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ORIGINAL ARTICLE

Morbidity of total thyroidectomy for substernal goiter: A series of 70 patients

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KEYWORDS
Substernal goiter;
Thyroidectomy;
Sternotomy

Summary Total thyroidectomy for substernal goiter occasionally requires a sternotomy associated with a cervical incision. We sought to analyze the postoperative complications of thyroidectomy for substernal goiters in our center and more precisely the complications related to the sternotomy. All patients who underwent total thyroidectomy for substernal goiter in our center between 2007 and 2016 were reviewed retrospectively. Patients with combined cervical incision and sternotomy (ST group, $n=16$) were compared to those with cervical incision alone (CT group, $n=54$), with regard to postoperative complications. Risk factors for the occurrence of postoperative complications were investigated in this population. A total of 24 patients (34.2%) had one or more postoperative complications. The incidence of transient hypoparathyroidism and recurrent laryngeal nerve injury were higher in the ST group ($P=0.001$ and $P=0.052$, respectively). The median duration of hospitalization was longer in the ST group ($P<0.001$). Eighteen patients (25.8%) had a malignant tumor on final pathology. In univariate analysis, the following risk factors for transient postoperative hypoparathyroidism were identified: sternotomy, preoperative symptomatic character and thyroid height ($P=0.001$, $P=0.009$ and $P=0.013$, respectively). In multivariable analysis, only sternotomy was an independent risk factor for postoperative transient hypoparathyroidism (OR = 4.48 [1.1; 18], $P=0.035$). Sternotomy is associated with added morbidity that is not negligible. This surgical approach should be reserved for substernal goiters that descend into the posterior mediastinum, below the level of the aortic arch, when there is suspicion of carcinoma with loco-regional invasion, or when the thyroid tissue is located mainly intrathoracically (conical shaped thyroid, asymptomatic goiter, ectopic thyroid).

Introduction

By definition, a goiter is as an enlarged thyroid gland whose volume is twice normal size or exceeds 40 grams. The definitions of intrathoracic or substernal goiter are variable, which explains the significant variability of reported prevalence (1 to 48%) [1—14].

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At our center, a goiter is considered to be substernal when more than 50% of the thyroid gland lies inferior to the sternal notch; in such cases, mediastinal dissection is required in order to perform total thyroidectomy.

Although most authors agree that a cervical incision may be sufficient in most cases, the use of an extracervical approach to perform total thyroidectomy varies from 0.3 to 29% among different surgical teams [13—18]. Several decision trees have been proposed; for some, the surgical approach is determined by the vertical extension of the goiter (the gland's location with respect to the right atrium and the aortic arch), requiring either cervicotomy alone, manubriotomy, or sternotomy. The vertical extent of the goiter alone does not seem to accurately define the need for an extracervical approach.

Some authors [1] report that up to 55% of patients with substernal goiter in contact with the aortic arch can be operated by cervicotomy alone without the need for an associated thoracic approach.

For other authors, sternotomy is indicated for any goiter extending into the posterior mediastinum, recurrent or forgotten goiter, thyroid carcinoma requiring mediastinal nodal dissection, or in case of conical goiter [1,7—9,16,18].

Some authors feel that sternotomy increases the morbidity of total thyroidectomy with a reported complication rate of up to 35% [2,5,9,12,13].

The aim of our study was to compare patients undergoing total thyroidectomy via cervicotomy alone with those who underwent associated sternotomy, in order to determine the specific morbidity of sternotomy. We also analyzed the morbidity and mortality of the surgical treatment of substernal goiters throughout the population.

Material and methods

Our study included all patients who underwent total thyroidectomy (primary or secondary totalization) for substernal goiter at our center between 2007 and 2016. The ST group consisted of patients requiring a combined sternotomy and cervicotomy. The CT group consisted of those who underwent total thyroidectomy via cervicotomy alone. The decision to perform a sternotomy was made preoperatively in conjunction with cardiothoracic surgeons.

Data were retrospectively collected from the patient's medical record: demographic characteristics, history of prior thyroid surgery, preoperative symptoms and laboratory tests, imaging characteristics on echography or CT scan, intra-operative findings, postoperative follow-up and pathology results. The study was approved by the local ethics committee.

A goiter was considered substernal when more than 50% of the thyroid mass extended below the sternal notch. The diagnosis was made based on preoperative CT or ultrasound and confirmed by the intra-operative findings. The location of the gland in relation to the aorta (vertical extent) and trachea (depth) was collected for all patients based on imaging and intra-operative findings. The thyroidectomy was carried out through a cervicotomy with or without a total or partial sternotomy (the partial or total character of the sternotomy was determined intra-operatively). Patients with goiter extending beyond the aortic arch or into the posterior mediastinum were more likely to have a sternotomy but this was not an absolute rule, as shown in Table 1 (some of these patients were treated with cervicotomy alone).

Intra-operative visualization of the recurrent laryngeal nerves and parathyroid glands during surgery was recorded. The use of electrical neurostimulation (System NIM, Medtronic) to aid in the exploration of the recurrent nerves varied among the surgeons.

Measurement of intact parathyroid hormone (iPTH) at four hours postoperatively was performed in all patients according to our previously published protocol [19]. A decrease in iPTH of more than 68% from the preoperative value was predictive of symptomatic hypocalcemia and was an indication for systematic postoperative calcium supplementation.

In cases of hoarseness, dysphonia or suspected injury to the recurrent laryngeal nerve(s), transnasal fiberoptic laryngoscopy was performed to confirm the diagnosis vocal cord paralysis due to recurrent nerve injury.

The ST group was compared to the CT group with regard to the occurrence of postoperative complications. We looked for risk factors for the occurrence of postoperative complications in the entire population of substernal goiters. The data were analyzed using IBM SPSS Statistics version 20 software and presented as median values with interquartile range. The difference between the two groups was calculated with the non-parametric Mann-Whitney test (for qualitative and quantitative variables) and the Fischer exact test (for qualitative variables). A result having a P-value < 0.05 was considered statistically significant. Univariate analysis was performed in search of risk factors for postoperative complications. Factors with $P < 0.1$ were also included in a multivariable analysis for independent risk factors.

Results

Between 2007 and 2016, more than 1700 thyroidectomies (partial or total) were performed at our center. Seventy of these patients (4.2%) had a goiter. Sixteen of these patients (22.8%) required partial ($n = 2$) or total ($n = 14$) sternotomy in combination with cervicotomy (ST group). Sternotomy was performed when the goiter descended below the arch of the aorta ($n = 9$), extended into the posterior mediastinum ($n = 7$), when the patient had a history of prior thyroidectomy ($n = 4$) or when malignancy with mediastinal tumor invasion was suspected ($n = 3$). Simple cervicotomy was sufficient for 54 patients (77.2%, CT group). The median age was 67 years [57.7—75], the sex ratio was 0.37 (26 males, 44 females). Thirty-four patients (48.6%) had clinical symptoms preoperatively related to the goiter: dyspnea ($n = 7$; 10%), dysphagia ($n = 8$; 11.4%), cervical pain ($n = 3$; 4%), or superior vena cava syndrome ($n = 2$; 2.8%). Twenty-one patients (30%) had preoperative hyperthyroidism and received antithyroid medications as well as beta-blockers. Six patients (8.5%) had totalization of a previous thyroid lobectomy.

CT scan characteristics are detailed in Table 1. Preoperative patient data are provided in Table 2.

In the ST group, the substernal goiters were substantially deeper and more in contact with the aortic arch ($P = 0.045$ and $P < 0.001$, respectively). The weight and maximal size of the thyroid were not statistically significantly different between the ST and CT groups ($P = 0.417$ and $P = 0.406$, respectively).

The prevalence of injury to the recurrent laryngeal nerves and parathyroid glands were not statistically significantly different between the two groups ($P = 0.703$ and $P = 0.743$, respectively). Four patients in the ST group (25%)

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