

## Original Research Article

# Surgical management of intrathoracic goiters: 20 years experience

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### ABSTRACT

**Background:** Surgery is necessary for intrathoracic goiters (ITG) even in asymptomatic forms considering the risks of compression and malignancy. The major problem is the adequate approach. Intrathoracic goiter's removal can be performed via a cervical approach, whereas sternotomy might be required intraoperatively in some cases.

**Methods:** A retrospective analysis of twenty years on 122 cases of intrathoracic goiters in a referral centre for thoracic surgery was carried out. We included secondary substernal goiters and ectopic thoracic goiters.

Our aim was to define the specificities of this surgery and its outcomes. Postoperative data were examined as well as morbidity and mortality factors.

**Results:** The most common symptoms included dyspnea, cough and dysphagia. Whereas Twenty-two patients were asymptomatic. One hundred sixteen patients underwent a successful transcervical incision without thoracic approach. Six cases of primary goiters were noted, of whom 3 were extracted via a cervical approach. Two cases showed unilateral recurrent nerve paralysis and two cases a hypoparathyroidism.

**Conclusions:** Surgical management of intrathoracic goiter was correlated with low morbidity and mortality. The cervical approach was performed in the vast majority of cases without an extra cervical procedure. Intrathoracic approaches were restricted to some selected indications.

**Keywords:** Goiter, Substernal, Thoracotomy, Sternotomy, Morbidity

### INTRODUCTION

The frequency of ITG is differently appreciated because their definition is not univocal.<sup>1</sup> The incidence appears to be declining, particularly in developed countries, due to iodized salt consumption; early diagnosis and treatment of cervical goiters.<sup>2,3</sup> Two types of ITG can be distinguished: secondary goiter (95-99% of the ITG) and primary or ectopic or autonomous goiter.<sup>4</sup> ITG are mostly located in the anterior and middle mediastinum, and rarely (10-15% of cases) in the posterior mediastinum. They are almost always benign (80 to 97%).<sup>5-7</sup> Its individualization as a distinct entity is however legitimate because it is distinguished by its potential gravity linked to the compression of the noble organs and the additional

difficulties of surgical management.<sup>2,3,5</sup> Surgery is the only effective treatment for ITG. Most of them are removed through a transcervical approach. Thoracic approaches may be necessary in giant tumors, posterior mediastinal goiter, ectopic goiter, or invasive cancers.<sup>5</sup>

The aim of this study was the surgical management of intrathoracic goiters and its results. In the present study we report 122 patients who were operated on for ITG (116 secondary mediastinal goiters and 6 primary mediastinal goiter), retrospectively analysed focusing on the diagnosis, preoperative symptoms, surgical therapy, and postoperative complications.

**METHODS**

We examined retrospectively from January 1998 to December 2018, patients with ITG, in the Department of Thoracic and Cardiovascular Surgery at the Abderrahmane Mami Hospital in Ariana, Tunisia. We included secondary substernal goiters and ectopic thoracic goiters.

Our aim was to define the specificities and the outcomes of this surgery. The goiter was defined substernal when lying 3 fingerbreadths below the thoracic inlet with the patient in a supine position, and which require a specific extraction technique according to the definition of COUGARD.

Preoperative Variables such as age, sex, comorbidities and presence of malignant disease were examined. Chest X-ray was performed to check for tracheal deviation and any mediastinal mass. Other imaging methods such as thyroid ultrasound, neck and thorax CT, and scintigraphy were employed, depending on the case. CT-Scan delineated the extent of the intrathoracic goiter and specified its relation to the trachea, esophagus, and major vessels.

We also recorded surgical techniques, intraoperative findings and postoperative course. Complication data (surgical site infection, pneumonia, unplanned intubation, ventilator use for 48 hours, deep venous thrombosis or pulmonary embolism, cardiac arrest, and sepsis), return to the operating room, 30 days mortality and postoperative length of stay were studied.

Statistical analysis were based on Chi-square or Fisher’s exact test in order to compare categorical variables. The SPSS 22 (IBM Corporation, Armonk, New York) was used. When the p value was less than 0.05, the difference was considered significant.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**RESULTS**

During the study period, 834 patients were operated for a mediastinal mass, of whom 122 (1.62%) had intrathoracic goiter. Six patients had ectopic intrathoracic goiters (EITG) and 116 had substernal goiter. The mean age was 58 years and 92 (75.41%) were female. Ten patients (8%) had a history of previous thyroid surgery. Preoperative comorbidities included dysthyroidia diabetes, hypertension, current dialysis, and bleeding disorders. Compressive symptoms were present in 72% of cases. The most common symptoms included dyspnea, cough and dysphagia (Table 1). However, the goiter was asymptomatic in 22 cases (18%). Diagnoses were made

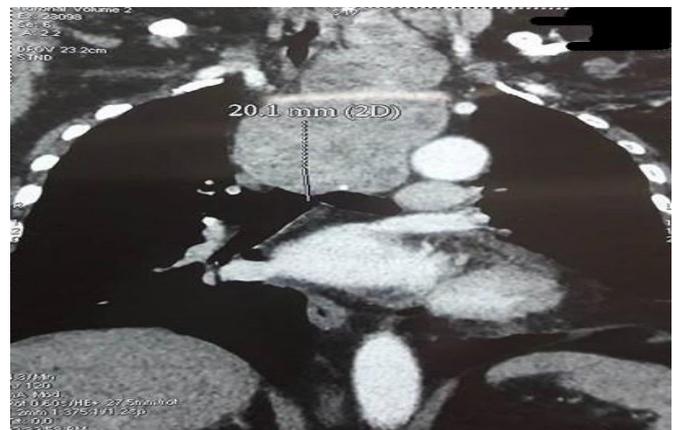
by clinical examination, chest X-ray, thyroid ultrasonography, neck and thorax C and MRI, and thyroid scintigraphy, and the confirmation of the intrathoracic character was essentially intraoperatively (Figures 1-4). Goiter was located in the anterior mediastinum in 83.2% of cases and in the posterior mediastinum in 16.8%. One hundred-eight patients had a euthyroid preoperative status, hyperthyroidism was noted in 13 cases and hypothyroidism in one case.

**Table 1: Occurrence of clinical symptoms (n=122).**

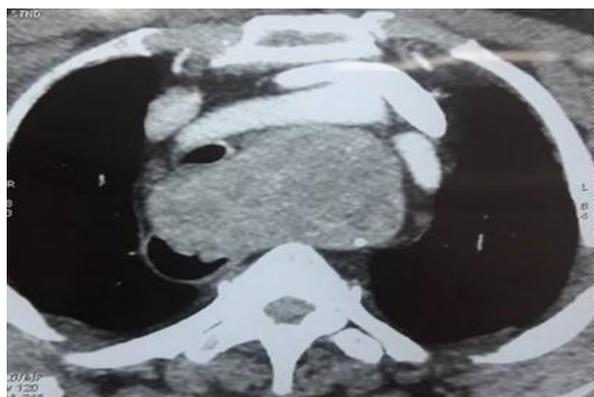
Variables	Patient(s) (%)	Clinical symptoms	Patient(s) (%)
<b>Asymptomatic</b>	22 (18)	-----	-----
<b>Symptomatic</b>	100 (82)	Dyspnea	70 (57.4)
		Dysphagia	26 (21.31)
		Neck mass	26 (21.31)
		Oppressive feeling	19 (15.6)
		Cough	31 (25.4)
		hemoptysis	5 (4.09)



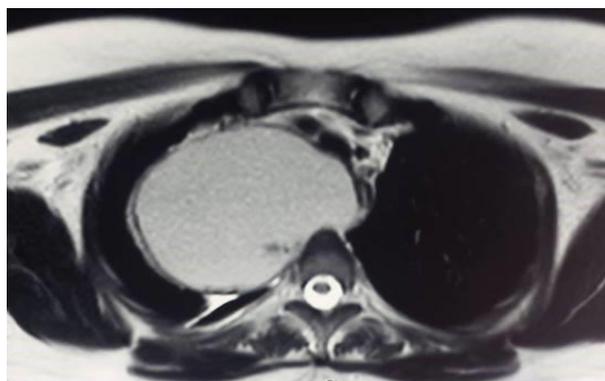
**Figure 1: Chest X-ray.**



**Figure 2: Right thyroid remnant shifting the trachea and major vessels to the left, with huge intrathoracic component.**



**Figure 3: Extension of the cervical goitre into the right side of the thorax.**



**Figure 4: MRI, Cervical goiter with right extension.**

The cervical approach was sufficient in 95.08% of cases. Six patients (4.92%) required a transthoracic approach (Table 2). Sternotomy was necessary in two patients due to a very large posterior mediastinal goiter with contralateral extension in one patient, and an EITG in the other patient. In two cases of EITG, posterolateral thoracotomy and Video-thoracic surgery (VTS) was performed.

**Table 2: Surgical approaches (n=122).**

Approaches	Patients	Percentage
<b>Cervical</b>	116	95.08
<b>Cervicotomy with anterior thoracotomy</b>	2	1.64
<b>Sternotomy</b>	2	1.64
<b>Posterolateral thoracotomy</b>	1	0.82
<b>VTS*</b>	1	0.82

\*VTS: Video-thoracic surgery

Total thyroidectomy was performed in 50 cases, of whom 3 patients underwent tumorectomy (excision of ectopic mass) for an EITG with no connection with the multinodular goiter, 69 underwent loboisthmectomy and 3 patients underwent tumorectomy (Figure 5).

In operation, the substernal component was seen on the right in 76 (62.29%) cases, on the left in 35 (28.71%) cases, on both sides in 5 (4.09%) cases and was ectopic in 6 (4.91%) cases.



**Figure 5: Specimen of right intrathoracic goiter.**

Postoperative negative pressure drainage for 48 hours was used. The duration of hospital stay was 5 days on average. Mortality was estimated at 0.81%. Postoperative complications occurred in 14 (11.47%) patients (Table 3). Two (1.63%) of whom developed recurrent laryngeal nerve palsy (RLNP) and two developed transient hypocalcaemia; they were treated with oral calcium. Other complications were observed such as pneumothorax, dyspnea, hematoma and in 1,2 and 5 cases respectively. Those patients had an additional stay between 6 and 8 days. Multiple outcomes including recurrent laryngeal nerve palsy, dyspnea, return to operating room, surgical site infection, pneumonia, cardiac rhythm disorders, were analysed to evaluate 30-day morbidity and mortality.

P values were calculated for each variable (Table 3 and 4). There was no significant difference between cervical approach and thoracic one. The main factors of morbidity were age, goiter volume (bigger than 5 cm), localization in the posterior mediastinum and malignancy.

In fact, histopathologic examinations revealed malignancy in 6 cases (4.91%): 4 patients had papillary carcinoma and 2 patients had follicular carcinoma.

The limits of our study consist in the fact that it is a retrospective one comparing our results to those of the literature.

We could not compare our results to those of cervical goiter surgery since we only operate, in our thoracic surgery department, the thoracic goiters and not the cervical goiters which are operated by otolaryngologists.

**Table 3: Comparison between complications after cervical approach compared and thoracic approach.**

Complications	Patient(s)	Cervical approach	Thoracic approach	P value
<b>Complications</b>	15 (12.29%)	10	5	0.746
<b>Transient hypoparathyroidism</b>	1	1	0	1
<b>Permanent hypoparathyroidism</b>	1	1	0	1
<b>Transient RLN *injury</b>	2	2	0	1
<b>Permanent RLN *injury</b>	0	0	0	1
<b>Postoperative hematoma</b>	5	4	1	0.305
<b>Pneumothorax</b>	1	0	1	1
<b>Dyspnea</b>	2	1	1	0.422
<b>Parietal infection</b>	1	0	1	1
<b>cardiac rhythm disorders</b>	2	1	1	0.275

\*RLN: recurrent laryngeal nerve

**Table 4: Main morbidity factors (P value).**

Factors	Age >60 years	Volume of the goiter >5 cm	Localization in posterior mediastinum	Malignant goiter
<b>Complications</b>	0.379	0.244	0.178	0.04
<b>RLNP</b>	0.632	0.046	0.116	0.01
<b>Dyspnea</b>	0.047	1	1	1
<b>cardiac rhythm disorders</b>	1	0.59	0.024	0.09

**DISCUSSION**

ITG was first described in 1749 by Albrecht VON Haller.<sup>5</sup> It represents between 1% and 30% among patients who underwent thyroidectomy and between 3% and 12% of all mediastinal masses. This variability is due to the fact that definition of an ITG is not unequivocal and several authors have tried to give their own definitions.

Most of them define diving goiter as being goiters of which more than 50% of their total mass is located below the upper orifice of the thorax. Others considered that every thyroid that extends down to the aortic arch as an ITG.<sup>8,10</sup>

Cougard defined the ITG as the goiter which is lying 3 fingerbreadths below the thoracic inlet with the patient in a supine position, and which require a specific extraction technique.<sup>11</sup>

In our study, we used this definition. ITG are actually classified into two groups: primary intrathoracic or ectopic goiter and secondary goiter.

In contrary to the most of the series in literature, we studied all thoracic goiters. Ectopic thyroid tissue in the chest causing de novo substernal goiter is an exceptional finding (less than 1% of all ITG). It has no connection with the cervical thyroid gland and its blood supply come from the ima artery, the aorta, the subclavian artery.<sup>3,12</sup> The secondary goiters are more common. Its pathogenesis is poorly understood, but the descent into the thorax seems to be multifactorial.<sup>4</sup>

It protrudes beyond the upper orifice of the thorax and descends into the mediastinum by the effect of gravity and the attraction of negative intra-thoracic pressure. The extension of the goiter is preferably done towards the least resistant zone. The development is either anterior or posterior to the plane of the supra-aortic trunks. Posterior goiter represents 10-15%. Anterior goiter is more frequent due to its quickly compressive situation.

ITG can remain asymptomatic for many years until compression of the structures located in the thoracic inlet occurs. The most common symptoms are compressive ones: compression of adjacent organs such as trachea, oesophagus and major vessels induces dyspnea, dysphagia, chronic cough, hoarseness, superior vena cava syndrome, and even haemoptysis. Otherwise, mechanical compression can be life-threatening because of the limited space below the thoracic inlet.<sup>13</sup>

Most of authors agree that medical treatment is ineffective for ITG and surgery is the treatment of choice especially in symptomatic forms. Even in the absence of clinical symptoms, surgery is a necessity considering the risks of malignancy and compression. But, surgical removal of ITG is a challenging procedure. The major problem is the adequate approach.

Cervical approach is sufficient in the vast majority even in patients with significant intrathoracic component. Whereas, extra cervical approach is required in 25% of thyroidectomies for ITG. Some authors have reported an incidence of sternotomy in 29% of cases, in patients in whom the gland cannot be safely resected through a

cervical incision due to the volume of the tumor and the intimate contact with major vessels.<sup>9, 14, 15</sup>

In our study, ITG were removed using a standard cervical approach, in 116 /122 patients (95,08%). Sternotomy was required in 2/122 patients (1,64%) due to a very large posterior mediastinal goiter with contra lateral extension in one patient, and an EITG in the other patient.

Several series have examined significant preoperative predictive factors of the need for sternotomy. Most of authors recommended sternotomy for posterior mediastinal goiter with contra lateral extension, ectopic goiters with mediastinal blood supply, goiters causing superior vena cava syndrome, significant tracheal deviation, goiters extending below the aortic arch, when the diameter of the mediastinal nodule significantly exceeds the diameter of the thoracic inlet and revision surgery. Some authors stated that sternotomy is inevitable when a 70% of the goiter resides within the mediastinum.<sup>15-17</sup>

Other thoracic approaches such as posterolateral thoracotomy, anterior thoracotomy and thoracoscopic approach have been described for rare cases in which the goiter is predominantly intrathoracic.<sup>16, 17</sup>

Posterolateral thoracotomy is rarely indicated, essentially in EITG or posterior goiters with superior vena cava syndrome. According to Merlier and Eschapasse, it is useless and very uncomfortable. Anterior thoracotomy in the 2<sup>nd</sup> or 3<sup>rd</sup> intercostal space in combination with cervicotomy is uncommon, used essentially in right goiters in order to push up the lower pole.<sup>18</sup>

It is easier to perform and aesthetically invisible especially for women. It does not oblige to change the position of the patient intraoperatively and gives a view of the superior mediastinum. Video-assisted thoracoscopy have rarely been described in the literature. In our study, VTS was used in a case of autonomous goiter. Robotic techniques have also been described recently.<sup>15, 19</sup>

Sternotomy is also required in invasive cancer. As a matter of fact, the incidence of malignancy in ITG has been reported between 3–21%. In ITG the principle issue is to give the correct indication to avoid potential complications.

Surgery of ITG is a difficult surgery involving several dangers, with greater associated risks of injury to native structures. The morbidity of this surgery varies from 4 to 12% in the literature. Postoperative complication rate following surgery for ITG is slightly higher than the average rate for cervical goitre surgery.

An American study conducted in 2016 showed that patients operated for ITG had significantly more complications than patients operated on for cervical

goiter. However, other authors like Rios and Raffaelli were against.<sup>20, 21</sup>

In our series, we did not find any significant difference between the group of patients operated by cervicotomy and those operated by sternotomy. This can be explained by the limited number of patients operated by sternotomy (2 patients) which makes the two groups incomparable.

RLNP is the most common complication.<sup>21, 22</sup> Its mechanism corresponds to a stretching or even a section of the nerve during extraction maneuvers, especially at the right side. RLNP is seen mainly in voluminous goiters. It is usually unilateral and transient.<sup>23, 24</sup> In our series, two cases of RLNP were noted. Both patients had large goiter (>9 cm). There is relative agreement in the literature that the risk of RLNP seems to be higher with ITG surgery than in cervical goiter (2-10% versus 0.3-2%). Goudet made a comparative study between ITG and cervical ones. He found 3% of permanent RLNP in the thoracic group versus 0% in the cervical group but the difference was not significant (p=0.06). For Goudet and Yann-Sheng Li, sternotomy increases the likelihood of RLNP increases.<sup>25</sup>

For Cougard, 212 patients underwent cervicotomy, 15 developed RLNP, whereas the 16 patients operated by sternotomy did not develop this complication.<sup>11</sup>

He explained this high frequency of RLNP in cervicotomy by the desire of surgeons to avoid sternotomy, which requires dissection and extraction using dangerous and laborious techniques.

In our study, the two cases of RLNP were observed in patients who underwent cervicotomy.

Hypoparathyroidism, another complication that seems to be more important in ITG surgery and which requires hormone replacement therapy. Some authors such as Erbil considered this risk to be higher in total thyroidectomy due to extracapsular dissection.<sup>26</sup>

On the other side, several authors considered that this complication is more uncommon with sternotomy.

Hematoma was also noted in the literature with a frequency of 0-3%; it is rare but it could be compressive and suffocating responsible for severe acute respiratory distress syndrome requiring revision surgery which was the case for one of our patients.

Other specific complications observed in ITG may be related to tracheomalacia which is a very rare complication with a frequency varying between 2 and 10%. Other complications such as pneumothorax, post-operative pain, mediastinitis or sternal suture dehiscence can be seen but they are rare.

The main morbidity and mortality factors found in the literature were the thoracic approach, total thyroidectomy, posterior and voluminous goiters and malignant goiters.<sup>4</sup>

## CONCLUSION

The choice of the adequate approach is the main challenge in the treatment of ITG Cervical approach is generally sufficient. Thoracic approach may be indicated in order to visualize the anatomy of the mediastinum and prevent complications.

Knowledge of significant preoperative predictive factors and the adequate analysis of the goiter and its plunging part would allow for better management.

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