

Cervical Delivery of Retrosternal Goitre is Amenable, But When To Do Sternal Split? ®

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Volume 2 Issue 2- 2019

Received Date: 13 Sep 2019

Accepted Date: 10 Oct 2019

Published Date: 15 Oct 2019

2. Key words

Goitre; Manubriotomy;
Retrosternal.

1. Abstract

1.1. Background: Retrosternal Goitre (RSG) is incidentally diagnosed. The standard treatment is total thyroidectomy via a cervical access. Sternotomy split may be needed in selected cases [1]. Options of the operative techniques, practical surgical problems and preoperative findings indicating thoracic access are retrospectively analyzed reaching reasons for sternal splitting.

1.2. Methods: A retrospective analysis of 21 RSG cases during 5 years period. All patients underwent standard preoperative clinical exam and CT based surgical planning. Surgery was performed by collaborative team via cervical approach and in selected cases via combined approach.

1.3. Results: Total thyroidectomy was performed in all cases. A cervical approach was used in 80.9% of patients. Shorter surgical time was observed in the cervical approach group. Benign struma was observed in 19 patients and a carcinoma in only 2. Postoperatively, transient unilateral recurrent laryngeal nerve palsy occurred in 14.2%.

1.4. Conclusion: Sternal split is indicated only in selected cases. Interdisciplinary team equipped and experienced yields better results.

3. Introduction

Cervical delivery of retrosternal goitre is amenable, but in special situations, sternal split or thoracotomy becomes inevitable. Interdisciplinary assessment of these cases consists of general surgeon and cardiothoracic surgeon [1]. Our study is retrospective; where a review of patients records from the last 5years, who underwent thyroidectomy due to RSG. The primary goal was to analyze the collected preoperative and intraoperative data of those cases searching for findings indicating the need for thoracic access.

4. Methods

Over a 5-year period (January, 2014 - December, 2018), 486 patients underwent thyroidectomy in the general surgery and cardiothoracic surgery departments, Mansoura University Hospitals, Egypt. Only 21 thyroid cases with clinically non-palpable lower pole; suspicious of retrosternal intrathoracic growth or

with a superior mediastinal mass or tracheal deviation on CXR. Preoperative cervicothoracic CT scan studied to confirm diagnosis and help in surgical planning.

All our 21 procedures were performed by team of experts of general surgeon in thyroid surgery and thoracic surgeon.

If the goitre reached at least 2 cm below sternal notch level, it is considered RSG, seen on CT examination, with hyper-extended neck. We adopted the simplest radiological classification as most reports did. The records of these patients were analyzed as regard: age, gender, BMI, obesity, tall, short neck, clinical presentation, previous thyroid intervention, deviation or compression of trachea on CXR or CT, direction of mediastinal extension (anterior or posterior / right or left), the used surgical approach (either cervical or cervical with thoracic), surgical time, its weight, histopathological findings, post-operative complications and total hospital stay (**Table 1**).

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Table 1: Demonstrating the pre and intraoperative characters of both groups

		Cervical approach group (17 cases)	Combined approach group (4cases)	All patients (21 cases)
Mean age		42±1.5 (rang 27-55)	39±2.1 (rang 29-46)	44±5.2 (rang 27-55)
Sex	Male	3	1	6
	Female	12	3	25
Clinical symptoms	Asymptomatic	3	1	4
	Dyspnea	11	3	14
	Pain	3	1	4
	Pressure symptoms	9	3	12
	Dysphagea	8	2	10
	Recurrence	1	1	2
Tracheal compressio		14	3	17
Mediastinal depth	Above arch	10	0	10
	Below arch	7	0	7
	Reaching carina	1	3	4
Descent side	Anterior	12	0	12
	Posterior	7	2	9
	Right	9	3	12
	Left	4	3	7
	Both sides	0	2	2
Weight of goitre		153	482.5	192
Histopathology	Begnin	15	4	19
	Malignant	2	0	2
Surgical time		106 min. (95-240)	175 min. (100-255)	168 min. (95-255)

5. Statistical Analysis

For statistical analysis in this study, we used SPSS version 21. Continuous variable data were expressed as the mean ± standard deviation. Statistical comparisons between the two groups were made through Student's t-test for continuous variables. Statistical significance was set to p values of less than 0.05.

6. Result

Overall, 21 patients over 5 years period nearly 4.3% of all operated goitres, 15 females, 6 males (mean age 44±5.2 years; range: 27-55), were subjected to total thyroidectomy due to RSG. In 17 patients (80.9%), we used cervical approach only. In 2 patients (9.52%), we used accessory median sternotomy and in another 2 manubriotomy (9.52%). Those 4 cases had to be approached through thoracic access after trial was done from cervical, in presence of thoracic surgeon, to achieve complete gland removal. In our series, 16 patients (76.1%) were obese with a short, broad neck.

In cervical group, 14 patients (82.3%) were pre-operatively symptomatic, while 3 (17.6%) was asymptomatic. Various degrees of dyspnea recorded in 11 patients (64.7%); 8 patients had dysphagia (38.1%). In the thoracic approach group, just 1(25%) patient was asymptomatic, while 3 (75%) patients had dyspnea and 2 (50%) complained of dysphagia.

Two cases (9.5%) had with recurrent goitre, after 4 and 23 months (mean 18.5). One of these patients was actually a forgotten intra-thoracic goitre, and reaching the tracheal bifurcation (**Figure 1a,b**). The patient was free of symptoms and incidentally detected in follow up CXR and confirmed by cervicothoracic CT.

Overall, 17 cases (80.9%) (14 from cervical group and 3 from thoracic group), had CT tracheal compression or deviation on CT. Pain sensation was reported in 3cases (17.6%) from cervical group and 1 (25%) in combined access group, while pressure sensation was perceived in 9 (52.%) cases out of 17 cases in cervical group while it was reported in 3 (75%) out of 4 in combined access group. Few cases had toxic manifestations they were 2 in cervical and 1 in combined access group.

Among our RSG cases, 12 patients were extending anteriorly to the trachea (57.1%), posteriorly in 9 patients (42.8%) (**Figure 2,3**).

The downwards mediastinal extension of RSG was towards the right in 12 patients (57.1%), on the left in 7 (33.3%) patients, and bilateral in 2 (9.5%) patients.

While the depth or the mediastinal extent, 10 cases (47.6%) reaching above aortic arch, 7 cases (33.3%) descent till or below the aortic arch (**Figure 2a,b**). Those 17 cases had cervical thyroidectomy. In 4 cases (19%), goitre reached the carina; 3 of them required additional sternotomy.

The mean weight of all removed goitre was 192 g (range: 150-625); the mean weight of cervical group was 153 g (range: 150-350), while the combined approach had mean weight of 482.5 g (range: 180-625).

The mean surgical time was 106 minutes (range: 95-240) in the cervical group and 175 minutes (range: 100-255) in cases in combined group.

Only 2 (9.5%) cases with malignant tissues and both delivered cervically. Histopathologic picture of medullary and papillary carcinoma. Either colloidal goitre or follicular adenoma were detected in the remaining 19 (90.4%) cases.

Post-operative complications recorded in (**Table 2**). Transient RLN in 2 cases (9.5%) in cervical group and 1 case (25%) in combined group. No bilateral injury or permanent injury happened. Transient hypoparathyroid state happened in 3 cases (14.2%) in cervical group only. Airway injury required temporary tracheostomy in 1 case in cervical group. No fatality.

Mean hospital stay was 8±0.5, and the range was 3 to 15 days, with no significant difference between the 2 groups.

We co-related the preoperative and intraoperative parameters with the need to sternal split and only the weight and mediastinal depth were significant.

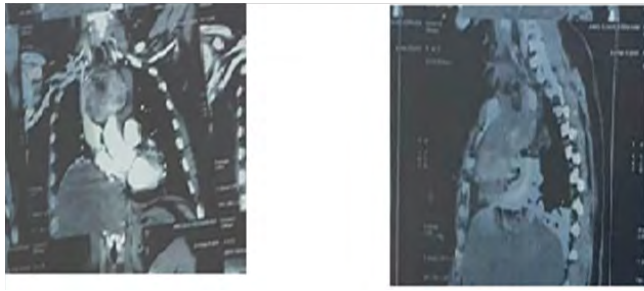


Figure 1a, b: showing forgotten goitre seen in follow up CT chest coronal and sagittal sections

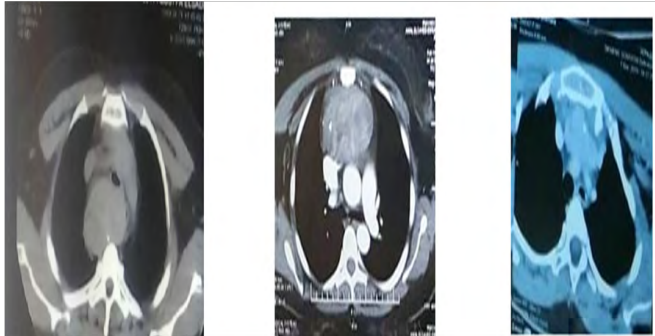


Figure 2a, b: showing various degree of descent of RSG a) below aortic arch level, b) above aortic arch level.

Table 2: Postoperative complications.

	Cervical approach(17)	Combined approach(4)	All patients(21)
Transient unilateral RLN injury	2 (11.7%)	1(25%)	3 (14.2%)
Transient hypoparathyroid	3 (17.6%)	0	3(14.2%)
Airway injury	1 (5.88%)	0	1(4.76%)

7. Discussion

Surgical total thyroidectomy of RSG can be operated by a cervical approach with the need of sternal split only in 2-5% of cases. But some other reports have higher incidence of sternal split; 29% in their series. This is due to the argument around what should be considered as RSG [1].

Initially it's considered RSG after Albrecht von Haller described it as the extension below the upper opening of the chest. Later defined by Candela if descends for > 2 cm below the thoracic inlet. A more inclusive definition by deSouza and Smith, goitre with at least 50% of its volume within the superior mediastinum, at least two fingers below the thoracic inlet with hyper-extended neck and the radiological opacity reaching D4 level. We consider our goitre to be RSG if clinically couldn't reach the lower pole, CXR showing mediastinal mass and lastly on CT chest finding extending goitre below thoracic outlet [2,4].

And according to Thomas Shields, approximately 80% are small RSG if less than 50% of it is intrathoracic, 15% are "partial intrathoracic RSG" if less than 80% of it is intrathoracic and only 5% are "complete" RSG if all of the mass is intrathoracic. Huins and his colleagues proposed three stages. Firstly, to the level of the aortic arch (cervical delivery), secondly, till the level of the pericardium(manubriotomy) and thirdly if below the level of the

right atrium(full sternotomy) [3].

We confronted with a variety of intrathoracic extension from the few fingers inwards growth in 10 cases with actually less than 50% of its volume seated intrathoracic, 7 cases reaching the aortic arch, 4 cases reached the carina level. In our cases, the intrathoracic part nearly between 50 – 75% with fusiform shape and a wider diameter than the thoracic inlet where evident constriction on the glandular tissue is seen in sagittal CT images; with tracheal displacement and disfigurement (Figure 2,3).

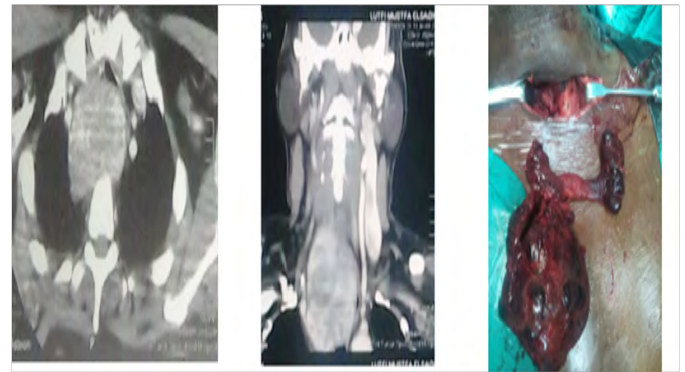


Figure 3a, b, c: (a.showing tracheal compression, b: mass reaching aortic arch, c: mass originating from right lower pole).

Primary RSG has a separate intrathoracic vascularization while secondary RSG vascularization comes from the inferior thyroid artery, thus; safer control of its arterial supply via a cervical approach. While for primary RSG, it is safer via thoracic approach [5].

The vast majority of RSG in literature were a downward growth from the lower pole of one lobe or both or the isthmus through the thoracic inlet directed by collective forces of gravity, thoracic negative pressure and swallowing, between the relatively low resistant structures. So, it extends into the superior mediastinum behind sternum and in front of trachea [5]. With further growth and due to resistance offered by thymus and great vessels, right posterior mediastinum position will be higher [1,6]. In our series, 12 cases had anterior extension and 9 out of those 12 extends to the right with tracheal deviation and luminal compression. Where another 9 cases had posterior extension and 5 out of 9 extended to the right with tracheal deviation and luminal compression.

RSG has a natural history of a slowly growing mass, often detected as incidental finding in CXR. The second symptom is a sensation of local pressure [6]. In our series, 3cases in cervical group and 1 in combined access group were asymptomatic while others had varied symptoms. Most of our patients were in 5th or 6th decade of life (Table 1).

Other reports on RSG, their patients presented with shortness of breath (68.8%), neck mass (75%), dysphagia (31.3%), toxic symptoms (19%), or pressure sensation [9-12]. Compressive of

cervical neurovascular structures like Horner's syndrome are rare. Cervical or cervicobrachial pain is indicative of a neoplastic degeneration [9-12].

Cervico-thoracic CT scan is 82% positive [8]. On CT images, RSG is well defined mass with shows variable density according to the contained iodine or presence of calcific plaques or colloid cyst. CT helps in defining the relation to vascular structures, trachea, pericardium. CT exam of our cases reveal variable densities with well defined capsule that co-related with the histopathological exam were they were predominantly colloidal in nature.

Bronchoscopy should be performed in case of airway obstruction (wheezing and stridor), severe dyspnea, dysphonia. It is necessary if suspecting malignancy to see mucosal irregularities or neoplastic infiltration, and in cases of severe tracheal compression with huge RSG, the anesthesiologist uses a small single lumen tube [10].

Total thyroidectomy guarantees the cure and prevents recurrence from any retained tissues. Radioactive iodine is inefficient and hazardous; it might induce glandular swelling and airway obstruction [11]. In our series, fortunately we could do total thyroidectomy in all cases with efficient preservation of RLN and parathyroid glands in almost 93% of our cases.

Our technique did follow footsteps of others; the RSG was removed through Kocher incision, but the mediastinal portion is troublesome to be externalized by manual traction and digital maneuvers, but feeding vessels are cervical and they descend behind the mediastinal extension of the goitre, thus allowing the digital dissection of the thyroid and its cervical delivery before ligating the vessels with minimal risk of rupture or difficult or slipped ligatures. Thyroidectomy with intact capsule is the standard procedure to avoid "forgotten" goitre which results from incomplete removal of a plunging goitre or it might be a separate concomitant mass [10]. In our series, we had one patient with forgotten goitre after 4months from incomplete surgical removal of his thyroid (**Fig. 1a, b**).

Morcellation of the thyroid tissue leads to bleeding and help disseminating occult carcinoma and should be avoided. But not a few times in our series, the glandular capsule was punctured while trials to deliver it out and bouts of hypertension while traction was applied on the mediastinal part; was watched by our vigilant anesthetic team.

Our keen dissection from lateral side and retraction of each lobe medially with or without delivery of the retrosternal component outside helped us to identify RLN and parathyroid gland and thus reduced the postoperative morbidities. Only transient RLN palsy in 3cases while transit hypoparathyroid state in another 3 cases.

On general; a variety of thoracic accesses exist, including manubriotomy, sternotomy, anterior or posterolateral thoracotomy and Video Assisted Thoracoscopic Surgery (VATS) [12,13]. We started most of our cases by cervical approach and strived to deliver the RSG completely but needed sternal split in 4 cases, where large size and deep mediastinal position and in a recurrent case.

According to Flati and colleagues, if an iceberg shaped RSG with >70% of its mass inside the mediastinum shall need sternal split; while de Perrot and colleagues mentioned goitre > 10 cm, in redo cases, or in the presence of invasive carcinoma. Burns and associates depended upon CT finding of adherence to the surrounding mediastinal tissues and extension of the goitre to or below the aortic arch. White and coworkers used thoracic access in primary RSG or mass larger than the thoracic inlet [11-14].

8. Conclusion

Delivery of retrosternal goitre is amenable through neck incision, but sternal split should be done according to the situations like big mass with the inferior limit at the level of the tracheal carina, or posterior seated RSG extending beyond the aortic arch or in patient with severe kyphosis or when mediastinal structures were compressed or there's strong adhesions. Interdisciplinary cooperation between general surgeon and cardiothoracic surgeon would yield better preoperative planning, intraoperative cooperation and eventually better results.

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