Case Report

Total Thyreoidectomy for Cervico-Mediastinal Goiters: Case Series and Literature Review

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Abstract

There is no consensus today on distinct definition of retrosternal (RG), substernal (SG) or cervico-mediastinal(CMG) goiter. It is commonly defined as thyroid mass that extends three or more centimeters below the suprasternal notch while the neck is in the hyperextended condition [1]. RGnowadays is a challenge for the surgeon and the radical resection represents the only one effective treatment modality. It is noteworthy that total thyroidectomy is recommended due to the risk of present malignancy or future malignant degeneration and compressive symptoms. This isusually a successful operation with low complication risk and excellent long term results in experienced centers. In this article we described three cases with large retrosternal goiters, which were successfully operated in Thoracic surgery department and we created a brief literature review.

Keywords: Retrosternal goiter, Surgical treatment, Total thyroidectomy

INTRODUCTION

Retrosternal, substernal, cervico-mediastinal, intra-thoracic or mediastinal goiter are widely used synonyms in literature. Anatomically the goiters are classified as retrosternal, retrotracheal and retroesophageal. Even though various definitions have propounded for substernal goiter, it is commonly defined as a thyroid mass that extends three or more centimeters below the suprasternal notch while the neck is in thehyperextended condition and it accounts for 1%-20% of goiters, depending on the chosen definition [1].RG is classified as primary and secondary depending on the origin of the blood supply: the primary is rare (1%) and arises in the mediastinum and has mediastinal feeding vessels,whereas the secondary originates in the neck and has cervical vessels [7].The most exhaustive examination for assessment are chest x-ray and CT scan. The treatment is mostly surgical. A variety of postoperative complications are possible.

Presentation of three cases

Case 1

A 71-year-old woman was admitted to Thoracic surgery department due to complaints of dyspnea on exertion, weakness and mild dysphagia, dating from 6 months and accelerating in the last one month. As concomitant diseases there were reported arterial hypertension, non-insulin-dependent diabetes mellitus, right breast cancer, proved 2 months before via quadrantectomy, as a radical mastectomy and following radiotherapy were suggested.Paraclinical studies were all in normal range and the patient was euthyroid. On the performed chest x-ray it was shown an upper mediastinal opacity with smooth right and left convex borders, right-sided tracheal deviation (Figure 1). After conduction of CT scan it was revealed a heterodense upper mediastinal mass with

Figure 1. Chest x-ray, demonstrating a round upper mediastinal mass and right-sided tracheal deviation.
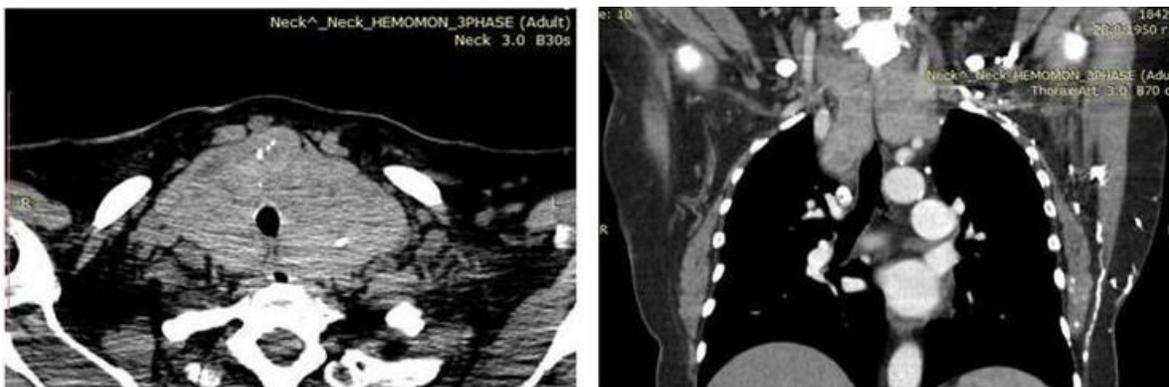
Figure 2. CT scan, demonstrating a retrosternal goiter with right-sided tracheal deviation and compression.

zones of calcification (Figure 2). It originatedfrom anenlarged thyroid gland, as the left lobe's dimensions were 95/74 mm in coronal and axial planes, as the right lobe's dimensions were 155/100 mm respectively. The mass descended and enveloped like a cuff the trachea and compressed the esophagus. The right thyroid lobewas in close proximity to the right innominate vein and there was suspicion for vessel infiltration. CT conclusion for retrosternal mediastinal goiter was made.

A neck collar incision was performed. A polycystic multinodulargoiter, descending into the superior mediastinum was discovered (Figure 3). The incision was T-shaped extended to a proximal partial sternotomy because there is no possibility to mobilized the gland. The left thyroid lobe waswith dimensions of about 80/60 mm and it descended into the upper mediastinum up to the level of aortic arch. An isthmotomy was accomplished, the left thyroid lobe was mobilized and a

left lobectomy was performed by ligating the upper and lower left thyroid arteries and veins. The right thyroid lobe was with dimensions of about 100/70 mm and it was located behind the right brachiocephalic veinnearits confluence with the left brachiocephalic vein. An another similar formationwith dimensions of 60/40 mmwas discovered,originating from the right lower lobe ona wide pedicle. It descended behind the brachiocephalictrunk, paratracheally, retrocavally, and paraesophageally, reaching almost to the level of the right pulmonary artery. The formation pushed the trachea to the left and compressed it, as the right carotid vessels were right-sided displaced. The right lobe and the described formation, emanating from it were carefully dislocated in the operative field and they were resected with the help of a harmonicknife, ligating and resecting the right upper and lower thyroid arteries and veins until total thyroidectomy. The incisions were closed.
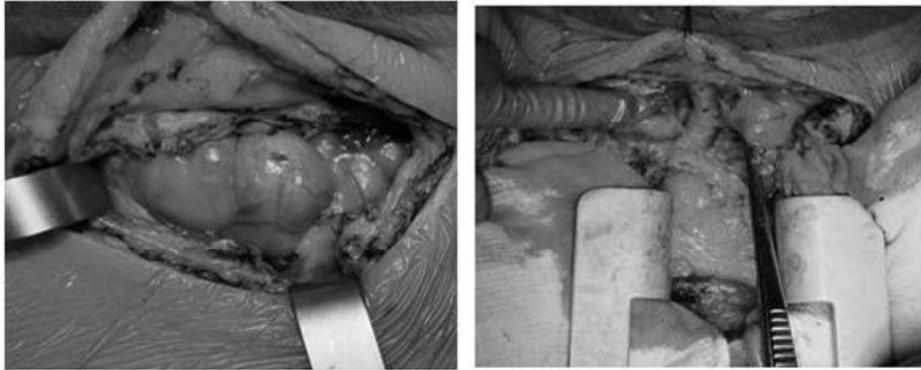
Figure 3. Intraoperative views.

Figure 4 (a, b). Macroscopic views of the right and left thyroid lobes.

Macroscopically the left thyroid lobe was with dimensions 100/75/45 mm (Figure 4). After cut there were many coalesced nodules with gelatinous consistency and two small parts with bone density. Right thyroid lobe was with dimensions of 80/60/50mm and one prominent light brown nodule with size of 70/45 mm originated from its lower pole. After cut it was with analogous structure as the left lobe.

Histologic results showed thyroid parenchyma with expressed nodular change. Individual nodules were built from thyroid follicles with different shape and size. They were upholstered with one row strongly compressed cuboid cells and were filled with homogeneous eosinophil colloid. Therewerealso groups of small follicles, presented from follicular cells and without colloid. Some parts were with expressededema of the stroma, fibrosis, focuses of bone metaplasia, haemorrhages and lymphoplasmocytic infiltration with small lymph follicles. Final morphologic diagnosis was multinodular colloid goiter.

The patient was discharged on the 5th postoperative day uneventfully.One month postoperatively she is without any complaints and in excellent health condition.

Case 2

A 68-year-old woman was admitted to Thoracic surgery department with complaints of neck swelling and dyspnea. She had arterial hypertension as concomitant disease. Paraclinical studies, including thyroid function tests were all normal. CT scan revealed anenlarged thyroid gland, asdimensions of right thyroid lobe were 33 mm in axial plane, 98 mm in coronal plane and respectively 25 mm and 78 mm for left lobe (Figure 5). Caudal poles of the two lobes descendedin the upper mediastinum, as the right thyroid lobe lay21 mm above the cranial contour of aortic arch. Different in shape and form thyroid nodules and fine-grainy calcifications were visualized. At the level of upper thoracic aperture, the thyroid gland compressed the trachea, as its lumen was cleft-changed up to axial sizes of 6/16 mm. The length of the stenotic part was 16 mm. In 9th segment of left inferior pulmonary lobe it was visualized a discreetly lobulated solid nodule with diameter of 13 mm. The final conclusion was for multinodular goiter with retrosternal propagation, secondary compressive upper third tracheal stenosis and a left solitary pulmonary nodule, suspicious for benign.
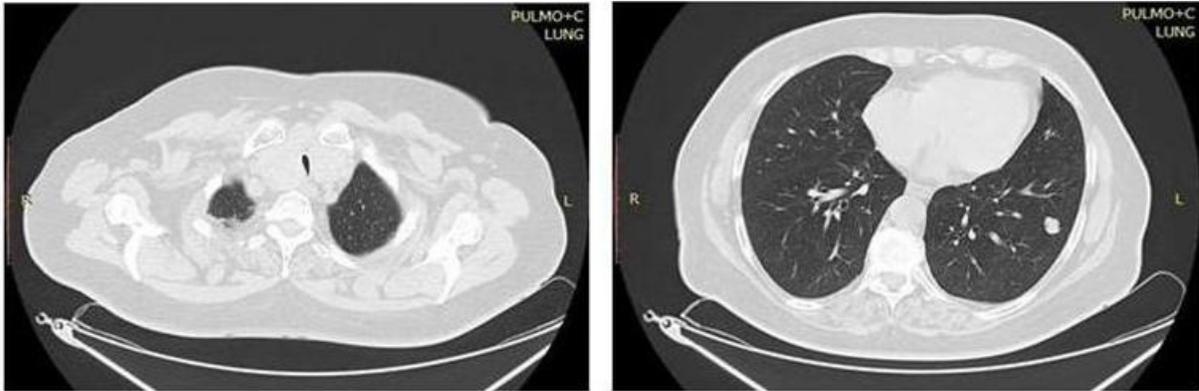
Figure 5. CT scan images.

Figure 6. Intraoperative view.

Figure 7. The postoperative specimen.

Under general intubation anesthesia a collar neckincision was performed. Apolycystic-nodular formation with dimensions of 80/60 mm was discovered, emanating from the right thyroid lobe and descending in the mediastinum, lying paratracheally, paraesophageally and reaching distally almost to the level of the aortic arch (Figure 6). The formation pushed to the left and compressed the trachea, dislocating the innomainate vessels ventrally and the right carotid vessels to the right. An isthmotomy was performed and the right lobe was carefully dislocated in the operative field and resected with a harmonic scalpel. The left lobe was also polycystic-nodular changed, with dimensions of about 60/50 mm. It was mobilized and left thyroid lobectomy up to total thyroidectomy was performed.Two months later in the second stage, the lung lesion wich turned out to be a benign hamartoma was removed.

Macroscopically there were strongly enlarged thyroid gland, as the right lobe was with dimensions of 111/50/40 mm, and the left lobe was respectively 80/35/30mm (Figure 7). After cut they were built from many dense nodules with different shape and size, filled with gelatinous brown content.

Histopathologic results showed thyroid gland with expressed nodular architectonics, as separated nodules were built from thyroid folicules with different shape and
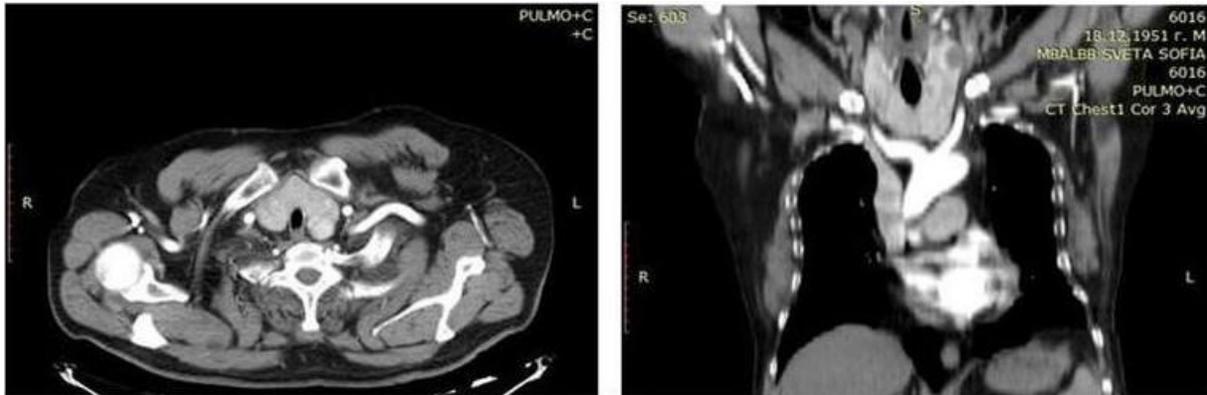
Figure 8. CT scan demonstrating a retrosternal goiter.

size. They varied, as from significant dilated, upholstered with one row of strongly slapped cells and filled with homogeneous eosinophil colloid, as to so small ones, built from a group of cells and non-containing colloid. The stroma was focally edematous and with focally fibrosis. There were parts with haemorrhages, groups from haemosiderophages and cleft, optic empty cholesterol crystals. Final morphological diagnosis wasmultinodular goiter.

The patient was discharged on the 3th postoperative daywith mild left recurrent laryngeal nerve paresis, which faded away in the first postoperative month. Three months postoperatively the patient is in excellent overall condition.

Case 3

A 66-year-old man was admitted to Thoracic surgery department with complaints of neck swelling, cough with difficulty expectoration of yellow-green sputum, fatigue, palpitations, dating from several months with exacerbation in the last month. He reportedmany concomitant diseases as decompensated chronic respiratory failure, chronic bronchitis, arterial hypertension- thirdgrade, coronary heart disease –stable angina pectoris, single branch coronary heart disease, history of LAD PCI, left ventricular dysfunction, heart failure- second functional class, left ventricular systolic dysfunction, brain vascular disease,ischemic brain stroke, type 2 diabetes mellitus, diabetic polyneuropathy, dyslipidemia, grade 1 obesity, hepatic steatosis, cholelithiasis, nephrolithiasis, combined otoneurological syndrome, auditory nerve neuritis, chronic gastritis, chronic duodenal ulcer. After physical exam it was palpated diffuse enlarged thyroid gland with multiple nodules. The performed paraclinical studies did not show any deviation and the patient was euthyroid. Chest x-ray showed a round upper mediastinal mass. CT scan revealeda diffusely enlargedthyroid gland with a maximum cranio-caudal size of 93 mm for the left lobe (Figure 8). The caudal poles of both lobes descended retrosternally into the upper mediastinum. The structure of the gland was heterodense with many hypodense nodules, the largest of which, was in the left lobe with axial dimensions of 23/27 mm. In both lobes, more in the left one, many punctiform calcifications were visualized. Conclusion was made for multinodular retrosternal goiter, retrosternal lipomatosis, partial relaxation of the left diaphragmatic dome. Fiberoptic bronchoscopy showed swollen but currently mobile vocal cords. Tracheal mucosa was edematous and the relief of the tracheal rings was erased. The left tracheal wall was slightly pushed by the external oppression 4-5 cm from the rhyme.

Under general intubation anesthesia we proceeded with a cervical collar approach. A mulitinodular goiter with dimensions of 90/60 mm was reached, with the left lobe descending mediastinally paratracheally and retroesophageally and reaching up to the aortic arch (Figure 9). Anisthmotomy was not possible due to the deeply mediastinal position of the isthmic part. Bouth lobes were mobilized from lateral to medial direction and the glan was removed completely en-block without isthmotomy.

Macroscopically anencapsulated thyroid gland with greatly increased dimensions 120x70x40mm. After cut formed different in size soft nodules from5-20/20mm (Figure 10)

Histopathological results showed a right thyroid lobe with colloidal multinodular goiter with pronounced secondary degenerative changes and small encapsulated follicular adenoma. Isthmic part of the thyroid gland was with colloidal nodular goiter with pronounced secondary degenerative changes with fibrosis and calcifications. Left lobe of the thyroid gland was with colloidal nodular goiter with severe secondary degenerative changes - extensive haemorrhages, necroses, formed pseudocysts and fibrosis. Morphological diagnosis was colloidal multinodular goiter.

Figure 9a,b. Intraoperative view a), and after removing the gland b).

Figure 10. Postoperative specimen of the whole thyroid gland.

The patient was discharged on the 7th postoperative day uneventfully. Three years later he is without any complaints.

DISCUSSION

The first author, who described retrosternal goiter (RG) was Haller in 1749 [2] and the first surgeon, who resected successfully RG was Kleinin 1820 [3].

Anatomically the goiters are classified as retrosternal, retrotracheal and retroesophageal. In one study the reported rate of RGwas75.7% from all intrathoracic goiters, as the rates of retrotracheal and retroesophageal goiter were lower (respectively 12.8% and 11.4%), as well asin most cases thegoiter arised from one lobe of the gland (75.7%) [4]. In other study the cervico-mediastinal goiters extended above, at and below the level of the aortic arch respectively in 76.72%, 18.10% and 5.17% of the patients [5]. In presented three cases all goiterswere retrosternal and originated from the two lobes. In cases 1 and 3 the RGs reached the aortic arch level and in case 2 the RG was in supraaortic position. In cases 1, 2 and 3 RGslayparatracheally and paraesophageally.

The extension of RGs into the mediastinum is aided by the anatomical continuity between the neck and the thorax, by the traction caused from the negative intra-thoracic pressure, by constitutional factors such as short neck and strong muscles[6], under the action of swallowing and gravity.

RG is classified as primary and secondary depending on the origin of the blood supply: theprimary is rare (1%) and arises in the mediastinum and has mediastinal feeding vessels,whereas the secondary originates in the neck and has cervical vessels[7].All RGs, presented in this article were secondary, as they had primary neck origin and descended later on.

According to the results in one analysisthe median age of the patients was 52.3 years, and the majority were female (81.74%) [8].Two of our cases were women and the patients were older, as they were 71, 68 and 66 years old respectively.

Most patients with RGs are euthyroid, as the reported incidence of euthyroidism was 80% and 20% of patients exhibited hyperthyroidismin one study[9]. All our patients were also with normal thyroid function.

Mass (95.1%) and dyspnea (73.2%) are the most common clinical symptoms among patients [10].Other

symptoms are wheezing, hoarseness, stridor, orthopnea, dysphagia, choking, dysphonia, superior vena cava syndrome, chest pain,Horner syndrome andglobus sensation.In the rest of the patients the disease is asymptomatic.In addition, the tracheal compression can take an acute form secondary to a sudden increase in the volume of the gland by an intracystic hemorrhage or a degeneration which can lead to asphyxia [5].The reported symptoms in our cases were dyspnea, cough,mild dysphagia, neck swelling, palpitations,fatigue, weakness.

According to the postoperative pathologic findings in one report, 58.5% of the cases were multinodular goiter, 22.9%were papillary cell carcinoma, 7.1% were medullary carcinoma, 5.7% were anaplastic carcinoma, 5.7% were thyroid lymphoma andonly 1.4% were thyroid adenoma[11]. Previous radiotherapy, presenceof cervical adenopathy, recurrent goiter and family historyof thyroid pathology have been described as risk factors formalignancy [12]. The histopathological result in all cases here was multinodular goiter and in case 3 it was accompanied by a small follicular adenoma.

The most exhaustive examination for assessment is the performance of chest x-ray and CT scan. The results of one study indicated that 100% of the findings obtained from CXR had tracheal deviation, and in 100%of the findings obtained from CT scan, there were superiormediastinal mass, tracheal deviation and tracheal stenosis[11]. Ultrasound examination is not useful in assessment of RGs. In our patients the diagnosis was also made by chest x-ray and CT. We also observed upper mediastinal round mass in cases 1 and 3 on chest x- ray. CT scan in our cases demonstrated a heterodense retrosternal mass, that compressed and deviated the trachea.Fine needle aspiration biopsy is not so effective in RGs due to the close proximity to vital structures and vessels. Furthermore, some of the nodules in multinodular goiter could be benign and others malignant and therefore biopsy of only one nodule is not informative and biopsy of all nodules is impossible. Therefore, we did not perform any preoperative histological verification.

Surgical resection is indicated in all RGs due to compressive symptoms (dyspnea, dysphagia, superior vena cava syndrom), tendency for progression in size, risk from malignant degeneration, lack of secure preoperative histologic verification, absence of effective conservative treatment alternative, high effectiveness, radicality and safety in surgical therapy. There are three standard surgical approaches: cervicotomy, sternotomy and thoracotomy. Usually neck incision is sufficient, although the retrosternal mediastinal location. One study revealed, that in most patients (90.2%), surgery was performed using a cervicotomy approach, but in 9.8% cases, an extra-cervical approach was used (sternotomy and cervicotomy 7.3% and thoracotomy and cervicotomy 2.4%) [10]. The approaches in our case were through cervicotomybut only in case one it was combined with a proximal partial sternotomy, because of the too deeply

mediastinal localization of RG to the level of right pulmonary artery. In such goiters, the usual surgical volume is thyreoidectomy due to the fact that malignancy is sometimes possible in some areas. In the third case, the gland was removed and mobilized completely without performing isthmotomy, which is more difficult and risky to injure the reccurent nerves. In this case there were no postoperative complications.

Other authors indicated other risk factors for extracervical approach such as malignancy, revision surgery, ectopic goiter, mediastinal goiter with mediastinal blood supply, mediastinal infiltration, extension beyond the carina or aortic arch, retrotracheal or retroesophageal goiters, obstruction of the superior vena cava, discrepancy of the chest diameter and the one of the goiter, thyroiditis, etc.

Surgical intervention for RG is more challenging than standard thyroidectomy for cervical goiter, due to the close proximity to vital organs and vessels.Dissection and hemostasis after sternotomy is safer than the blind one. From utmost importance during the procedure is to safe the upper two parathyroid glands because the lowers ones are sacrificed in most cases. It is better practice firstly to visualize the recurrent laryngeal nerve and to protect it.

Some authors reported, that sternotomy took an average of 2 hours longer than a cervical incision, was associated with significantly more blood loss (600 *versus* 190 mL), and a longer length of stay (3.1 *versus* 1.8 d) than cervical thyroidectomy, but there was no increased risk of long-term postoperative complications [13].

The most common reported postoperative complications are recurrent laryngeal nerve paralysis and palsy, transient and permanent hypocalcemia, tracheomalacia, pneumothorax, postoperative haemorrhage and wound infection.The risk of temporary recurrent laryngeal nerve palsy wasmuch higher in the cervicosternotomy group (21%) compared to cervicotomy (4%) and standard thyroidectomy (3%)and therisk of temporary hypocalcemia after cervicotomy (28%) was comparable to a standard thyroidectomy (32%) but higher after cervicosternotomy (20%)[14].The major risk factors associated with postoperative complications are recurrence and extension beyond the carina[6]. In the cases described by us only case 2 had transient laryngeal nerve palsy.

CONCLUSION

RGnowadays is a challenge for the surgeon and the radical resection represents the only one effective treatment modality. It is noteworthy that total thyroidectomy is recommended due to the risk of present malignancy or future malignant degeneration and compressive symptoms. This is usually a successful operation with low complication risk and excellent long

term results in experienced centers. Due to difference in criteria used to define a substernal goiter in the literature, it is necessary in future this terminology to be more correctly defined and also large prospective studies and meta-analyses to be conducted for more accurate future data.

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