular or capsular invasion. Another reason is that hemithyroidectomy allows safer subsequent completion thyroidectomy without the need to explore the ipsilateral operative bed. In order to avoid reoperation, many authors suggest total thyroidectomy as the treatment of choice, whereas other authors recommend hemithyroidectomy as the treatment of choice with thyroid totalization in case of diagnosis of cancer at histology examination.

In a study conducted in 1999 on 203 thyroid resurgery procedures out of 4,433 thyroid operations, Menegaux et al. [9] reported that 90.2 % of their patients undergoing resurgery came from other centers. Similarly, in our series, 70 % of patients who need resurgery have had primary operation in other centers. The incidence of transient hypoparathyroidism was 36.6 %, a figure consistent with the report from Calò et al. [3], who found an incidence of 39.1 % among 92 patients undergoing resurgery, and with the data by Pironi et al. [10], who reported an incidence of 47.3 % in 76 patients who needed resurgery. In our series, the only statistically significant difference in the rates of transient hypoparathyroidism emerged when comparing the group of patients who had bilateral reoperations (B) (48.7 % in B1 and 64.7 % in B2) with those who were treated by monolateral reoperations (A) (32.5 %) ($p < 0.05$ at Fisher's exact test). Moreover, patients with transient hypoparathyroidism rapidly improved during the following 1-2 months after resurgery, and only 3.4 % of them experienced definitive hypoparathyroidism; this percentage was much higher after bilateral totalization (Group B) than after monolateral totalization (group A) (5.5 vs. 1.7 %), though the difference was not statistically significant ($p =$ N.S.). In our sample, transient hypoparathyroidism was not increased in patients reoperated for nodal metastases (group C) as reported by other authors [6, 7, 11, 12]. Moreover, we did not observe a significant difference of transient hypoparathyroidism comparing patients who underwent resurgery for malignant or benign thyroid disease (3.5 vs. 3 %, respectively, $p =$ N.S.).

RLN palsy in our series was transient in 7 % of cases and definitive in 1.7 %. The incidence of transient RLN injury showed a significant influence of the type of disease (8.7 vs. 4.7 % of cases for benign vs. malignant disease, $p = 0.04$), but this difference was not correlated with the cases of definitive RLN palsy (1.7 vs 1.6 %, respectively, $p =$ N.S.). Regarding the 5 cases of definitive RLN palsy, 4 (2.7 %) were observed in patients who underwent bilateral reoperation (group B). In light of these data, it can be speculated that bilateral resurgery is a risk factor for RLN palsy and that total thyroidectomy "ab initio" may be preferable to avoid this complication [13–17].

From the histological point of view, the rate of incidental carcinoma in our series was 9.9 %, comparable with the figures reported by other authors, 13 % [3], 11.4 % [9], 7.6 % [18], 9.3 % [19], and 15.6 % [20].

We recorded a postoperative hematoma compression incidence of 2.5 %, similar to the data reported by Menegaux et al. [9] in 1999, i.e., 2.5 %. In our experience, this complication occurred significantly more in bilateral resurgery (3.6 and 5.5 % for Groups B1 and B2, respectively) than in the other patients' groups. Similar data were reported by other authors (ranging from 0.4 to 1.6 % [12, 21, 22].

Calabrò et al. [4] in 1988 reported 12.1 % of transient hypocalcemia and 1.5 % of transient RLN palsy in a series of 66 who had been first treated by lobectomy and who had undergone prompt contralateral totalization (within 3 months from the first operation) because of postoperative histopathological diagnosis of carcinoma. It is important to note that all these patients underwent contralateral resurgery; this is in line with our data, that is that thyroid surgeon's main goal should be to prevent the need for any bilateral reoperation as first approach because resurgery in this case is associated with a greater number of severe complications. We also support Calabrò's suggestion to prompt reoperate if necessary (diagnosis at definitive histopathology of malignancy), and to avoid the formation of scars in the operated tissues which determined a greater percentage of complications at resurgery.

Also, in the experience of Menegaux et al. who reoperated 203 patients for a benign thyroid disease derived from a whole series of 4,433 patients recruited during a 8-years period, the authors observed that the highest incidence of RLN palsy occurred in patients in whom primary surgery involved both thyroid lobes rather than lobectomy alone (prevalence of RLN palsy was 6.0 vs. 2.2 %, respectively).

In 2007, Lefevre et al. [12] compared 685 cases of resurgery for benign or malignant recurrent diseases (taken from a total of 9,017 operations performed over a 14-year period) with 5,104 primary total thyroidectomies; the authors reported that factors associated to complications in resurgery were (a) the presence of hyperthyroidism, (b) the weight of the resected gland, and (c) the primary surgery performed in both thyroid lobes.

In a recent large study by Vasica et al. [23] a whole series of 12,354 thyroid surgical procedures collected during a two decades period (from 1987 to 2009), the factors involved in thyroid complications at resurgery were investigated in a group of 528 patients. The author reported a higher incidence of transient (4.2 vs. 2 %, respectively) and definitive RLN impairment (1.6 vs. 0.5 %, respectively) in the group of patients who had primary treated by received bilateral lobectomy in comparison to the group of patients who had been treated by primary thyroidectomy. On the other hand, the authors did not find significant difference between the two groups in terms of the incidence of transient and permanent hypoparathyroidism.

Finally, it is worth noting that non-surgical approaches have been proposed to cure nodular goiter [24, 25]

Lobectomy thus represents the standard surgical approach to benign monolateral thyroid disease. It poses a risk to only one recurrent laryngeal nerve, and is unlikely to cause hypoparathyroidism [4, 9, 24], so replacement therapy may be avoided. In addition, should resurgery prove necessary, it will carry much more limited morbidity—irrespective of the disease involved.

Reoperation may also be facilitated by the contribution of improvements in technique, refined over years of experience; for instance, the ultrasound dissector has an important role in helping to preserve parathyroid glands situated in a "high" position, close to the thyroid capsule.

Lateral neck access, as described by Pelizzo et al. in 1993, represents a valid strategy that affords direct access to the thyroid bed laterally to the pre-thyroid muscles, thereby avoiding the wall of adhesions deriving from the previous medial access [25]. Then, the inferior thyroid artery can be identified and bound medially with an elastic band to the vessel-nerve bundle lying up against the carotid. Traction on the artery makes it easier to identify the recurrent laryngeal nerve that crosses over it; this manoeuver is useful for subtending and tracking the nerve, especially if follows a pre-vascular course. It is always wise to begin bilateral totalization procedures from the dominant or suspect side because then, if surgeons have any doubts intra-operatively about whether the RLN is intact on the most heavily involved side, they can defer contralateral completion, pending the histology report, and an assessment of cord motility.

Elective total thyroidectomy cannot always be supported as an effective policy for preventing recurrences in patients with a single, benign node; lobectomy is safer and has the advantage of placing only one RLN at risk and inducing no hypoparathyroidism, and therefore, possibly avoiding the need for replacement therapy.

Immediate or metachronous thyroid resurgery is significantly less challenging if the previous operation involved a standard lobectomy. Should resurgery prove necessary, a contralateral totalization alone carries no greater risk than the primary procedure, again risking only one RLN and with the advantage of knowing whether or not the contralateral nerve is intact.

As confirmed by the results reported here, the incidence of complications in patients who undergo monolateral totalization after standard lobectomy for benign or malignant disease is substantially the same of patients treated by primary total thyroidectomy—meaning that the latter is not always be indicated. In the event of bilateral totalization, procedures that only involve one side (contralateral to a prior lobectomy) carry a lower risk of complications than bilateral completion thyroidectomies. The same consideration can be made for monolateral versus bilateral central lymph node dissection.

In conclusion, lobectomy, preferably associated with extemporaneous histological examination, represents the best minimal approach to thyroid resection.

Conflict of interest None.

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