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Research Article
Large Thyroid Gland: A Midline Surgical Splitting Approach

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Abstract

Background: Large cervical thyroid gland usually represented a challenge facing the general surgeon. It usually difficult in performance need higher curve of skill and complications usually unavoidable. **Objective:** Researcher presented a technique modification rendering total thyroidectomy for large cervical thyroid an easy procedure, with short operative time and high safety. **Materials and Methods:** The present study included 25 patients for elective thyroidectomy for large thyroid goiter. The surgical indication was bilateral multi-nodular goiter. All patients were evaluated preoperatively and postoperatively. Postoperative complications were documented and postoperative pain was evaluated using a Visual Analogue Scale (VAS). **Results:** Females represented 72% of studied subjects, there was statistically significant decrease of postoperative calcium and parathyroid hormone (PTH) when compared to corresponding preoperative values (9.58±0.29 and 53.32±4.91 vs. 9.13±0.40 and 32.80±5.84, respectively). The operative time ranged from 66-90 min with a mean of 73.88±5.31 min, the amount of drainage at 24 h postoperatively ranged from 19-36 mL with a mean of 27.56±4.25 mL. In addition, there was statistically significant progressive decrease of pain from 5-24 h postoperatively. About 9 subjects (36.0%) needed analgesia at 6 h and 5 subjects (20.0%) needed analgesia at 18 h and no injury of recurrent laryngeal nerve injury was reported. **Conclusion:** Midline splitting dissections of each thyroid lobe provide an effective, extra-safe technique to removal of large thyroid gland.

Key words: Huge thyroid, midline splitting, general surgeon, new approach, thyroid surgery, difficult dissection, lateral dissection, split thyroid isthmus

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Multi-nodular goiter representing one of the commonest thyroid gland diseases. It may be discovered accidentally or presented with aggravating symptoms such as shortness of breath, dysphasia and obstruction of venous flow in the head and neck. Surgery is the main curative treatment option in the presence of indications (e.g., compressive symptoms, high suspicion of malignancy, hyperthyroidism, cosmetic preference, etc.)[1,2].

For simplicity, large goiter is defined as the goiter which could be identified from distance[3]. Diagnosis of enlarged thyroid can be achieved by history, clinical examinations and imaging findings[4].

Thyroidectomy for enlarged thyroid can be performed by a cervical approach in the majority of patients. Previously, it was reported that, skilled surgeons need to perform an extra-cervical approach in 2-5% of thyroidectomies for enlarged thyroid[5] but other researchers reported an incidence of extra-cervical approach in 29% of patients[6].

Total thyroidectomy is the procedure of choice for treatment of large goiters and it is in most cases practiced by the cervical approach. Morbidity rates for large goiters are usually higher and the dissection process is difficult needing higher experience to guard against different morbidities especially recurrent laryngeal nerve injury and post-surgical hematoma[7].

Management of small cervical goiters is standardized a long time ago but there are few studies dealing with how to treat large goiters. Usually total thyroidectomy was used and the thyroid gland is dissected as one block, the approach which associated with intra-surgical difficulty and higher rate of complications[3].

In this study, large goiter in the neck (enlarged both lobes and isthmus) was removed. The idea about the approach originated from the difficulty of manipulations of huge thyroid and difficulty in displacement of lobes from lateral to medial to ligate the middle thyroid vein. Also, where identification of the nerve is very difficult. Thus, the idea originating to decrease difficulty and help ease of nerve identification. So, I started the approach from inferior part of thyroid by ligation and division of inferior thyroid veins. Separation of isthmus from trachea, from below upwards by passing artery curved forceps. Clamping of both sides by kocher clamps and cutting in between the kocher's clamp, with artery forceps in place to protect the trachea. Then, started to dissect one lobe from anterior surface of trachea "upto" beginning of lateral wall of trachea (here the mobilization of the lobe over the trachea become easy, as it is not attached to anterior surface, sliding over it and also i can get rid of the counter action of the other lobe). Traction of the lobe medially and counter traction on sternomastoid and strap muscles give good space for ligation of middle thyroid veins. In addition, traction of the lobe caudally with counter traction to sternomastoid give good space to ligate the upper pole of thyroid gland. Also, identification of parathyroid gland (especially upper parathyroid) and recurrent laryngeal nerve become an easy procedure. Ligation of terminal branches of inferior thyroid artery in close to thyroid gland and removal of the lobe as usual. The same procedure to the other thyroid lobe was done. Absolute hemostasis was insured by ligation of individual vessels or by suturing the capsule of the remnant to the tracheal fascia.

To overcome difficulties in dissection of large thyroid gland, it was decided to midline splitting the thyroid from its isthmus and dissected each half inferomedially.

MATERIALS AND METHODS

Subjects and methods: The present study included 25 patients who presented with a huge thyroid enlargement, confined to the neck (without retrosternal extension) for elective thyroidectomy. They were selected from General Surgery Department, Al-Azhar University Hospital (New Damietta) during the period from January, 2013 till June, 2016. All patients were informed as concerns the nature of the study and an informed consent was obtained for participation in the study. Confidentiality and the right of withdrawal were ascertained. Fortunately, no-one had been withdrawn from the study. The surgical indication was bilateral multi-nodular goiter.

Operative procedure

Anesthesia: All subjects were operated under general endotracheal anesthesia. It was induced by 130 mg of propofol, 150 µg of fentanyl and 50 mg of rocuronium. Anesthesia was maintained by isoflurane, 1.2-2.5% nitrous oxide and 50.0% oxygen.

Positioning: The patient lies supine on operating table, with titling of the table 15° upwards at the head to decrease venous congestion. A sand bag pillow was placed between shoulder blades with extended neck.

Incision: A curvilinear skin crease incision extending laterally as far as the sternomastoid muscle was made, about one inch above the suprasternal notch.

Raising flaps (as usual): The flaps of skin, subcutaneous tissues and platysma muscle were raised upwards to the level of the notch of thyroid cartilage and downwards to the suprasternal notch.

Strap muscles: The midline raphe between the strap muscles was divided longitudinally (no need for cutting of strap muscle). The pretracheal fascia was opened. A plane of dissection was developed between the strap muscles superficially and thyroid capsule deeply.

Approach and devascularization

In lateral approach (Usual approach): Each thyroid lobe, in turn was mobilized. Division between ligatures of the middle thyroid vein was done. The superior thyroid pedicle ligated within the upper pole to avoid the external laryngeal branch of superior laryngeal nerve. The inferior thyroid veins were ligated and divided. The inferior thyroid artery branches were ligated on the surface of the thyroid gland. The recurrent laryngeal nerve was identified in its course in the whole operative field. The parathyroid gland was identified before resection of thyroid gland.

Superior approach: This approach is difficult and involved taking down the superior pole of the thyroid gland and find the nerve beneath the tough vascular ligament of berry. In nodular enlargement of upper pole or large enlargement of thyroid gland, this approach can be extremely difficult.

Inferior approach: In this approach, the nerve was found low in the neck before its branches, which avoids damage to minor divisions and is dissected cranially until it enters the larynx.

Closure: Closure of the wound with suction drainage of the thyroid bed was done. To measure the amount of drainage, a vacuum drain was placed and amount of drainage was recorded at 12 and 24 h after surgery. The duration from the beginning of the incision to the closure is defined as the operative time.

All patients were evaluated preoperatively and postoperatively by the researcher. For evaluation purposes, vocal cord paralysis lasting longer than 6 months was defined as permanent Recurrent Laryngeal Nerve (RLN) damage. It was considered as temporary if the paralysis healed within 6 months. Serum calcium levels were measured preoperatively and at 12 h after surgery. The parathyroid hormone (PTH) was measured preoperatively and just after the closure of the skin. The presence of serum calcium levels corrected for albumin lower than 8 mg dL^{-1} and/or the need of intravenous calcium support was defined as temporary hypoparathyroidism. On the other hand, permanent hypoparathyroidism was defined as the need for oral vitamin D and/or calcium support and a period longer than 6 months to maintain the normal serum calcium levels corrected for albumin.

Postoperative pain was evaluated using a Visual Analogue Scale (VAS), which is a 10 cm strip extending from 0-10 with zero "Painless" on the left side and 10 is "The most severe pain imaginable" on the right side[8]. All patients were asked to evaluate their pain according to VAS levels at 6, 18 and 24 h after the operation. Analgesic amounts used within the first 24 h were obtained from patient charts. Any patient in need of analgesics received 75 mg diclofenac sodium (Novartis Pharma, Pharmaceutical Company, Egypt) intramuscularly.

Statistical analysis: All data were analyzed using SPSS 16.0 for windows. Results were denoted as Mean±Standard Deviation for quantitative data and relative frequency with percent distribution for qualitative data. Paired comparison of the data was made by a paired samples student's t-test. The two-tailed probability value was defined as statistically significant when $p<0.05$.

RESULTS

In the present study age ranged from 29-50 years with a mean age (±SD) of 42.96 (±5.61) years, females represented 72% of studied subjects with female to male ratio of 2.57, there was statistically significant decrease of postoperative calcium and PTH when compared to corresponding preoperative values (9.58±0.29 and 53.32±4.91 vs. 9.13±0.40 and 32.80±5.84, respectively). The operative time ranged from 66-90 min with a mean of 73.88±5.31 min, the amount of drainage at 24 h postoperatively ranged from 19-36 mL with a mean of 27.56±4.25 mL. In addition, there was statistically significant progressive decrease of pain from 5-24 h postoperatively. About 9 subjects (36.0%) needed analgesia at 6 h and 5 subjects (20.0%) needed analgesia at 18 h and no injury of recurrent laryngeal nerve injury was reported (Table 1, Fig. 1-6).

Table 1: Results of a midline surgical splitting approach for large thyroid gland

Variables	Statistics	Paired comparison	
		Test	p-value
Age (Mean±SD)	42.96±5.61, 29-50		
Sex (n, %)			
Female	18 (72.0%)		
Male	7 (28.0%)		
Female: Male ratio	2.57:1		
Preoperative calcium	9.58±0.29, 8.90-10.30	6.62	<0.001
Postoperative calcium	9.13±0.40, 8.40-9.80		
Preoperative PTH	53.32±4.91, 42-62	16.35	<0.001
Postoperative PTH	32.80±5.84, 24-47		
Operative time (min)	73.88±5.31, 66-90		
Drainage (24 h)	27.56±4.25, 19-36		
VAS at 6 h	2.56±0.86, 1-5		
VAS at 18 h	1.12±0.83, 0-3		
VAS at 24 h	0.36±0.48, 0.0-1.0		
Need for analgesia 6 h	9 (36.0%)		
Need for analgesia 18 h	5 (20.0%)		
Recurrent laryngeal nerve injury	0 (0.0%)		

PTH: Parathyroid hormone, VAS: Visual analogue scale

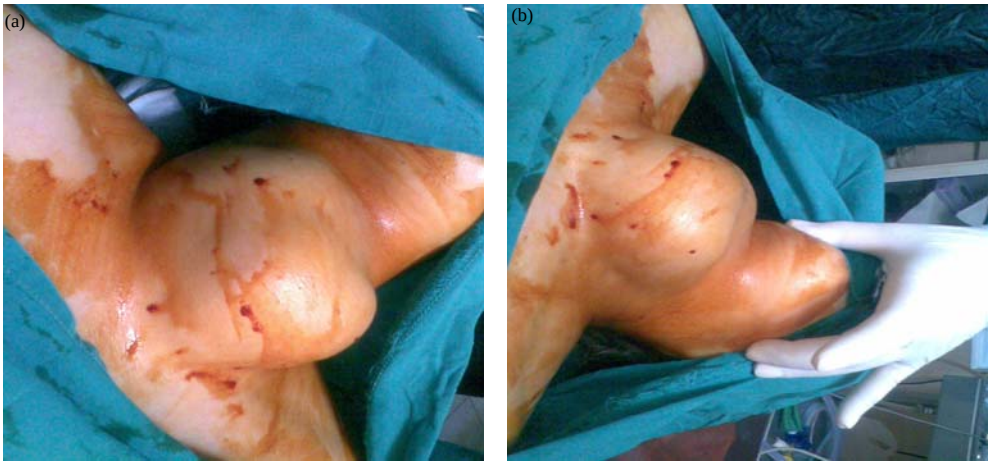

Fig. 1(a-b): (a) Cervical huge thyroid and (b) Preoperative view

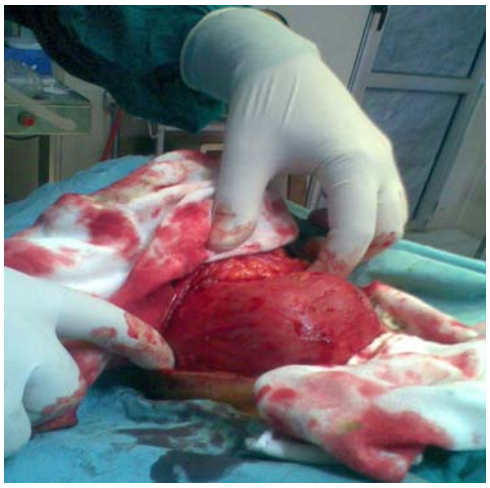

Fig. 2: Elevation of the flap

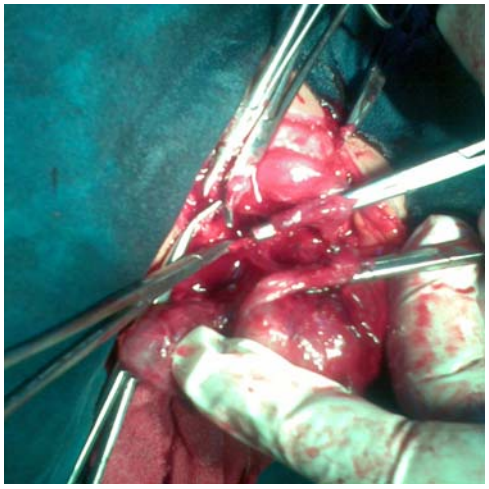

Fig. 3: Splitting of the isthmus

Fig. 4: Dissection of the thyroid lobe from midline to lateral

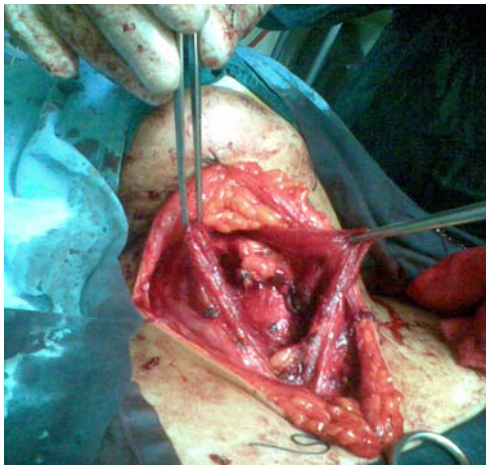

Fig. 5: Field view after removal of huge thyroid with intact strap muscles

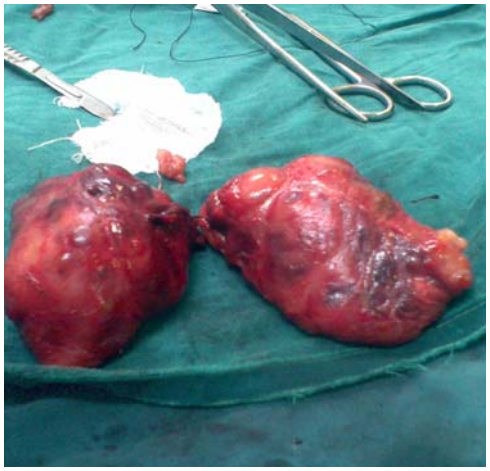

Fig. 6: Both thyroid lobe after removal showing the large size and separation at the isthmus

DISCUSSION

Total thyroidectomy has replaced subtotal thyroidectomy as a preferred option in bilateral benign multinodular goiter in the last 25 years and significant differences have been found in the development of the technique over recent years in terms of a safe and effective total thyroidectomy[9]. However, the option of ease in performing procedure was not addressed. The researcher could not found any study addressed the topic of ease of the performance of procedure, keeping the effectiveness and safety or even provide higher values of safety. In this study, the researcher presented his innovation of a technical modification of standard technique for total thyroidectomy for large cervical goiter. The basic modifications included removal of the thyroid gland lobe by lobe not en bloc and starting dissection from below, separation of the isthmus and dissection of each lobe from medial to lateral to provide additional safety for trachea, parathyroid vessels and recurrent laryngeal nerve. With application of the procedure, researcher noticed a higher ease, short operative time and safety of the procedure for such large thyroids. No cases in the study reported temporary or permanent recurrent laryngeal nerve injury.

Recurrent laryngeal nerve should be identified in all thyroidectomies as identification is known to reduce the incidence of nerve palsy. So, proper field for visualization was needed. The problem with inferior approach is the need for dissection along segment of the nerve with risk of damage to the lower parathyroid gland. In superior approach, finding the nerve beneath the tough vascular ligament of Berry in huge goiter is very difficult (no space for good visualization). In lateral approach, seeking the nerve among the branches of inferior thyroid artery, the nerve may be divided several times and its branches are at risk.

Three main complications could follow thyroid surgery: Recurrent Laryngeal Nerve (RLN) paralysis, hypoparathyroidism and postoperative hemorrhage. In this study, no patient required repeat surgery for a hematoma. The good visualizations of both thyroid vessels and recurrent laryngeal nerve through the whole procedure may be responsible for absence of such complications of hemorrhage, parathyroid injury and recurrent laryngeal nerve paralysis. Also, the small amount of drainage at 24 h confirmed the good hemostasis achieved by this technique.

According to Thomusch *et al.*[10] who performed en bloc total thyroidectomy on 306 cases, 4.2% of patients displayed temporary RLN damage, 1.6% suffered permanent RLN damage and temporary and permanent hypoparathyroidism respectively was reported to be 7.5 and 3.6%. Another study by Delbridge *et al.*[11] reported the rate of permanent

hypoparathyroidism at 0.4% and permanent nerve damage at 0.5%. Hussain and Hisham[12] recorded 26.8% of temporary hypocalcemia after total thyroidectomy and 1.5% of permanent hypocalcemia. Chang *et al.*[13] performed sutureless total thyroidectomy and found rates of permanent and temporary RLN paralysis to be 2% (n = 23) and 0.5% (n = 6), respectively. This is very interesting, as it was performed the surgery with sutures, no case reported RLN paralysis. This denotes the effectiveness of my technique. A study conducted by Sartori *et al.*[14] found rates for temporary RLN paralysis to be 2% (n = 2), while Pons *et al.*[15] reported 5% (n = 2) and no permanent RLN paralysis. Chang *et al.*[13] documented rates of temporary and permanent hypoparathyroidism of 7.1% (n = 82) and 0.5% (n = 6), respectively. Notably, Pons *et al.*[15] observed 2.5% (n = 1) of temporary hypoparathyroidism without any evidence of permanent hypoparathyroidism.

CONCLUSION

Inferomedial dissections of each thyroid lobe provide an effective, extra-safe technique to removal of huge thyroid gland.

SIGNIFICANT STATEMENT

A large thyroid surgery is a challenge for general surgeons. This study included the experience with a modified approach to easily and safely remove large cervical thyroid gland.

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