

An investigation into symptoms, diagnosis, treatment, and treatment complications in patients with retrosternal goiter

Manouchehr Aghajanzadeh¹, Mohammad Reza Asgary¹,
Fereshteh Mohammadi¹, Haniye Darvishi¹, Yasaman Safarpour¹

¹Inflammatory Lung Disease Research Center, School of Medicine, Razi Hospital, Guilan University of Medical Science, Rasht, Iran

ABSTRACT

Introduction: Retrosternal goiter refers to any thyroid enlargement in which over 50% of the thyroid permanently located under the thoracic inlet or the lower pole of thyroid is not palpable with the neck in hyperextended position. Due to the increasing number of surgical procedures of retrosternal goiter, the present study was carried out to examine the symptoms, diagnosis, treatment, and treatment complications in retrosternal goiter patients. **Materials and Methods:** Data related to demographic data (age and gender), clinical symptoms (dyspnea, dysphagia, dysphonia, lumps in neck, and hoarseness), methods of diagnosis (computed tomography [CT], chest X-ray [CXR], ultrasonography, and magnetic resonance imaging), and postoperative complications (bleeding, early and late dysphonia, early and late dyspnea, transient and permanent hypocalcemia, transient, and permanent recurrent laryngeal nerve paralysis) were collected. **Results:** According to the results 71.4% of patients were women and most of the participants (67.1%) aged 45–60 years. Mass in the neck was the most frequent symptoms before surgery (88.6%). The most common incision for thyroidectomy (95/7%) was neck collar incision. Diagnosis method in 82.9% and 17.1% of cases was, respectively, based on CT scans with CXR and CT scans with CXR and ultrasound. According to the postoperative pathologic findings, 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, and only 1.4% were thyroid adenoma. Postoperative complications occurred in 47.14% of patients. Most common complication was early transient dysphonia. **Conclusion:** This study recommends that retrosternal goiter should be operated early under suitable conditions, and the best diagnosis tool and best surgery methods are CT scan and surgery with collar incision, respectively.

Keywords: Complications, goiter, retrosternal goiter, surgery

Introduction

Goiter is considered mediastinal if the lower pole of thyroid is not palpable with the neck in hyperextended position.^[1,2] Epidemiologically, it is difficult to have access to the prevalence of retrosternal goiter. According to the reports, however, thyroid goiter develops into thorax in 2%–21% of cases. In 7% of cases, retrosternal

goiter appears as mediastinal tumor. Etiologically, 85%–95% of retrosternal thyroid masses emerge as benign goiter. Histologically, goiter is created as a result of iodine deficiency. This problem is nowadays observed in developing countries. Goiter can also be due to consumption of goitrogenic substances which are substances that cause disruption in the production of thyroid hormones. Malignity happens in 5%–15% of retrosternal goiters.^[1,3,4]

Retrosternal goiters are more common among women. They develop slowly, their symptoms appear mostly in the fifth and

Address for correspondence: Dr. Mohammad Reza Asgary, Inflammatory Lung Disease Research Center, School of Medicine, Razi Hospital, Guilan University of Medical Science, Rasht, Iran. E-mail: tsasgary85@yahoo.com

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sixth decades of life, and they usually put pressure on mediastinal structures.^[5,6] The most common symptoms of retrosternal goiter are dyspnea, respiratory problems, choking, and hoarseness.^[1]

Diagnosis is according to clinical symptoms and diagnostic methods such as chest X-ray (CXR) and computed tomography (CT), and sometimes, ultrasound also helps with diagnosis, but CT has high sensitivity.^[2-5] Surgery is the only effective method for retrosternal goiter. In most cases, suppressive therapies with levothyroxine are effective in reducing the size of multinodular goiter. Radioactive iodine is generally ineffective in decreasing goiter size and may cause acute inflammation, swelling of the glands, and an increase in the potential of airway obstruction.^[6-9]

In most cases, surgery is carried out using a collar incision.^[6-13] Only 2% of patients who are considered for retrosternal goiter surgery may need another type of incision such as manubriotomy, sternotomy, or thoracotomy.^[14-18]

Among the complications of retrosternal goiter surgery are hematoma, recurrent laryngeal nerve palsy, tracheomalacia, dysphonia, laryngeal edema, hypocalcemia, nausea, vomiting and wound complications after surgery,^[19-22] deep vein thrombosis, the need for transfusion after surgery due to the severity of bleeding, and mortality.^[23-29] In their study entitled, “Diagnosis, treatment, and surgery of retrosternal thyroid masses,” Zhang and Cui (2002) examined 64 patients with retrosternal goiter.^[30]

These researchers reported that the best method to diagnose retrosternal goiter is using CXR and CT, and the most common surgery for this type of goiter is collar incision which is associated with minimum morbidity and recurrence rate.^[30]

By taking into account the surgery of 334 patients over 1993–2002, Aghajanzadeh *et al.* (2006) stated that 32 patients had intrathoracic thyroid and were examined in a retrospective method in terms of diagnosis symptoms, treatment, and complications of the surgery. The results of that study showed that the most appropriate diagnosis tool is CXR and the best tool is CT scan. Iodine thyroid scan was helpful in five cases. These researchers concluded that patients with retrosternal goiter need to undergo surgery during their treatment because they sometimes experience bleeding inside the goiter and malignant transformation, which is a serious threat.^[31]

An ever increase in the number of retrosternal goiter surgery on the one hand, and given the advances in new medical knowledge and diagnostic facilities on the other hand, it is expected that patient with retrosternal goiter are diagnosed more precisely and rapidly to reduce the complications caused by late diagnosis and delayed surgery and the financial costs imposed on society. The present study was carried out to precisely examine the records of the patients with retrosternal goiter who underwent surgery over 2007–2013, their symptoms, diagnosis method, and complications caused by the surgery.

Materials and Methods

In this retrospective cross-sectional descriptive study, between 2007 and 2013, in Razi and Arya Hospitals, Rasht, Iran, from 777 patients that operated with thyroidectomy, 70 patients (9%) had retrosternal goiter.

The study's variables included the frequency of the medication and the underlying diseases before hospitalization, symptoms before surgery, the conducted therapeutic methods, diagnosis methods (CXR, CT, ultrasonography, and magnetic resonance imaging [MRI]), the postoperative pathologic findings, frequency distribution of the complications after the surgery according to the patients' sex, and the percentage of the complications based on the age groups.

The measuring tool in the present study was a checklist that was based on individual information including age, sex, underlying diseases and the section of symptoms, diagnosis-treatment methods, and the complications mentioned in the table of the variables. The patients' records were examined over the specified time, and there were no specific exclusion and inclusion criteria in the present study.

Data collection instruments and method

The records of all of the patients who were hospitalized for retrosternal goiter thyroidectomy were used in the present study. Then, a questionnaire consisting of 2 sections of demographic information (age, sex, medication consumption, underlying disease, etc.), and clinical symptoms (bleeding, dyspnea, dysphagia, dysphonia, mass in the neck, hoarseness, and asymptomatic), diagnosis method (CT, CXR, ultrasound, and MRI), and complications (early and late dysphonia, early and late dyspnea, transient and permanent recurrent laryngeal nerve injury, temporary and permanent hypocalcemia, and hoarseness) were completed for each patient.

Data analysis method

After the required data were collected, they were fed into SPSS 21.0, frequency and confidence interval 95% were used to determine the symptoms, treatment-diagnosis method, and complications, and Chi-square test was run to compare the data in terms of sex, age groups, and underlying diseases. The significance level was set at 5% for all tests.

Ethical considerations

Ethics and confidentiality were taken into account in extracting and recording the required data, and ethical consent letter was received from the patients to participate in the study.

Results

The results of the present study showed that out of 777 patients who had undergone thyroidectomy in Arya and Razi hospitals over 2007–2013, 70 patients had retrosternal goiter and out of whom 71.4% were women.

According to the results, most of the participants (46 people, 65.7%) did not take any thyroid medication, 20.3% took levothyroxine, and 14% took methimazole. Examining underlying diseases before hospitalization showed that 46 patients (65.7%) had euthyroid, 14 patients (20.3%) had hypothyroid, and ten patients (14%) had hyperthyroid.

Mass in the neck was the most frequent symptoms before surgery (88.6%). Total thyroidectomy and collar incision were the mostly used surgeries with, respectively, 74.3% and 95.7%.

None of the participants received iodine therapy alone, and all of them underwent surgery. Diagnosis methods were CT scan along with CXR in 82.9% of the cases and CT scan along with CXR and ultrasonography in 17.1% of the cases.

The comparative examination of frequency of postoperative complications according to the type of the data presented in Table 1 shows that 60% of the men (12 patients) and 42% of the women (21 patients) experienced postoperative complications; however, this difference was not significant although there was a difference of 18% based on Chi-square test. In comparative examining the percentage of the complications based on the age groups presented in Table 2, it was shown that the percentage of the complications among individuals under 45 years was 38.5%, among those between 45 and 60 years was 44.7%, and among those over 60 years was 70%. Although the difference between the age groups was over 30%, this difference was not significant due to lack of participants in the age group of over 60 years [Table 2].

In examining the postoperative pathologic findings, most of the participants (41 patients, 58.5%) were reported to have multi-nodular goiter, 22.9% (16 patients) papillary cell carcinoma, 7.1% (five patients) medullary carcinoma, 5.7% (four patients) anaplastic carcinoma, 5.7% (four patients) thyroid lymphoma, and only 1.4% (one patient) thyroid adenoma [Table 3].

Discussion

Retrosternal goiter was first described by Haller in 1794. It prevalence varies 3%–20% among patients who undergo thyroid surgery. Its extensive prevalence is due to different definitions of this type of goiter.^[32-39] In the present study, the prevalence of retrosternal goiter was 9%.

In the present study, most of the participants (88.6%) had neck mass, 70% (49 patients) had dyspnea, 27.1% (19 patients) had dysphonia, 22.9% (16 patients) had dysphagia, 15.7% (11 patients) had hoarseness, and only eight patients (11.4%) had no symptoms before surgery. In a study carried out in 2006, dyspnea was reported as the most common functional symptom among young patients (39.3%) due to compression of the trachea by the goiter, and dysphagia (16.2%) and the second most common symptom that has no relationship with goiter development among this group of patients. In their study, Grainger *et al.* (2005) reported

that patients with large goiter glands can have no symptoms in 10%–35% of cases, which is similar to the present study. According to the results of the study carried out by Siderys, 17%–32% of the patients who undergo surgery are asymptomatic, and their goiter is accidentally diagnosed in their CXR. In these patients, due to consequent hazardous complications, it is better to treat goiter by prophylaxis method.^[40,41] In the present study, diagnosis methods were CT scan along with CXR in 82.9% of

Table 1: Frequency of postoperative complications percentage according to sex groups

Crosstab	Postoperative complications		Total	P
	No	Yes		
Sex				
Male				
Count	8	12	20	0.173
Percentage within sex	40.0	60.0	100.0	
Female				
Count	29	21	50	
Percentage within sex	58.0	42.0	100.0	
Total				
Count	37	33	70	
Percentage within sex	52.9	47.1	100.0	

Table 2: Frequency of postoperative complications according to age groups among patients with retrosternal goiter

Crosstab	Postoperative complications		Total	P
	No	Yes		
Age group				
Below 45 years				
Count	8	5	13	0.272
Percentage within age group	61.5	38.5	100.0	
45-60 years				
Count	26	21	47	
Percentage within age group	55.3	44.7	100.0	
Over 60 years				
Count	3	7	10	
Percentage within age group	30.0	70.0	100.0	
Total				
Count	37	33	70	
Percentage within age group	52.9	47.1	100.0	

Table 3: Frequency of postoperative pathologic findings (lymphoma, anaplastic, medullary, etc.) among the patients with retrosternal goiter

Postoperative pathologic findings (lymphoma, anaplastic, medullary, etc.)	Frequency (%)
MNG	41 (58.5)
PTC	16 (22.9)
Medullary	5 (7.1)
Anaplastic	4 (5.7)
Lymphoma	4 (5.7)
Total	70 (100.0)

MNG: Multinodular goiter; PTC: Papillary thyroid carcinoma

the cases and CT scan along with CXR and ultrasonography in 17.1% of the cases.

The results of the present 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 superior mediastinal mass, tracheal deviation, and tracheal stenosis. Ultrasonography was done for 17.1% of the patients, and 100 of them had multinodular goiter in both thyroid lobes and larger than normal thyroid. MRI was not carried out for any of the patients. In the study carried out by Cui and Zhang the highest rate of diagnosis was related to CXR (70%) and CT scan (96%).^[30] CXR is abnormal in most cases.^[42] Studies indicated that radiography plays a limited role in measuring thyroid diseases. Radiography can show soft-tissue masses, tracheal deviation, and calcifications in thyroid. Radiography findings, however, have neither sensitivity nor specificity. As tracheal deviation and stenosis can be due to another reason except for retrosternal goiter, calcification in neck can be due to several other reasons except for thyroid cancer, and lung and bone metastases can be originated from several primary places. Like ultrasonography, MRI is not a sensitive method to show lesions in the thyroid, and does not have enough specificity to not prefer other imaging diagnosis methods over it. It is, however, useful in lymphadenopathy evaluation and development of thyroid neoplasms. Nowadays, MRI plays a limited role in diagnosing thyroid nodules. It seems to be useful in diagnosis of neck lymph node metastasis. CT scan is a useful method to evaluate lymphadenopathy, local development of thyroid, and spread to mediastinum or retrotracheal zone. Ultrasonography is an appropriate method for primary diagnosis of lesions in the thyroid, and CT scan and MRI are useful to stage the lesions. However, it cannot distinguish benign and malignant nodules.^[38] Neck scan is not the routine part of estimating thyroid nodule, but it can be used in patients with significant pressure or evaluating the retrosternal area or tracheal density. In the present study, 25% of the participants underwent fine-needle aspiration before the surgery, and their pathological findings indicated two cases of modular goiter and six cases of multinodular goiter. In the present study, 74.3% of the patients underwent total thyroidectomy, 25.7% subtotal thyroidectomy, 95.7% collar incision, and 4.3% median sternotomy. In their study, Gourin *et al.* reported that the most common retrosternal goiter surgery is neck incision, and sternotomy is carried out in rare cases, which is similar to the present study. However, selecting surgery method is completely dependent on the surgeon's experience and a method is chosen that led to minimum threat in terms of bleeding and hematoma.^[43-45]

Available data on treatment methods for patients with retrosternal goiter indicated that almost all of the patients underwent surgery, and only two patients (2.9%) had surgery along with iodine therapy before surgery, and none of them had iodine therapy alone. Radioisotope iodine 123 is often a choice that indicates metastatic cancer well, and one-third of papillary carcinoma and two-third of follicular carcinoma are so iodine absorbent that they can be seen. However, radionuclide imaging is not reliable in

approve or reject cancer.^[38] Moreover, using radioactive iodine to diagnose retrosternal goiter before surgery may lead to dyspnea, cause severe inflammation in airways, and make the disease an emergency condition which should be dealt with much care.^[43]

In the present study, about 47.14% of the participants experienced complications after the surgery, but 52.9% had no complications. Among the complications, 25.7% of the participants had early dysphonia, 12.9% had early dyspnea, 11.4% had transient hypocalcemia, 2.9% had late dysphonia, and 7.1% had postoperative bleeding. Permanent hypocalcemia was not seen in any of the patients. The results of a study carried out on 75 patients by Ben Nun *et al.* (2006) showed that transient recurrent nerve injury after surgery occurred in 7% of the patients, permanent nerve damage in 4% of the patients, transient hypocalcemia in 10% of them, and permanent hypocalcemia in 2.6% of them.

Examining the postoperative pathologic findings showed that 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, and only 1.4% were thyroid adenoma. In a study conducted in 2002, postoperative pathologic findings showed that most cases were multinodular goiter (54.7%), thyroid adenoma (21.9%), and thyroid carcinoma (15.6%).^[30] In a study, Aghajanzadeh (2006) reported that 68.8% of the patients had multinodular goiter, 21.9% had papillary cell carcinoma, 3.1% had modular cell carcinoma, 3.12% had anaplastic carcinoma, and 3.1% had thyroid lymphoma. Retrosternal goiter patients' precaution is highly significant. Chest goiter along with papillary and medullary cancers had highly acceptable results and good survival rate.^[46] In retrosternal goiter, however, patients with anaplastic and lymphoma cancers had a survival rate of about 6 months to 1 year.^[47]

Conclusion

The results of the present study showed that incidence of retrosternal goiter is higher among women and most patients with retrosternal goiter in old ages. Their common symptoms are dyspnea and dysphonia. They do not respond to suppressive therapies, and their size does not decrease. Moreover, with the passage of time, the possibility of turning into cancer is high. Bleeding in goiter leads to high compression on the trachea and creation of an emergency condition; therefore, it is better for all patients to undergo surgery in appropriate conditions unless there are cardiovascular problems.

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Conflicts of interest

There are no conflicts of interest.

References

- Hinson JR, Chew SH. The Endocrine System: Systems of the Body Series. 2nd ed. Elsevier Health Sciences: Arjmand; 2010.
- McGahan JG. Diagnostic Ultrasound. 2nd ed., Ch. 11. CRC Press; 2007.
- Radhad B. Incidence of nodular thyroids in sonography of 10-70-year-old individuals without the history of thyroid diseases. *Iran J Ear Throat Nose Larynx* 2004;16:7-13.
- L Hegedüs. The thyroid nodule. *N Engl J Med* 2004;21:1764-71.
- Nussey S, Whitehead S., The thyroid gland, *Endocrinology*, BIOS Scientific Publishers; 2001, Chapter 3.
- Pepper VK, Breuer C, Aldrink JH. Thyroid and parathyroid disease 29. *Fundamentals of Pediatric Surgery*. Springer International Publishing:Switzerland; 2016. p. 243.
- Neves MC, Rosano M, Hojaij FC, Abrahão M, Cervantes O, Andreoni DM, *et al.* A critical analysis of 33 patients with substernal goiter surgically treated by neck incision. *Braz J Otorhinolaryngol* 2009;75:172-6.
- Derwahl M, Studer H. Nodular goiter and goiter nodules: Where iodine deficiency falls short of explaining the facts. *Exp Clin Endocrinol Diabetes* 2001;109:250-60.
- Hughes K, Eastman C. Goitre-causes, investigation and management. *Aust Fam Physician* 2012;41:572-6.
- Sriram Bhat M. *SRB's Clinical Methods in Surgery*. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.; 2015.
- Kenneth WR, Jesse Fest. The best surgical approach for treating multinodular goiter. *Eramsus J Med* 2011;2:24-6.
- Ross DS. Treatment of Hypothyroidism; 2016;26:1343-98.
- Dubbs SB, Spangler R. Hypothyroidism: Causes, killers, and life-saving treatments. *Emerg Med Clin North Am* 2014;32:303-17.
- Vargas-Uricoechea H, Bonelo-Perdomo A, Sierra-Torres CH, Meza-Cabrera I. Autoimmune thyroid disease (Flajani-Parry-Graves-von Basedow Disease): An overview of treatment. *Thyroid Disorders*. Springer International Publishing:Switzerland; 2016. p. 169-84.
- Wong KK, Shulkin B, Gross M, Avram A. Retrospective analysis of efficacy of radioactive iodine treatment of hyperthyroidism using a single calculated 131-I dose. *J Nucl Med* 2016;57 Suppl 2:211.
- Tietgens ST, Leinung MC. Thyroid storm. *Med Clin North Am* 1995;79:169-84.
- Chiha M, Samarasinghe S, Kabaker AS. Thyroid storm: An updated review. *J Intensive Care Med* 2015;30:131-40.
- Zargar AH, Ganie MA, Masoodi SR, Laway BA, Bashir MI, Wani AI, *et al.* Prevalence and pattern of sick euthyroid syndrome in acute and chronic non-thyroidal illness - Its relationship with severity and outcome of the disorder. *J Assoc Physicians India* 2004;52:27-31.
- Medeiros-Neto G, Camargo RY, Tomimori EK. Approach to and treatment of goiters. *Med Clin North Am* 2012;96:351-68.
- Paschke R. Molecular pathogenesis of nodular goiter. *Langenbecks Arch Surg* 2011;396:1127-36.
- Pellegriti G, Frasca F, Regalbuto C, Squatrito S, Vigneri R. Worldwide increasing incidence of thyroid cancer: Update on epidemiology and risk factors. *J Cancer Epidemiol* 2013;2013:965212.
- Wilson B, Ramprakash B, Sambasivam K. A rare presentation of Takotsubo cardiomyopathy following total thyroidectomy for carcinoma thyroid. *Int J Contemp Med* 2014;2:141.
- Gonçalves J, Kowalski LF. Surgical complications after thyroid surgery performed in a cancer hospital. *Otolaryngol Head Neck Surg* 2005;132:490-4.
- Carvalho MB. *Diagnosis and Treatment of Substernal Goiter*, Rio de Janeiro, Editora Rubio; 2007. p. 329-48.
- Stevenk Dankle AD. *Substernal Thyroid Goiter*; 2014. Available from: <http://www.emedicine.medscape.com/article/849159-overview>. [Last accessed on 2015 Dec 11].
- RG Hardy. Controversial topics in surgery, management of retrosternal goiters. *Ann R Coll Surg Engl* 2009;91:8-11.
- Bouzari B. Abdominal wall, soft tissue sarcomas, hernia, and children thyroid. *Translation of Schwartz's Principles of Surgery*. Vol. 7, Ch. 38. The McGraw-Hill Companies, Inc; 2010. p. 150-70.
- Farling PA. Thyroid disease. *Br J Anaesth* 2000;85:15-28.
- Shahlan DM. Surgical treatment of intrathoracic goiter. In: Cady B, Rossi RL, editors. *Surgery of the Thyroid and Parathyroid Glands*. Philadelphia: Saunders; 1991. p. 215.
- Cui Y, Zhang Z. Diagnosis and surgical management for the retrosternal thyroid mass. *Chin Med Sci J* 2002;17:173-7.
- Aghajanzadeh M, Safarpour F, Kouhsari M, Alavi S, Amani H, Kalantari S. Substernal goiters: Clinical presentation, diagnosis, and surgical management. *Iranian Journal of Endocrinology and Metabolism*,8: (12-2006).
- Cho HT, Cohen JP, Som ML. Management of substernal and intrathoracic goiter. *Otolaryngol Head Neck Surg* 1986;94:282-7.
- De Andrade MA. A review of 128 cases of posterior mediastinal goiter. *World J Surg* 1977;1:789-97.
- Coskun A, Yildirim M, Erkan N. Substernal goiter: When is a sternotomy required? *Int Surg* 2014;99:419-25.
- Ayache S, Mardyla N, Tramier B, Strunski V. Clinical signs and correlation with radiological extent in a series of 117 retrosternal goitre. *Rev Laryngol Otol Rhinol (Bord)* 2006;127:229-37.
- Huins CT, Georgalas C, Mehrzad H, Tolley NS. A new classification system for retrosternal goitre based on a systematic review of its complications and management. *Int J Surg* 2008;6:71-6.
- Brito JP, Yarur AJ, Prokop LJ, McIver B, Murad MH, Montori VM, *et al.* Prevalence of thyroid cancer in multinodular goiter versus single nodule: A systematic review and meta-analysis. *Thyroid* 2013;23:449-55.
- Ket S, Ozbudak O, Ozdemir T, Dertsiz L. Acute respiratory failure and tracheal obstruction in patients with posterior giant mediastinal (intrathoracic) goiter. *Interact Cardiovasc Thorac Surg* 2004;3:174-5.
- Wright D, Mathisen DJ. Mediastinal tumors: Diagnosis and treatment. *World J Surg* 2001;25:204-9.
- Miller MR, Pincock AC, Oates GD, Wilkinson R, Skene-Smith H. Upper airway obstruction due to goitre: Detection, prevalence and results of surgical management. *Q J Med* 1990;74:177-88.
- Siderys H, Rowe GA. Superior vena Caval syndrome caused by intrathoracic goiter. *Am Surg* 1970;36:446-50.
- Shaha AR, Burnett C, Alfonso A, Jaffe BM. Goiters and airway problems. *Am J Surg* 1989;158:378-80.
- Park HM, Tarver RD, Siddiqui AR, Schauwecker DS, Wellman HN. Efficacy of thyroid scintigraphy in the diagnosis of intrathoracic goiter. *AJR Am J Roentgenol* 1987;148:527-9.

44. Torres A, Arroyo J, Kastanos N, Estopá R, Rabaseda J, Agustí-Vidal A, *et al.* Acute respiratory failure and tracheal obstruction in patients with intrathoracic goiter. *Crit Care Med* 1983;11:265-6.
45. Gourin A, Garzon AA, Karlson KE. The cervicomediastinal approach to intrathoracic goiter. *Surgery* 1971;69:651-4.
46. Katlic MR, Grillo HC, Wang CA. Substernal goiter. Analysis of 80 patients from Massachusetts general hospital. *Am J Surg* 1985;149:283-7.
47. Veronesi G, Leo F, Solli PG, D'Aiuto M, D'Ovidio F, Mazzarol G, *et al.* Life-threatening giant mediastinal goiter: A surgical challenge. *J Cardiovasc Surg (Torino)* 2001;42:429-30.