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Cervical Approach to Substernal Goiter: Do we Need Sternotomy? Cerrahpaşa Experience

Substernal Guatırda Servikal Yaklaşım: Sternotomiye ihtiyacımız var mı? Cerrahpaşa Deneyimi

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Abstract

Purpose: The purpose of this study was to evaluate the clinical and surgical differences between substernal goiter and non substernal goiter according to institutional experience.

Material and Method: Twenty-nine patients with substernal goiter and 62 randomly chosen non substernal goiter patients from January 2009 to October 2012 were compared retrospectively according to their pre-operative and post-operative data. Cervical approached total thyroidectomy was applied to patients with substernal goiter.

Results: Thirteen of twenty-nine substernal goiter patients were male (44.8%) and 16 were female (55.2%). Body mass index, age, gender in both groups were compared and found to be similar. No post-operative complication was observed. Pathology results revealed malignancy in 24.1% of patients.

Discussion: Patients with substernal goiter can be safely treated through the cervical approach with low complication rates in expert hands. *Turk Jem 2013; 17: 116-20*

Key words: Substernal goiter, sternotomy, cervical approach

Özet

Amaç: Bu çalışmanın amacı substernal uzanımlı tiroid patolojisi olan hastalarla substernal uzanımı olmayan tiroid patolojisi olan hastaların, klinik ve cerrahi farklarını tecrübemize göre değerlendirmektir.

Gereç ve Yöntem: Çalışmamız Ocak 2009 ve Ekim 2012 tarihleri arasında elektif şartlarda substernal uzanımlı tiroid patolojisi olan 29 hastanın, aynı tarihler arasında substernal uzanımlı olmayan tiroid patolojisi olup, rastgele yöntemle seçilmiş 62 hastanın preop ve postop verileri retrospektif karşılaştırılarak yapılmıştır. Substernal guatırlı hastalara servikal yaklaşımlı total tiroidektomi uygulandı.

Bulgular: Substernal guatırı olan 29 hastanın: 13'ü erkek (%44,8), 16'sı kadındır (%55,2). Her iki grup, BMI, yaş, cinsiyet dağılımı baz alınarak karşılaştırılmış; birbirine benzer gruplar olarak değerlendirilmiştir. Hastaların hiçbirinde komplikasyon gelişmedi. Bu hastaların %24,1'inin patolojisi malign geldi.

Tartışma: Substernal guatırlı hastalar deneyimli cerrahlar tarafından, servikal yaklaşımla güvenli bir şekilde tedavi edilebilmektedir. *Turk Jem 2013; 17: 116-20*

Anahtar kelimeler: Substernal guatır, sternotomi, servikal yaklaşım

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Introduction

Substernal Goiter (SG) is described as the extension of the thyroid tissue into the mediastinum. This structure might be unilateral or bilateral. Despite difficulties in estimating the overall incidence of SG, extensive thyroidectomy series show an incidence of 1-20% (1-4). It is generally seen in the fifth to sixth decade of life and female/male ratio is approximately 4:1. Neurovascularity generally originates in the cervical region, however, a limited number of studies have demonstrated that substernal thyroid tissue might originated in the mediastinum. While SGs usually extend into the anterior mediastinum (85-90%), 10-15% of them extend into the posterior mediastinum (2,5,6). Enlarged thyroid tissue may compress the trachea or esophagus and can cause symptoms such as dysphagia or dyspnea. However, in some studies, 5 to 50% of patients were found to be asymptomatic (1,2,7,8). Compression of the large venous structures may lead to venous congestion (7,9). The initial diagnosis is based upon clinical history and the findings of routine analyses, and radiological evaluations, then, is verified with intra-operative evidences. Surgery is considered to be the primary approach and the gold standard for the treatment of SG due to the fact that malignancy is observed in about 7 to 20% of patients with SG. Surgery can be done through cervical approach, sternotomy, thoracotomy or a combination of these techniques. The general consensus is that most SG patients can be treated through cervical approach, however, some cases may need thoracic intervention. Sternotomy is performed in about 0 to 11% cases. This wide range may be explained by the absence of a common SG definition (6,7,10-13). Most of the SG studies have been published as series of author's self-experience, evaluation of their own surgical techniques and comparison of other studies on SG. This study compared statistically similar groups of SG patients to non-substernal goiter (NSG) patients in whom same surgical technique was applied and investigated the possible differences between the two groups.

Materials and Methods

This study retrospectively compared the pre-operative, per-operative and post-operative data from 29 SG patients (group 1) with those from 62 randomly selected NSG patients (group 2) who have been admitted to Cerrahpaşa Medical Faculty, Department of General Surgery between January 2009 and October 2012. The diagnosis of SG was made by per-operatively confirmed pre-operative radiological investigation or per-operative observation of substernal thyroid tissue. Contrast-enhanced computed tomography (CT) of the neck and thorax was performed in only symptomatic patients. Chest X-ray was considered to be a pre-operative routine and made in all patients. Extension of the thyroid gland caudally beyond the sternal notch in chest X-ray was accepted as substernal. A sample of chest X-ray with tracheal deviation is given in Figure 1. Major symptoms, such as dyspnea, dysphagia, and hoarseness were questioned and, height, weight, submental distance, and neck circumference were recorded in all patients. Use of fiber-optic laryngoscope during intubation, duration of operation, duration of anesthesia, weight of specimens, and whether the thyroid was divided from isthmus or not were noted. Pre-operative and post-operative calcium and albumin levels were analyzed. All calcium levels were corrected for albumin before statistical calculations.

Pre-operative and post-operative vocal cord examinations were made in patients for hoarseness and the patients were evaluated for nerve paralysis at the Department of Otorhinolaryngology. Routinely recommended systemic antibiotic prophylaxis was not used. Total thyroidectomy was performed by energy-based devices (Harmonic FOCUS® or Ligasure™ LF1212). Surgical drains were used in all cases. Surgical knots were not applied according to sutureless thyroidectomy technique (14).

Study was conducted in accordance with the Helsinki Declaration and was approved by the Institutional Ethics Committee.

Statistical Analysis

The groups were compared in regard to BMI, age, submental distance, neck circumference, duration of operation, post-operative calcium levels, amount of drainage, duration of anesthesia and weight of specimens by using a chi-square test, Fisher's exact test, student's t-test, Mann-Whitney-U test, and the Shapiro-Wilk test all statistical analyses were performed by using IBM SPSS 20.0 for Windows. A p value of less than 0.05 was considered statistically significant.

Results

BMI, age, submental distance, neck circumference, duration of operation, post-operative calcium levels, amount of drainage, duration of anesthesia, and weight of specimens were analyzed. In group 1 (n=29), 13 patients were male (44.8%) and 16 were female (55.2%); in group 2 (n=62), 22 patients were male (35.5%), and 40 patients were female (64.5%). No reasonable relationship was found between gender and location of elongated thyroid tissue (p=0.393). No significant differences were detected between the groups in mean values of BMI (p=0.674), age (p=0.096), submental distance (p=0.399), neck circumference (p=0.03), and post-operative calcium level (p=0.029) (Table 1). A significant difference was found between the two groups in weight of specimens (p<0.001), duration of anesthesia (p=0.005), duration of the surgery (p<0.001), and average amount of drainage (p=0.002) (Table 1). We were unable to resect the glands in five Group 1 patients (17.2%) as unblock specimen and if compared with Group 2, significant difference was established (p=0.005). Dyspnea was the most common symptom in SG patients, 13 patients (51.7%) presented to the clinic with dyspnea as an admission symptom. No analysis was made between the two groups due to the limited number of symptoms (Table 1).

There was a significant difference in the size of the tyroid gland between patients with compression symptoms and asymptomatic patients. Increased specimen weight resulted in an increase in symptoms (p=0.01). Dyspnea was the most common symptom. There was no relationship between gender and distribution of symptoms (p>0.05). Chest X-ray showed tracheal deviation in 25 patients in group 1 (86.2%) and 11 subjects in group 2 (30.6%). There were significant differences in X-ray findings between the groups (p<0.001). None of the Group 2 patients were investigated with CT;

on the other hand, in the Group 1 patients, CT was performed in four patients with heavy dyspnea, one patient with dysphagia and in two asymptomatic patients with serious enlarged thyroid gland based on physical examination findings (Figure 2). Thyroid ultrasound (US) showed substernal enlargement in 10 (34.5%) patients in group 1, while no substernal extension was detected in group 2 (p<0.001). Two subjects in group 1 were considered hard-to-intubate patients, thus, fiber-optic intubation was performed in these patients. There were no substantial differences detected for intubation between the groups (p=0.09). Sternotomy or thoracotomy was not applied; all patients were operated via cervical approach. In group 1, the thyroid glands were resected in 24 patients as unblock (83.3%), unblock resection was not possible in five patients (16.7%). Only one patient in group 2 presented with post-operative hoarseness which found to be due to vocal cord trauma. One patient in group 1 (3.4%) and 2 subjects in group 2 (8.1%) presented with post-operative complications. There was no significant difference in terms of surgical complications between the two groups (p=0.66)., Pathological evaluation of the specimens from 7 group 1 patients

Figure 1. Tracheal deviation on a pre-operative chest- X-ray

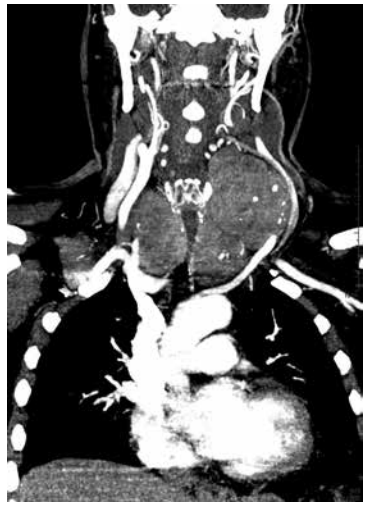

Figure 2. Mediastineal extension of thyroid gland on CT image

Table 1. Measured values of each group

	Group 1 (n=29)	Group 2 (n=62)	Total	p-value
Age (years)	54.24±14.07	49.53±11.63	51.03 ± 12.58	0.096
BMI (kg/m^2)	28.91±5.18	28.41±5.31	28.57 ± 5.25	0.674
Sternomental distance (cm)	15.48±2.99	14.98±2.50	15.14 ± 2.66	0.399
Neck circumferences (cm)	39.35±4.84	37.19±4.08	37.88 ± 4.42	**0.03**
Duration of operation (min)	31.69±9.79	41.90±12.88	38.65 ± 12.85	**<0.001**
Duration of anesthesia[a] (min)	49.24±12.92 49 (30-100)	58.69±15.52 60 (30-85)	55.68±15.32 50 (30-100)	**0.005**
Weight of specimens[a] (g)	155.90±180.34 108 (27-792)	45.82±51.14 30 (8-296)	80.90±120.63 37 (8-792)	**<0.001**
Amount of drainage[a] (ml)	51.55±29.13 45 (9-150)	37.10±21.19 35 (12-155)	41.70±24.78 37 (9-155)	**0.002**
Symptoms (n)				
Asymptomatic	15 (51.72%)	50 (80.65%)	65 (71.43%)	0.004
Symptomatic	14 (48.28%)	12 (19.35%)	26 (28.57%)	
Dyspnea	13 (44.83%)	3 (4.84%)	16 (17.58%)	
Dysphagia	1 (3.45%)	8 (12.9%)	9 (9.89%)	
Vocal cord palsy	0 (0%)	1 (1.61%)	1 (1.1%)	

Continues values were denoted as mean ± standard deviation. If the distribution was not normal median (minimum – maximum) values also were given.

[a] Data was not distributed as normal.

P values with statistical significance were typed in bold.

(24.1%) and 16 group 2 patients (25.8%) demonstrated malignancy. In those patients cytology was unknown prior to surgery. There was no significant difference in pathological diagnosis between the two groups (p=0.864).

Discussion

SG is defined as enlargement of the thyroid tissue into the mediastinum. After the first description of SG in 19th century, continuous developments in surgery and anesthesia changed the methods of the evaluation and treatment of SG radically. Thyroidectomy was considered as one of the brutal surgical interventions in the medical history; these operations are now performed with low mortality and morbidity rates. In contrast to female/male ratio of 4 to 1 in the literature, female/male ratio was 16/13 in this study (1-4). Clinically, some patients are admitted to hospital with compression symptoms, while, some patients remain asymptomatic (2,7,8). In this study, this percentage was calculated as high as 50% (14 patients).

Radiological imaging is considered to be an important part of the diagnosis. Chest X-ray does not provide a definitive diagnosis of SG, but may raise a suspicion of tracheal and esophageal deviation. In this study, 25 SG patients (88.2%) showed findings of deviation. The percentage of patients with normal chest radiograph findings was about 20-30% in other studies (2). However, in this study, the percentage was 13.8. This wide percentage dispersion is due to the fact that no certain standardization has been decided for radiographic imaging. Calculation of deviation angles can be helpful in creating standardization of deviation degrees. Thyroid US examinations diagnosed only 34.5% of the patients. Some other clinical studies showed that US was inefficient in diagnosing SG. In this study, US was generally done out of our clinic; any difference in results was considered normal given the differences in the experience of radiologists, and properties of US devices (2,3,6). Because of these heterogeneous US results, CT of the neck is accepted appropriate for patients with deviation findings on chest X-ray and for clinically symptomatic patients. CT examination helps us to evaluate substernal elongation and anatomical neighborhood with other mediastineal organs.

CT based diagnosis of SG was confirmed per-operatively for each patient. In this study, some of the patients were diagnosed by scintigraphy, however, inadequate number of patients in whom scintigraphy was performed prevented evaluation of the accuracy of scintigraphy in the diagnosis of SG. Scintigraphy shows the activity of the thyroid tissue enlarging to the mediastinum, but absence of nuclear activity cannot exclude SG. MRI can be used as a diagnostic method, but shows no advantage over CT (2,6,7). In this study, none of the patients were evaluated with MR imaging. To summarize, chest X-ray raise suspicion over SG, however, USG is not effective. CT and MRI may provide definitive diagnosis, but since these examinations are not cost-effective, they are not included in the routine tests. They must be used for the evaluation of patients with prominent symptoms.

Two of the subjects were accepted as hard-to-intubate patients according to chest X-ray images and examinations performed by anesthesiologists. These patients were intubated with the help of fiber-optic devices. In this study, there were no significant difference in the type of intubation between the two groups (p=0.09). Other studies showed that there is no difference in intubation between patients with SG and patients with nonsternal goiter. SG patients can be intubated with fiber-optic devices and standard way, even if there is a serious deviation, the fiber-optic devices remain unnecessary (2,10).

SG and malignancy might be seen together. However, malignancy rates do not differ from other thyroid pathologies. Most studies showed an incidence between 6-21% (2,7,8,10,13). In this study, the malignancy rate was 24.1%. There was no statistically significant difference in the frequency of malignancy between patients with SG and those with NSG (p=0.864). Still, total thyroidectomy is indicated in SG patients with possible malignancy. Malignancy in SG does not affect pre-operative and post-operative complications.

Potential complications of total thyroidectomy are vocal cord paralysis, bleeding, hypoparathyroidism, hypocalcaemia, and rarely, tracheomalasia. Most clinicians demonstrated that post-operative complications do not differ prominently between total and standard thyroidectomy (3,5,6). Only some of them found meaningful results in patients with hypoparathyroidism (15). In this study, the patients were pre-operatively and post-operatively examined by otorhinolaryngologists for vocal cord pathology. Only one patient was diagnosed with temporary unilateral vocal cord paralysis and when compared with all other complications, there were no significant differences between SG and NSG patients (p=0.66).

Surgery is considered to be the primary approach and the gold standard for the treatment of SG. Surgery can be done via cervical approach, sternotomy, thoracotomy or a combination of these techniques. The general consensus is that most of the patients can be treated with cervical approach but some cases need thoracic intervention. Sternotomy is performed in about 0-11% of cases. This wide range may be explained by the lack of a common SG definition (2,5,6,11-13). In this study, sternotomy or thoracotomy were not applied, all patients were operated through cervical approach. In terms of bigger glands, we fixed each gland with 2-0 silk suture in order to rotate and elevate the gland much more comfortably; sharp and blunt dissections were applied to pull out the thyroid gland from the thoracic region and, vessel ligation devices were used instead of surgical knots to maintain hemostasis.

Conclusions

SG is a rare thyroid disease with no common definition. CT must be used for the evaluation of patients with heavy symptoms. Patients with SG can be safely treated through the cervical approach with low complication rates in expert hands.

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