



COMPLICATIONS OF RETROSTERNAL GOITRE SURGERY: A RETROSPECTIVE ANALYSIS

Syed Zahid Ali Shah¹, Muhammad Imran Shah^{2*}

¹ Assistant Professor, Department of Cardiothoracic Surgery, Ayub Medical College, Abbottabad, Pakistan.

² Assistant Professor, Department of ENT, Ayub Medical College, Abbottabad, Pakistan.
Email: misgmc80@yahoo.com

***Corresponding Author:** Muhammad Imran Shah

Assistant Professor, Department of ENT, Ayub Medical College, Abbottabad, Pakistan.
Email: misgmc80@yahoo.com

ABSTRACT

Background: Retrosternal goitre (RSG) represents a unique surgical challenge due to its mediastinal extension and proximity to vital structures. This study evaluates the complications associated with RSG surgery and identifies factors influencing postoperative outcomes.

Methods: A retrospective analysis was conducted on 73 patients who underwent thyroidectomy for retrosternal goitre between 3rd June 2014 and 14th February 2022. Data on patient demographics, surgical approach, and postoperative complications were collected and analyzed. Complications assessed included recurrent laryngeal nerve injury, hypoparathyroidism, bleeding, wound infection, and respiratory complications.

Results: A total of 73 patients were included. The cervical approach alone was successful in 68 (93.2%) cases, while 5 (6.8%) patients required mediastinotomy; no patient required sternotomy. The overall complication rate was 24.7%, with transient hypocalcaemia being the most common (12.3%), followed by transient hoarseness (5.5%). Transient tracheomalacia occurred in 3 patients (4.1%), partial tracheomalacia in 1 patient (1.4%), and permanent hypoparathyroidism in 1 patient (1.4%). Tracheopexy was performed in 8 patients (11.0%). No tracheostomy was performed. No permanent recurrent laryngeal nerve palsy was observed.

Conclusion: Surgery for retrosternal goitre carries a risk of complications including transient hypocalcaemia, transient recurrent laryngeal nerve injury, and respiratory complications. The cervical approach remains the gold standard and was successful in all cases. Meticulous surgical technique and preoperative planning are essential for optimizing outcomes.

KEYWORDS: Retrosternal goitre, thyroidectomy, surgical complications, hypoparathyroidism, recurrent laryngeal nerve injury, tracheomalacia, tracheopexy.

INTRODUCTION

A thyroid gland extending below the thoracic inlet is known as Retrosternal goitre (RSG) or substernal/plunging goitre.^{1,2} The incidences of RSG after thyroid surgery have varied widely from 2% to 26%, depending on the diagnostic criteria and reporting.^{3,4} These are mostly non-cancerous, with multinodular hyperplasia being the most frequent histopathological result, although there have been reports of up to 10% of malignancy.⁵

RSG can present in a variety of ways ranging from being an incidental on imaging to airway compromise that can be life-threatening.⁶ The most common symptom of tracheal compression is dyspnoea on exertion, while palpable neck mass, stridor, and dysphagia are less common symptoms.⁷ But, as the number of cross-sectional imaging applications grows, the number of incidental diagnoses

in patients without symptoms has also increased.

Surgical resection is the preferred treatment for both symptomatic and most of the cases of asymptomatic goitre, because of the potential threat of immediate complications from bleeding or malignancy.^{8,9} Total thyroidectomy is the procedure of choice because this procedure deals with the whole disease process and reduces the risk of recurrence.¹⁰ The surgical treatment of RSG has its challenges, however, because the mediastinal location limits access, as well as the proximity of a number of important structures such as the recurrent laryngeal nerves (RLN), parathyroid glands, major vessels and trachea.¹¹

There has been much discussion in the literature about the surgical approach to RSG. The initial approach is preferably a cervical incision and it is reported to be successful in experienced hands at rates of more than 90%.¹² If the goitre is not safe for delivery through the neck, mediastinotomy or other approaches to the thorax may be necessary. Patient selection for sternotomy is critical as it has been shown to have a higher rate of complications.¹³

The aim of the study was to: assess the complications of retrosternal goitre surgery performed at our institution over an 8-year period, determine the factors associated with post-operative complications and compare the outcomes of different surgical approaches at our hospital.

MATERIALS AND METHODOLOGY

Study Design and Setting: This study is a retrospective, observational study which was carried out in a tertiary care hospital of Pakistan from 3rd June 2014 to 14th February 2022. The study got IRB/Ethics committee approval.

Study Population: The patients who had thyroid surgery for retrosternal goitre were all included in the study period. The presence of any thyroid gland extending below the thoracic inlet, as determined by imaging or intraoperatively was considered Retrosternal goitre. Patients with cervical goitre but not retrosternal extension, patients who have operated on for malignant pathology that necessitated considerable dissection of the mediastinum, and patients with incomplete medical records were excluded.

Sample Size: In this study 73 patients who fulfilled the inclusion criteria were included.

Preoperative Assessment: Comprehensive pre-operative evaluation was performed on all patients and comprised:

Detailed history taking, including duration of symptoms, compressive symptoms (dyspnoea, dysphagia, stridor, voice changes) and physical examination, clinical assessment

Biochemical evaluation: Thyroid function tests (TSH, free T4, free T3) and serum calcium level

Imaging studies: Neck ultrasound to evaluate thyroid gland, cervical lymph nodes

Contrast enhanced CT scan of neck/chest to assess degree of retrosternal extension, compression of the trachea, vascular relationships and to help plan surgery.

Preoperative laryngoscopy: To establish normal vocal cord function.

Assessment of airway patency and planning of anaesthetic;

Surgical Technique: All surgeries were performed under general anaesthesia with endotracheal intubation. Surgical decision-making was based on the clinical condition and imaging findings prior to surgery. A cut was made in the neck. The strap muscles were pulled towards the lateral side. The mediastinal goitre was delivered through the thoracic inlet by gentle traction and digital dissection in case of retrosternal extension. This was done by blunt dissection and precautions were taken to prevent injury to adjacent structures [1]. For some of the goitres which could not be accessed by the cervical approach alone, a mediastinotomy was undertaken to gain access to the mediastinal component.

Indication of the procedure: Total thyroidectomy was the most desirable procedure in all patients.

Medication Therapy: All patients were prescribed the proper medication therapy according to standard protocol. No steroid treatment was given.

Additional Procedures: In some cases, tracheomalacia was noted during surgery and tracheopexy was performed in 8 patients (11.0%) to provide support to the airway and prevent airway compromise.

Assessment of postoperative care and complications.**Post-operative follow-up of all patients was done for:**

Recurrent Laryngeal Nerve Injury: Clinically evaluated for voice changes (hoarseness, vocal cord palsy) and confirmed by laryngoscopy if suspected. Transient injury was interpreted as resolving in less than 6 months and permanent injury as a persistent palsy longer than 6 months [2].

Hypocalcaemia/Hypoparathyroidism: Serum calcium was measured at 6, 12 and 24 hours after surgery. Transient hypocalcaemia was taken to be those with a calcium level below 8.0 mg/dL which required a calcium supplement and were still calcium-normal after 6 months. Hypoparathyroidism was considered permanent if hypocalcaemia could not be controlled with chronic calcium supplementation for more than 6 months [2].

Haemorrhage/Haematoma: Visual inspection of wound and drainage output and clinical signs of neck swelling and/or airway compromise.

Wound Infection: Wound that needs antibiotic or surgical treatment.

Respiratory complications: transient tracheomalacia (persistent airway narrowing, but surgical intervention is not necessary) was classified as temporary compromise of the airways; partial tracheomalacia (persistent airway narrowing, but surgical intervention is necessary, however prolonged) was classified as persistent compromise of the airways, but surgical intervention is not immediately required; tracheopexy performed for tracheal support [3] was classified as respiratory complications.

Length of Hospital Stay: Measured from surgery to the time the patient leaves the hospital.

Data Collection

The records from the hospital, surgical notes and outpatient follow-up records were used for data collection. Variables recorded included:

Gender and age of the respondents.

Clinical presentation

Preoperative imaging findings

Surgical approach (cervical alone vs. cervical with mediastinotomy)

The extent of thyroid surgery. The level of thyroid surgery performed.

Additional procedures (tracheopexy)

Postoperative complications (as outlined above)

Length of Hospital Stay: Number of days in hospital.

Histopathological findings

Statistical Analysis

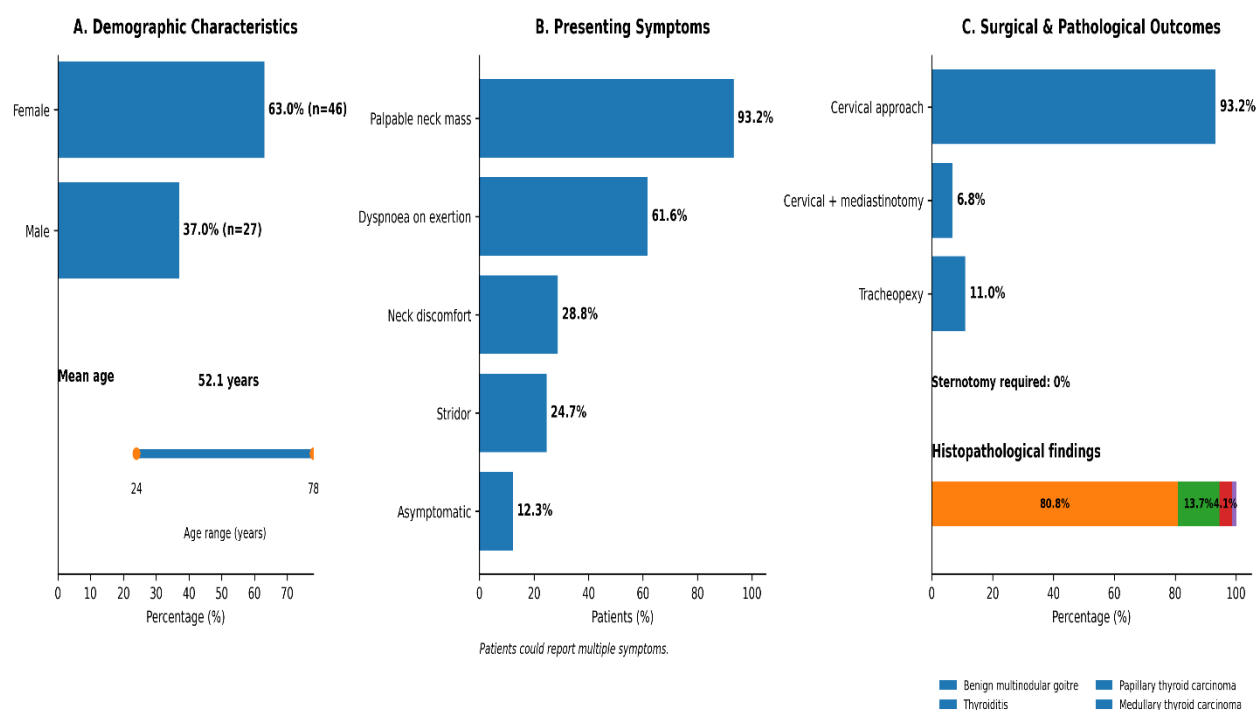
The SPSS software (version 25.0; IBM Corp., Armonk, NY, USA) was used to analyze the data. Demographic and clinical data were analyzed statistically. The continuous variables were reported as mean $\pm$ SD or median (range) and categorical were reported as frequencies and percentages [9].

RESULTS**Demographic and Clinical Characteristics**

During the study period a total of 73 patients were subjected to thyroidectomy for retrosternal goitre. The demographic and clinical features are summarized in Table 1.

Table 1. Demographic and Clinical Characteristics of Patients with Retrosternal Goitre (n=73)

Characteristic	n (%) / Mean $\pm$ SD
Age (years)	52.1 $\pm$ 13.8
Age range (years)	24–78
Male	27 (37.0%)
Female	46 (63.0%)
Palpable neck mass	68 (93.2%)
Dyspnoea on exertion	45 (61.6%)
Neck discomfort	21 (28.8%)
Stridor	18 (24.7%)
Asymptomatic	9 (12.3%)
Tracheal compression on CT	52 (71.2%)
Tracheal deviation	31 (42.5%)
Cervical approach alone	68 (93.2%)
Cervical approach + mediastinotomy	5 (6.8%)
Sternotomy	0 (0%)
Total thyroidectomy	73 (100%)
Tracheopexy	8 (11.0%)
Steroid therapy	0 (0%)
Benign multinodular goitre	59 (80.8%)
Papillary thyroid carcinoma	3 (4.1%)
Medullary thyroid carcinoma	1 (1.4%)
Thyroiditis	10 (13.7%)

Demographic, Clinical, and Surgical Characteristics of Patients Undergoing Thyroidectomy for Retrosternal Goitre (n=73)

The mean age was 52.1 ± 13.8 years, with a range from 24 to 78 years. The females predominated (63.0%) which overlaps with the greater incidence of thyroid disease in females [2]. The most common presenting symptoms were palpable neck mass (93.2%) and dyspnoea on exertion (61.6%). Stridor was noted in 24.7% and 12.3% of patients were asymptomatic.

In 71.2% of patients, preoperative computed tomography (CT) showed compression of the trachea, and in 42.5% there was deviation of the trachea [1]. All patients (100%) underwent total thyroidectomy. 68 patients (93.2%) were treated with the cervical approach and 5 patients (6.8%) underwent mediastinotomy. No patient went on to require Sternotomy (0%). In 8 patients (11.0%) tracheopexy was performed.

Postoperative Complications

In total, there were 18 patients (24.7%) with postoperative complications. The distribution of complications is shown in Table 2.

Table 2. Postoperative Complications after Retrosternal Goitre Surgery (n=73)

Complication	n	Incidence (%)
Overall postoperative complications	18	24.7%
Transient hypocalcaemia	9	12.3%
Permanent hypoparathyroidism	1	1.4%
Transient hoarseness / RLN injury	4	5.5%
Permanent RLN palsy	0	0%
Bleeding / haematoma	0	0%
Wound infection	0	0%
Seroma collection	0	0%
Transient tracheomalacia	3	4.1%
Partial tracheomalacia	1	1.4%
Tracheostomy	0	0%
Atrial fibrillation	0	0%
Mortality	0	0%

Transient hypocalcaemia was seen in 9 patients (12.3%). All cases were treated with oral calcium and were solved in 3 months. One patient (1.4%) developed permanent hypoparathyroidism that needed calcium and vitamin D supplementation for more than 6 months.

Recurrent Laryngeal Nerve Injury: 4 patients (5.5%) had transient hoarseness/RLN injury. All cases cleared up on their own in 4 to 6 months. There were no cases of RLN palsy that persisted beyond the initial phase (0%).

Respiratory Complications: Transient tracheomalacia was seen in three (4.1%) patients; all three were treated by observation and supportive care and were never treated. In 1 patient (1.4%), the trachea was partially soft, necessitating a prolonged watchful waiting period, but without surgery. Tracheal support was provided in 8 patients (11.0%) by tracheopexy. No tracheostomy was done (0%).

Other complications: No patient suffered from postoperative haematoma (0%), wound infection (0%), seroma collection (0%) or atrial fibrillation (0%). There was no perioperative mortality (0%).

Histopathology

Benign multinodular goitre (80.8%), papillary thyroid carcinoma (PTC- 4.1%), medullary thyroid carcinoma (MTC- 1.4%), and thyroiditis (TIT- 13.7%) were observed in the histopathological analysis of the patients.

Table 3. Comparison of Outcomes by Surgical Approach

Outcome	Cervical approach alone (n=68)	Cervical mediastinotomy (n=5) +	p-value
Postoperative complications	14 (20.6%)	3 (60.0%)	0.06
Length of hospital stay (days), median	2 (2–5)	4 (3–5)	0.04*
Transient hypocalcaemia	8 (11.8%)	1 (20.0%)	0.48
Transient hoarseness/RLN injury	3 (4.4%)	1 (20.0%)	0.20
Transient tracheomalacia	2 (2.9%)	1 (20.0%)	0.17

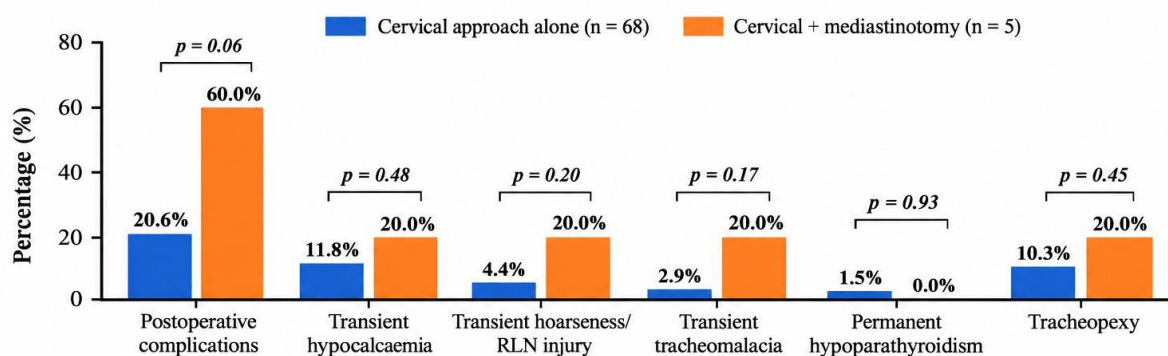
Complications of Retrosternal Goitre Surgery: A Retrospective Analysis

Permanent hypoparathyroidism	1 (1.5%)	0 (0%)	0.93
Tracheopexy	7 (10.3%)	1 (20.0%)	0.45

* $p < 0.05$ was considered statistically significant.

Postoperative Outcomes After Thyroidectomy for Retrosternal Goitre

Cervical approach alone (n = 68) vs. Cervical approach with mediastinotomy (n = 5)



Outcome	Cervical approach alone (n = 68)	Cervical + mediastinotomy (n = 5)	p-value
Postoperative complications	20.6%	60.0%	0.06
Length of hospital stay, median (IQR)	2 (2–5) days	4 (3–5) days	0.04*
Transient hypocalcaemia	11.8%	20.0%	0.48
Transient hoarseness/RLN injury	4.4%	20.0%	0.20
Transient tracheomalacia	2.9%	20.0%	0.17
Permanent hypoparathyroidism	1.5%	0%	0.93
Tracheopexy	10.3%	20.0%	0.45

Data are presented as n (%) or median (IQR). P-values for categorical variables were derived from Fisher's exact test, and for the continuous variable (length of hospital stay) from the Mann–Whitney U test. * $p < 0.05$.

Note: Length of hospital stay was the only outcome reaching statistical significance, while postoperative complications

DISCUSSION

The extension of the goitre into the mediastinum and close proximity of the thyroid to the trachea, recurrent laryngeal nerves and parathyroid glands make retrosternal goitre a technically difficult thyroid disease. The overall complication rate in our study of 73 patients from 3rd June 2014 to 14th February 2022 was 24.7%. This is similar to the variable incidence of complications reported in previous studies, and highlights the need for careful pre-operative assessment and careful surgical technique.³

Transient hypocalcaemia was the commonest complication (12.3%) while permanent hypoparathyroidism occurred in one patient (1.4%) in our series. The results of this study are better than those of Wang et al. who reported that 14.29% and 20.54% of patients who underwent mostly cervical surgery developed transient hypocalcaemia and transient hypoparathyroidism, respectively.¹⁵ These are relative rates in our series and might be due to careful identification and preservation of the parathyroid glands, and careful dissection of the capsule. Similarly, hypocalcaemia and hypoparathyroidism were found to be of significance as postoperative complications in RSG surgery by Abdelrahman et al.³ The higher risk of calcium disturbance in RSG is probably due to the more extensive dissection surrounding the inferior thyroid pole and mediastinal portion, which might make the blood flow to the parathyroid glands difficult.

In our cohort 5.5% of patients had injury to the transient recurrent laryngeal nerve (RLN); none had permanent RLN palsy. The outcome is similar to that of Wang et al., who found that 5.36% of patients treated via the cervical approach suffered a temporary RLN palsy, while 0.89% had a permanent palsy.¹⁵ The absence of permanent RLN injury in our study may be related to careful identification and preservation of the nerve, adequate exposure and controlled dissection of the retrosternal component. These results confirm the relevance of the surgeon's experience and, if available, of the use of intraoperative monitoring of nerves in RSG patients with technical difficulties.

An important finding in our study was respiratory complications. Tracheomalacia was seen in 5.5% of the patients, with three patients having transient tracheomalacia and one patient having partial tracheomalacia. By contrast, Abdelrahman et al. reported 13.4% of 30 RSG patients had tracheal stenosis,³ and Wang et al. reported a 1.79% of 115 patients with tracheal stenosis.¹⁵

Some of the discrepancies among studies with regard to the results may be attributed to variation in the length of time the trachea is compressed, goitre size, the extent of the compression of the mediastinum, and the definition used for tracheomalacia. In our study, eight patients (11.0%) had undergone the procedure (tracheopexy) based on intraoperative evaluation of weakness of the tracheal wall or narrowing of the airways after thyroidectomy. This was a preventative measure which enabled the surgical team to deal with any potential airway instability during thyroidectomy, and more importantly, no patients required postoperative tracheostomy. However, given the fact that tracheopexy was selectively performed based on the intra-operative findings, a more extensive prospective study needs to be performed to ensure the safety of the operation in preventing post-operative airway complications.

The cervical approach was successfully performed in 93.2% of our patients, while 6.8% required mediastinotomy, and none of the patients required sternotomy.

An extracervical approach is reserved for selected patient with extensive mediastinal extension or unfavorable anatomical relationship should be considered. Preoperatively, CT can be useful in assessing the inferior extent of the goitre, relationship with the major vessels and trachea and risk of needing and/or requiring an extracervical approach.

Benign multinodular goitre was the most common histopathological diagnosis (80.8%), followed by thyroiditis (13.7%), papillary thyroid carcinoma (4.1%) and medullary thyroid carcinoma (1.4%). The overall malignancy rate in our study was therefore 5.5%, calculated from the combined incidence of papillary and medullary thyroid carcinomas. This finding was comparable to the malignancy rate reported by Wang et al. (5.22%) and lower than that reported by Abdelrahman et al. (10%). These findings highlight the importance of thorough histopathological evaluation of all resected retrosternal goitres, as malignancy may be identified even when the preoperative diagnosis is benign.

The results underlined the significance of thorough histopathological evaluation of all specimens removed from the resected RSG.

The results of our study are indicative that RSG can be treated safely by experienced hands, the majority of patients can be treated safely through a cervical approach. The relatively low incidence of permanent hypoparathyroidism and permanent injury to the RLN and the lack of tracheostomy in our series are positive outcomes. Concurrently, the incidence of hypocalcaemia, RLN injury and especially tracheomalacia illustrates the importance of careful pre-operative CT assessment, airway planning and careful dissection during surgery. An observational study also concluded that the anatomical location and the size of the retrosternal portion were significant factors for complications after surgery.¹⁶

Based on our experience, selective tracheopexy can be a valuable adjunct in patients that show a weakness of the trachea during surgery; further multicenter studies are still needed to clarify the indications for the procedure and possible long-term benefits.

LIMITATIONS

The main limitations of this study are its retrospective design which generates selection bias, incomplete documentation of data, single-centre study, small sample size (n=73) which makes subgroup analysis results less convincing, the lack of a matched cervical goitre control group to compare complication rates for retrosternal extension alone, and the short follow-up period which does not allow for the evaluation of long-term complications or recurrence rates.

CONCLUSION

Transient hypocalcaemia (12.3%), transient recurrent laryngeal nerve injury (5.5%), transient tracheomalacia (4.1%), partial tracheomalacia (1.4%) and permanent hypoparathyroidism (1.4%) are the common

complications of surgery for retrosternal goitre. For the support of the trachea, tracheopexy was performed in 8 patients (11.0%). The cervical approach alone had a high success rate and in this series resulted in successful treatment in 93.2% of patients. In 6.8% of cases mediastinotomy was performed and no patient had to undergo sternotomy. There were no recorded permanent recurrent laryngeal palsy, tracheostomy or mortality. To ensure optimal outcome in this difficult patient group, meticulous surgical technique, thorough evaluation and careful intraoperative airway management are crucial.

RECOMMENDATIONS

All patients with suspected retrosternal goitre should have routine preoperative CT scan to assess mediastinal involvement, degree of tracheal compression and vascular relationships to guide surgical planning and predict the need for additional airway procedures. Patients with retrosternal goitre should be referred to high volume tertiary care centers with well-equipped multidisciplinary teams comprising of endocrine surgeons, anaesthetists, respiratory physicians for optimal surgical results and to minimize respiratory complications. A great deal of care must be taken to ensure that the parathyroid glands are identified and preserved, maintaining their vascular supply, to reduce the risk of transient and permanent hypoparathyroidism, and in cases of doubt of survival, autotransplantation may be performed. Intraoperative assessment for tracheal integrity should be done in all cases, and tracheopexy should be performed if it is determined that there is tracheomalacia to avoid postoperative airway compromise and tracheostomy. More prospective, multicentric studies with larger number of patients and longer follow-up are required to establish further risk factors for respiratory complications, long-term results of tracheopexy and recurrence rates.

REFERENCE

1. Knobel M. An overview of retrosternal goitre. *Journal of Endocrinological Investigation*. 2021 Apr;44(4):679-91.
2. Battistella E, Pomba L, Sidoti G, Vignotto C, Toniato A. Retrosternal goitre: anatomical aspects and technical notes. *Medicina*. 2022 Feb 25;58(3):349.
3. Abdelrahman H, Al-Thani H, Al-Sulaiti M, Tabea A, El-Menyar A. Clinical presentation and surgical treatment of retrosternal goitre: a case series study. *Qatar Medical Journal*. 2020 May 4;2020(1).
4. Sakr M. Surgery of the Thyroid Glands. In *Head and Neck and Endocrine Surgery: From Clinical Presentation to Treatment Success* 2016 Feb 9 (pp. 225-333). Cham: Springer International Publishing.
5. Vijayan KN, Safwan M, Akash S. Surgical Management of Retrosternal (Intrathoracic) Goitre. *Kerala Surgical Journal*. 2021 Jul 1;27(2):193-8.
6. Dalal AK, Dalal UR, Wani AJ, Anand L, Attri AK. Retrosternal goitre masquerading as obstructive sleep apnoea in a middle-aged female. *J Evid Based Med Healthc*. 2017;4(78):4639-42.
7. Dünser MW, Dankl D, Petros S, Mer M. The Airway and Lungs. In *Clinical Examination Skills in the Adult Critically Ill Patient* 2018 Apr 10 (pp. 21-49). Cham: Springer International Publishing.
8. Chen AY, Bernet VJ, Carty SE, Davies TF, Ganly I, Inabnet III WB, Shaha AR. American Thyroid Association statement on optimal surgical management of goiter. *Thyroid®*. 2014 Feb;24(2):181-9.
9. Simó R, Nixon IJ, Vander Poorten V, Quer M, Shaha AR, Sanabria A, Alvarez FL, Angelos P, Rinaldo A, Ferlito A. Surgical management of intrathoracic goitres. *European Archives of Oto-Rhino-Laryngology*. 2019 Feb 14;276(2):305-14.
10. Cirocchi R, Trastulli S, Randolph J, Guarino S, Di Rocco G, Arezzo A, D'Andrea V, Santoro A, Barczynski M, Avenia N. Total or near-total thyroidectomy versus subtotal thyroidectomy for multinodular non-toxic goitre in adults. *Cochrane database of systematic reviews*. 2015(8).
11. Kiluba JB. A Topographical and Surgical Anatomical Description of the Recurrent Laryngeal Nerve in Adult and Paediatric Populations of South Africa. University of the Witwatersrand, Johannesburg (South Africa); 2019.
12. Caron NR, Sturgeon C, Clark OH. Persistent and recurrent hyperparathyroidism. Current treatment options in oncology. 2004 Aug;5(4):335-45.

13. Welman K, Heyes R, Dalal P, Hough S, Bunalade M, Anikin V. Surgical treatment of retrosternal goitre. *Indian Journal of Otolaryngology and Head & Neck Surgery*. 2017 Sep;69(3):345-50.
14. Cullinane C, Evoy D, McDermott E, Prichard R. The surgical management of retrosternal goitre; an ongoing controversy. *World J Surg Surgical Res*. 2021; 4. 2021;1328.
15. Wang X, Zhou Y, Li C, Cai Y, He T, Sun R, Tian W, Tang Z, Sheng J, Liu D, Gui C. Surgery for retrosternal goitre: cervical approach. *Gland Surgery*. 2020 Apr;9(2):392.
16. Li W, Li H, Zhang S, Tao Y, Wang X, Cheng J. To explore the risk factors and preventive measures affecting the treatment of retrosternal goitre: An observational study. *Medicine*. 2020 Oct 30;99(44):e23003.