A Comprehensive Study of Mediastinal Goiters

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ABSTRACT

Background: *Thyroid masses are common, especially in areas of iodine deficiency. Mediastinal goiter is defined by the presence of enlarged thyroid tissue below the level of the thoracic inlet. This study aimed to evaluate the presentation, diagnosis, treatment, histopathological findings and complications of patients with mediastinal goiter or masses.*

Materials and Methods: *This was a descriptive cross-sectional chart review study of patients with substernal goiter or masses who underwent cervical and mediastinal thyroidectomy from March 2003 to February 2007.*

Results: *From a total of 470 patients admitted for thyroid surgery, 60 cases (12.7%) presented with substernal extension of goiter or masses during the study period; 88% of patients were females with a mean age of 46.77±10.77 yrs. Cervical masses were the most common preoperative presentation (78%), followed by compressive symptoms (67.8%); 5.08% of cases were asymptomatic. In 10%, the goiter or masses were located in the posterior mediastinum. Total thyroidectomy was performed in 59% of patients mostly by low collar incision. Sternotomy or thoracotomy was required in three patients (5%) mainly because of mediastinal masses or invasion of carcinoma. Postoperative complications included transient hypocalcaemia (46%) and persistent recurrent nerve paralysis (3.4%). There was no mortality. Histopathologically, 18.5% of masses were malignant; mostly papillary carcinoma.*

Conclusion: *Presence of substernal goiter or masses is an indication for early surgery, even in asymptomatic or elderly patients. These masses have progressive enlargements and carry a high risk of tracheal compression.* **(Tanaffos 2010; 9(1): 15-20)**

Key words: *Intrathoracic goiter, Mediastinal goiter, Substernal goiter, Thyroidectomy, Thoracotomy*

INTRODUCTION

The extension of thyroid tissue into the mediastinum was first described by Haller in 1749. Klein was the first to remove a substernal goiter successfully in 1820 (1). Its incidence is reported to be 3% to 20% in the literature and it is defined as a goiter with more than 50% of the thyroid tissue extended below the sternal notch. Negative intrathoracic pressure, gravity and large potential space of the mediastinum are the predisposing factors that facilitate the downward migration of the goiter (2,3). Patients with substernal goiter may be asymptomatic or present with a variety of symptoms and signs of compression to the trachea, esophagus,

vascular structures or nerves. In advanced cases, respiratory distress may occur. Dysphagia or hoarseness and superior vena cava (SVC) syndrome occur less commonly. Symptoms of thyrotoxicosis and hyperthyroidism also occur less frequently. Medical treatment with exogenous thyroid hormone can reduce the size of gland up to 20% to 30% and can improve the symptoms temporarily. A significant number (7% to 17%) of substernal goiters have been found to contain malignancy in recent reports (1). Surgery is the most accepted form of treatment in both symptomatic and asymptomatic patients. It is performed through cervical incisions in the vast majority of patients. There is no clear indication for thoracic or mediastinal approach. In this study, we evaluated the presentation, management and treatment of a group of patients with substernal goiter or masses. We also studied the complications in these patients.

MATERIALS AND METHODS

This was a retrospective cross sectional chart review study of 470 patients who underwent thyroid surgery between 2003 and 2007 at our referral hospital. There were 60 patients who presented with mediastinal masses and were evaluated in this study. All surgeries were performed by thoracic surgeons. There were 53 (88%) females and 7 (12%) males, and patients were in the age range of 19 to 70 years (mean 46.77 ±10.77 years). The indications for surgery are listed in Table 1. Most cases were benign. Different types of surgeries performed are demonstrated in Table 2. One patient was excluded from the study because he did not meet the criteria required for general anesthesia. All patients underwent partial or total thyroidectomy with or without node dissections for their substernal masses. A total of 59 patients enrolled in this study. We reviewed patients' medical records for recurrent goiter, identification of recurrent laryngeal nerve or

parathyroid, autotransplantation of parathyroid glands and requiring mediastinal or thoracic approach. One patient with a mediastinal mass invading trachea and postoperative diagnosis of papillary carcinoma of aberrant thyroid tissue and paralysis of right recurrent nerve was treated with midsternotomy and tracheal resection. Postoperative outcome measures included length of hospitalization, signs and symptoms of hypocalcaemia, and presence of other complications. The follow up period ranged from 3 to 18 months. The mean duration of hospitalization was 53.14 ±8.76 days for men and 45.92 ± 10.79 days for women.

Statistical analysis: Data analysis included Chi-square test, independent samples test and ANOVA test. A p–value of less than 0.05 was considered significant. All analyses were performed using SPSS software version 15.

RESULTS

There were a total of 60 patients (12.76%), 7 (12%) men and 53 (88%) women with a mean age of 46.77 ±10.77 years (range 19 to 70 years). No significant difference was found among signs and symptoms, males and females or age groups.

Retrosternal extension of the mass was assessed through chest x-ray in 13.5%, computed tomography (CT) in 11.8% and magnetic resonance imaging (MRI) in 1.7% of cases. Twelve patients (20.3%) were diagnosed as having mediastinal goiter preoperatively. Five patients were diagnosed clinically and 7 were diagnosed through paraclinical procedures. No significant difference was found between clinical diagnosis of mediastinal goiter and paraclinical procedures.

In one patient, mediastinal mass was seen as a separate mass and in 58 patients, mediastinal masses and goiters were adherent to the cervical part of thyroid. In 26% of cases right lobe, in 28% left lobe and in 46% both lobes were extended to mediastinal

spaces. In six patients (10.2%), mediastinal goiters were extended to posterior mediastinum and in the remaining 89.8%, thyroid masses were extended to superior and anterior mediastinum. Bronchoscopy could detect malignant tracheal invasion preoperatively in 2 patients. In 23.7% of patients, a malignant appearance was observed macroscopically during surgery.

Total thyroidectomy was performed in 59% mostly via low collar cervical incisions. The mean duration of hospitalization in cases who underwent cervical and mediastinal total thyroidectomies was 7.71 ± 2.57 and 14.00 ± 7.81 days, respectively. Significant statistical differences were found between types of procedures and hospitalization period (p=0.001)

Table 1. Indications for surgery

Indications	N (%)
Cervical mass	45(78)
Compressive goiter	40(67.8)
Known or possible malignancy	8(13.6)
Toxic goiter	30(50.8)
SVC syndrome	3(5.08)
Dysphonia & stridor	10(16.9)
No sign	3(5.08)

Table 2. Type of surgery

Type of Surgery	N(%)
Cervical & mediastinal total thyroidectomy	59(100)
Mediastinal lobectomy &subtotal lobectomy	31(52.5)
Cervical & mediastinal total thyroidectomy with radical lymph node dissection	10(16.9)
Thoracotomy with mediastinal thyroidectomy and paratracheal lymph node dissection	1(1.7)
Sternotomy & total mediastinal thyroidectomy with resection of trachea & paratracheal lymph node dissection	2(3.4)

Hospitalization period ranged from 6.39 ± 2.4 days for lobectomies to 8.67 ± 2.33 days for total thyroidectomies together with radical lymph node dissections. The difference in this regard was statistically significant (p=0.029).

An intra-operative complication was severe bleeding due to rupture of innominate vein during surgery in one patient that needed median sternotomy to control it.

Postoperative complications are shown in figure 1. Temporary paralysis of recurrent laryngeal nerve was observed in two patients (3.4%). In 3 patients (%5), the nerve had to be sacrificed because of the malignant involvement (vagus nerve in one patient and recurrent nerve in two patients). In 7 patients (12%), autotransplantation of parathyroid was performed in sternocleidomastoid muscle fibers. Two patients needed tracheal resection during resection of the mediastinal mass because of its invasion to the trachea.
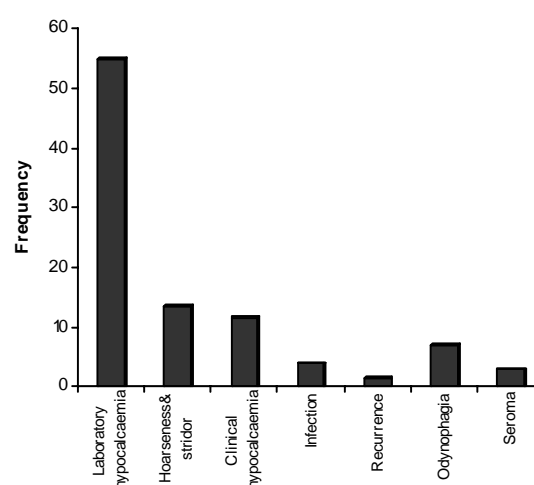

Figure 1. Complications of surgery of Retrosternal goiters in 59 patients

Transient hypocalcaemia was seen in 27 patients (46%). Permanent hypocalcaemia was seen in 2 patients.

Ionized calcium levels were checked preoperatively and postoperatively. A patient would

be considered hypocalcaemic if the corrected ionized calcium level was less than 8.0 mg/dl. The mean discharged ionized calcium level of patients was 1.0225±0.07 (minimum level 0.8 and maximum 1.2).

Eleven patients needed ICU hospitalization with a mean duration of 2.91±1.18 days (range 1 to 7 days).

The mean ICU hospitalization period for malignant cases was 5.00±2.64 days versus 2.14±0.69 days for benign patients. However, no significant difference was found in this respect (p=0.21).

No significant correlation was found between the surgical approach and complications or malignancy and SVC syndrome. None of the patients with SVC syndrome had malignant pathology.

Malignancy did not increase the rate of parathyroid autotransplantation. Also, no significant correlation was found between hypocalcaemia after thyroidectomy and parathyroid autotransplantation (p=0.67).

However, a significant correlation was found between malignancy and sacrificing the recurrent nerves (p= 0.001).

The mean hospitalization period was 10.57 ± 5.60 days in males and 7.57 ± 2.77 days in females. The difference in this regard was statistically significant (p=0.023)

Post-operative cervical odynophagia and seroma were seen in 10% and 3.4% of cases, respectively that were eventually resolved spontaneously after 4-17 days.

The histopathology of the masses was multinodular goiter in 81.5%, papillary cell carcinoma in 6.7%, follicular adenoma in 3.5%, Hurtle cell carcinoma in 1.7%, medullary carcinoma in 1.7%, and mixed carcinoma in 5% of cases. There was a statistically significant correlation between type of surgery and histopathology of malignancies (p=0.04).

No significant correlation was found between

malignancy and mediastinal invasion of goiter or masses. No mortality was reported among patients.

DISCUSSION

The reported incidence of mediastinal goiter varies from 0.6% to 30% (4). This is probably due to the difference in definition. Unfortunately, there are no clear criteria for selecting patients who would likely require median sternotomy or thoracotomy. According to Lahey's clinical criteria, mediastinal or substernal goiters are those that require dissection in the upper mediastinum for removal (5).

Extension of the goiter to aortic knuckle on the CT scan is a strong indication for median sternotomy (6). There are various recommendations for combining cervical incision with anterior thoracotomy and partial or full sternotomy. Atypical vasculature, severe adhesions, invasive malignancy, recurrences, ectopic goiter or inability to deliver the gland into the neck were observed in 2% to 6% of patients (7-11). In one case, the malignant mediastinal mass had no correlation with the cervical thyroid; this was the only case among 59 patients who was treated through midsternotomy. In our patients, sternotomy and right thoracotomy were required in 2 and one patient, respectively. Subtotal thyroidectomy was used for smaller goiters. Large goiters with compressive signs and symptoms or malignant ones were managed with total thyroidectomy.

In most reported series the female to male ratio was found to be 70% to30% while in our series 88% were females. The reason for the higher percentage of female patients is not known.

The mean age of our under study patients was 46.77 yrs while it was reported to be 50 years in the literature (4). The reason might be lack of iodine in our country and also the young age of the population. Cervical mass and tracheal compression as a respiratory symptom were predominant in two of our

patients. Large mediastinal goiters compress the trachea much more easily and cause more compression symptoms compared to cervical goiters (12). None of our patients presented with dysphagia.

Rate of hyperthyroidism or thyrotoxicosis varies between 0%- 50% in the literature. This rate was 50.8% in our study. Eight of our patients (13.5%) had recurrent goiters. These patients had undergone a prior thyroid surgery less extensive than total thyroidectomy and had recurrence of goiter in the substernal space. We also found 18.5% of our cases to be carcinoma. This rate varies from 2% to 21% in the literature (13).

Prevalence of primary ectopic thyroid mass with papillary carcinoma was 1.7% in our series while it was reported to be 0.8% in the literature (14).

Asymptomatic goiters were reported in 17% to 32% of cases in previous studies (4). However, this rate was 5.08% in our study. The reason might be weak screening and late diagnosis of this disease in our area.

CT-scan is usually adequate and reliable for diagnosis (100%)(15, 16);however, its efficacy was 11.8% in our study because of weak preoperative screening. Therefore, surgery of substernal goiters would be difficult for our surgeons. For example, in one patient sternotomy was required because of massive intraoperative bleeding due to the rupture of innominate vein.

A cervical approach would be adequate for 95% of these patients. The rate of median sternotomy and thoracotomy in this study was 5% (3/59) and 0.64%, (3/470), respectively. Only three patients required sternotomy or thoracotomy. Despite the clinical and radiographic features that suggest the possible indication of median sternotomy or thoracotomy, a cervical approach would suffice in a large number of patients (17).

In one patient, CT-scan showed the extension of mediastinal mass to the aortic knuckle; whereas, in another patient it was extended to the posterior mediastinum below the aortic knuckle and needed right thoracotomy. In another patient multinodular goiter had been extended at the level of aortic knuckle in a way that during cervical resection of the mass innominate vein was injured and resulted in massive bleeding.

We performed total thyroidectomy in almost 59% of our patients. This rate varies between 50%- 100% in the literature .The incidence of transient and persistent hypocalcaemia in this study was 46% and 3.4%, respectively, while these rates were reported to be 6-40% and 0-6% in the literature (1,13,18).

Rate of complications such as vocal cord paralysis, infection, tracheomalacia and hemorrhage was minimal in our study. In previous studies, the rate of transient and persistent paralysis of recurrent nerves was reported to be 0-11% and 0-4% respectively (19,20). These rates were 3.4% and 0%, respectively in our study.

While the mortality rate was reported to be 0.7 to 2.8% in the literature, we had no mortality (4). None of our patients needed tracheotomy.

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