ORIGINAL ARTICLE

Surgical Management of Retrosternal Goitre: Experience of a Moroccan Center

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KEYWORDS
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Abstract

Introduction and objectives: This was a retrospective study reviewing 93 cases of retrosternal goitre (RG) operated in our department, with the aim of describing epidemiological and clinical data and discussing the surgical challenges of RG.

Patients and methods: From January 2004 to December 2012, 35 men and 58 women presenting with RG had surgery. Eighty-nine cases (95.7%) underwent cervicotomy, and a sternotomy was mandatory in 4 cases (4.3%). Laryngoscopy was performed in all cases. A second preoperative laryngoscopy by a senior was mandatory for patients with hoarseness or dyspnea even if the initial laryngeal exam was normal.

Results: A cervical mass was noted in 81 cases (87.1%), dyspnea in 17 cases (18.3%), dysphagia in 2 cases (2.1%), hoarseness in 7 cases (7.5%), partial vena cava syndrome in 2 cases and recurrent goitre was noted in 2 cases (2.1%) after previous thyroid resection. Mediastinal extension was on the left side in 47 cases (50.5%), on the right side in 29 cases (31.2%) and bilateral in 21 cases (23.3%).

A total thyroidectomy was performed in 86 cases (92.5%) and a unilateral isthmo-lobectomy was performed in 7 cases (7.5%). Mean goitre size was 9.3 cm. Postoperative complications were present in 9 cases (9.7%), 3 cases with hypoparathyroidism (3.2%) and 4 cases (4.3%) of recurrent nerve injury. There was no postoperative death. The histological study objectified 88 cases of multiheteronodular goitre, 4 cases of Basedow thyroid, and 1 case of thyroid carcinoma (papillary carcinoma).

Conclusion: Our experience confirms that cervicotomy often allows removing goitre with a mediastinal extension. However, intraoperative enlargement may be necessary, with increased operating time, hospital stay and morbidity.

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Introduction

Substernal or retrosternal goitres (RG) are currently defined as an extension of the goitre below the upper opening of the chest.\textsuperscript{1,2} It was first described by Albrecht von Haller in 1749 who considered this extension of the thyroid tissue as a challenge during surgical removal.

A uniform definition of RG is still hard to find. Authors described different definitions such as "the goitre is substernal when more than 50% portion of the mass is located in the mediastinum".\textsuperscript{3} Conversely a complete or "true" primary intrathoracic goitre is one that is completely within the mediastinum and separated from a coexisting cervical thyroid gland.\textsuperscript{4,5} This latter receive blood supply exclusively from aorta arch, innominate and thoracic vessels.\textsuperscript{6,7} Generally in our practice the goitre is retrosternal when it is more than 2 cm below the manubrium in cervical and chest CT scan with patient’s neck extension.

Most of RG can be resected safely through a cervical incision.\textsuperscript{8,9} In minority of cases 1%–11% a sternotomy is necessary to have complete exposure of the goitre and remove mediastinal compression.\textsuperscript{7}

Materials and Methods

In this retrospective study, to describe epidemiological profile, clinical data and surgical approach of RG, we reviewed 93 cases of RG operated in our department.

From January 2004 to December 2012, 3016 patients underwent a cervicotomía for surgical thyroid disease in our hospital, 93 (3.1%) of them including 35 men (38%) and 58 women (62%), presented with RG were operated in the department of thoracic surgery. We exclude ectopic thoracic or cervical goitres. Data collected from clinical records were age, sex, geographic origin, thyroid surgery, clinical symptoms, imaging findings, type of surgical approach, postoperative complications and pathologic results.

Clinically, a RG is suspected when the lower lobe of the cervical goitre is not palpable, and/or when some symptoms related to compression (dyspnea, dysphagia, hoarseness, etc.) are recently reported.

Laryngoscopy was mandatory and a routine exam for all patients. But since our patients stayed about 20–45 days before surgery, when admitted, patients with hoarseness or dyspnea, underwent a second laryngoscopy by a senior to characterize the probable palsy of recurrent nerve.

We performed CT scan if a tracheal compression or deviation or an upper mediastinal mass were noted in chest X-ray when the goitre is not clinically suspected to be retrosternal, but if the goitre is clinically retrosternal CT scan becomes a routinely mandatory exam.

Most of cases were operated through a cervical approach in 89 cases (95.7%), and via a sternotomy in 4 cases (4.3%). Preoperatively, complete dissection of the cervical portion made easier the ascension of the retrosternal portion even in very large substernal goitres.

Results

The most frequent clinical symptoms were: cervical mass in 81 cases (87.1%), dyspnea in 17 cases (18.3%), dysphagia
in 2 cases (2.1%), dysphonia in 7 cases (7.5%), 2 cases of partial vena cava syndrome and a recurrent goitre is noted in 2 cases (2.1%) after initial thyroid resection (Table 1).

Chest X-ray showed a mass of the upper mediastinum in 90 cases (96.8%), tracheal compression and/or deviation in 49 cases (52.7%) and tracheal stenosis in 13 cases (15%). Mediastinal extension was on the left side in 47 cases (50.5%), on the right side in 29 cases (31.2%), and bilateral in 17 cases (18.3%) (Fig. 1). The cervical-thoracic CT scan with patient’s neck extension identified RG when the mediastinal extension is more than 3 cm. The CT scan was realized in all cases and can routinely confirm the RG (Fig. 2).

In 95.7% of cases (n=89), the surgical resection was performed through cervical approach, while in 4 cases a total sternotomy was necessary to relieve safely the mediastinal portion of the RG (Fig. 3A and B). A total thyroidectomy was performed in 86 cases (92.5%) and a unilateral isthmo-lobectomy was performed in 7 cases (7.5%) (left in 2 cases and right in 5 cases). The mean size of the goitre is 9.3 cm (5-18.5 cm in the diameter).

The postoperative complications were present in 9 cases (9.7%) with 7 cases operated via cervicotomy (7.5%), and 2 by sternotomy (Table 2). There was no postoperative death. The histological study objectified 88 multi-heteronodular goitres, 4 cases of Basedow, and one case of papillary carcinoma. The hospital stay was between 2 and 7 days (mean 3.6 days). The patient with papillary carcinoma was treated

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Chest X-ray</th>
<th>Chest X-ray</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Left side</td>
<td>Right side</td>
</tr>
<tr>
<td>Cervico mediastinal mass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dysphagia</td>
<td>2 (2.1%)</td>
<td></td>
</tr>
<tr>
<td>Dyspnea</td>
<td>17 (18.3%)</td>
<td></td>
</tr>
<tr>
<td>Vena cava syndrome</td>
<td>2 (2.1%)</td>
<td></td>
</tr>
<tr>
<td>Dysphonia</td>
<td>7 (7.5%)</td>
<td></td>
</tr>
<tr>
<td>Recurrent goitre</td>
<td>2 (2.1%)</td>
<td></td>
</tr>
<tr>
<td>Tracheal compression</td>
<td>49</td>
<td>31 (33%)</td>
</tr>
<tr>
<td>Tracheal deviation</td>
<td>18 (19%)</td>
<td>12</td>
</tr>
<tr>
<td>Tracheal stenosis</td>
<td>13 (15%)</td>
<td>9</td>
</tr>
<tr>
<td>Mediastinal extension</td>
<td>93</td>
<td>47 (50.5%)</td>
</tr>
</tbody>
</table>

Figure 1 Diapositive of the different features in chest X-rays (A: upper mediastinal mass with tracheal compression, B: upper mediastinal mass with tracheal stenosis and C: upper mediastinal mass with right tracheal shift).
by radioiodine ablation with favorable outcome after 63 months of follow-up.

Discussion

The frequency of RG (1%-15%) is differently appreciated because their definition is not unique. A slow-growing enlargement (20%-40% for Shen et al.) was noted in most of cases of RG, that explain incidental finding on examination. This enlargement can descend in a downward direction because of anatomical barriers preventing a migration in others directions except inferiorly (thyroid cartilage, cervical vertebra bodies and fascia planes). Besides, negative intrathoracic pressure and swallowing associated traction forces facilitates this vertical migration. The extension can be in anterior or posterior side of supra aortic vessels. Posterior RG represent 10%-15% of cases and only 4.3% in our study. The retro sternal portion of the goitre can increase the risk of fatal complications such intracystic

Figure 2 Retrosternal goitres in CT scan (A: sagittal view with tracheal compression, B: frontal view and C: transversal view with great vessel compression).

Figure 3 (A) Surgical removal of a retrosternal goitre via cervical approach. (B) A retro-sternal goitre with the plunging portion attached to the cervical portion.
hemorrhage, iatrogenous hemorrhage during fine needle aspiration, malignant transformation 13 that is why a precise preoperative evaluation of the plunging portion is necessary. The main symptoms of RG are due to deviation or compression of the vital organs lying in the thoracic inlet. In most cases the RG lies in the anterior mediastinum, displacing the trachea either backwards or commonly sideways. Compression or deviation of the trachea caused a variable respiratory distress since it reduces the diameter of tracheal lumen and gives stridor, as well as a diminution of air intake and accumulation of viscous bronchial secretions. Compressive symptoms of the intrathoracic goitre upon the great vessels are not uncommon but only 2 cases of partial vena cava syndrome were noted in our study. Biologic data determines hyperthyroidism that forbids surgery.

Ultrasound can simply suspect RG when lower lobes of the goitre are not visualized. 13 The Chest CT affirms the thoracic extension and appreciates the size, content and relative position with mediastinal vessels, trachea and esophagus in the frontal plane. MRI allows coronal and sagittal planes. 14 We insist about the size of the real gland since some times the plungant part of the thyroid is related to the cervical gland by a small "bridge" that can be under-estimated during a fast dissection and the thoracic part will be left (Fig. 3B).

The treatment of intrathoracic goitre is surgical removal, and it is unnecessary to state that the earlier in the course of development of a substernal goitre surgery is undertaken, the easier, simpler and safer is the surgical procedure.

Surgeons are aware that most RG can be excised through a Kocher transverse collar incision, but in rare circumstances a partial–complete median sternotomy or a thoracotomy is mandatory.

The surgery is indicated when the risk of compression, hyperthyroidism, malignant degeneration or associated cancer exists. 15 Most of RG can be totally removed through cervical incision without any rupture of the capsule surrounding them. It is possible by slow dissection with the fingers which encompass the entire goitre, and then slow deliverance of the goitre by a finger beneath the lower pole. The mass becomes much exposed and easier to remove. This procedure is generally not hemorrhagic. There is no consensus about the predictive factors of sternotomy, in spite of several attempts, Burns et al. performed a sternotomy in only 3/140 patients with RG, and defined significant factors of sternotomy such as CT adherence to the surrounding mediastinal structures and extension of the goitre to, or below, the aortic arch. 16 In the opinion of de Perrot et al. in 2007, goitres up to 10 cm, recurrent goitres, invasive carcinoma or ectopic goitre 17 need to perform a sternotomy. Multiple extensions of the goitre, previous thyroid surgery and posterior plunging goitres are suggestive of preoperative difficulties.

More recently, Cohen et al. identified four factors of sternotomy in RG. These factors are malignancy, extension into the posterior mediastinum, substernal extension inferior to the level of the aortic arch, and the lack of a solid attachment between the cervical and mediastinal components of the thyroid gland. Although previously reported, the latter factor has not received sufficient recognition in the management of retrosternal goitre. 18

The main postoperative complication is the compressive hematoma. It may cause acute respiratory distress even with a good drainage. 13 One of our patients has been immediately re-operated (at the third postoperative hour) because of a respiratory distress and bleeding after a cervicotomy. However another cause of respiratory problems is tracheomalacia with a frequent need of invasive ventilation or tracheotomy. 20

The risk of recurrent nerve injury in surgery of RG is higher than that of cervical surgery, between 2% and 10%. 21

There is always a risk of recurrent nerve injury during extraction maneuvers particularly at the right side. The risk of nerve section seems higher with sternotomy than exclusive cervical approach (3%–8% of definitive recurrent palsy). 22 Electrophysiologic recurrent laryngeal nerve monitoring during thyroid (and parathyroid) surgery has been considered as a routine complement for the gold standard, the visual nerve identification. 23

The parathyroid glands are also more exposed to surgical trauma by sternotomy. Their identification can be quite difficult, especially for the lower glands located under the goitre or in a very low position in the cervico-thoracic junction. They can be easily injured during the dissection and extraction of goitre.

The hypoparathyroidism is a very common complication. In our study hypocalcemia appeared in 3 cases. The hypoparathyroidism seems more important with sternotomy than cervical goitres (2.8%). 24 This risk is further increased in cases with previous surgery where the dissection becomes harder, in our series 50% of sternotomies developed hypoparathyroidism.

A recent review of evidence-based management of substernal goitres concluded the incidence of malignant

<table>
<thead>
<tr>
<th>Complications</th>
<th>Cervicotomy</th>
<th>Sternotomy</th>
<th>No.</th>
<th>%</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive hematoma</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.1</td>
<td>Reoperation</td>
</tr>
<tr>
<td>Respiratory distress</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.1</td>
<td>Mechanical ventilation for 4 days</td>
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<tr>
<td>Transient recurrent nerve palsy</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>3.2</td>
<td>Reduccion of vocal cords</td>
</tr>
<tr>
<td>Definitive recurrent nerve palsy</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Transient hypoparathyroidism</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3.2</td>
<td>Calcium supplement for 6 months</td>
</tr>
<tr>
<td>Malignant lesions (carcinoma)</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.07</td>
<td>Radioiodine</td>
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<tr>
<td>Hospital stay (days)</td>
<td>4.2</td>
<td>5.5</td>
<td></td>
<td></td>
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<tr>
<td>Operative time (min)</td>
<td>125</td>
<td>175</td>
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</table>
transformation is equivalent in retrosternal goitres to those residing entirely in the neck.\textsuperscript{7}

Unfortunately our study is limited by the reduced cases of sternotomies (n=4) so we could not clearly make a comparison between groups of cervical and sternal approach.

In conclusion, our experience confirms that cervicotomy is a safe and favorable approach to remove a goitre with mediastinal extension. An intraoperative enlargement may however be necessary. Postoperative morbidity is mainly due to the respiratory risk and recurrent nerve palsy and hypoparathyroidism.

\section*{Conflict of interest}

The authors declare that they have no conflict of interest.

\section*{References}