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Original Research

Advanced vessel sealing devices in total thyroidectomy for substernal goitre: A retrospective cohort study

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HIGHLIGHTS

- 75 patients underwent total thyroidectomy by the same surgeon for substernal goiter.
- Patients were divided in three groups, according to the used technique: "clamp and tie", Ligasure Small Jaw, Harmonic Focus.
- No difference among the groups in morbidity, duration of drain. Advanced vessel sealing devices shortened operative time.

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ABSTRACT

Introduction: When total thyroidectomy is performed for substernal goitre, a high risk of morbidity is reported. Advanced vessel sealing devices provide an alternative to the conventional clamp and tie technique. The aim of this study is to compare the outcome of patients who underwent total thyroidectomy for substernal goitre using Ligasure Small Jaw, Harmonic Focus, or conventional technique.
Methods: Between 2011 and 2014, from a population of 393 patients undergoing surgery for thyroid disease, 75 (49 females, 26 males, mean age: 57.9 years; range: 28–83 years) underwent total thyroidectomy by the same surgeon for substernal goitre. Patients were divided into three groups: group A ($n = 26$) in which total thyroidectomy was performed using conventional technique; group B ($n = 22$), and group C ($n = 27$) in which total thyroidectomy was performed using Ligasure Small Jaw and Harmonic Focus, respectively. Operative time, time to drain removal, hospitalization and morbidity (hypoparathyroidism, vocal cord palsy, haemorrhage, seroma, other) were analyzed.
Results: Mean duration of surgery was 136.5 ± 26.7 min in group A *vs* 110.5 ± 24.8 in B, and 101.6 ± 25.4 in C, with significant statistical differences between A *vs* B ($p < 0.005$) and C ($p < 0.0001$). There was no mortality. The overall morbidity was 29.3%. There was no significant difference in time to drain removal, postoperative hospitalization, and morbidity among the three groups.
Conclusion: This is the first study analyzing advanced vessel sealing devices in total thyroidectomy for substernal goitre in the literature. The use of advanced vessel sealing devices significantly reduces operative time of total thyroidectomy performed for substernal goitre but does not seem to affect the other evaluated outcomes.

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1. Introduction

Substernal extension of cervical goitre (SG), also called retrosternal or cervicomediastinal goitre, is a clinical condition defined as thyroid enlargement in which most of the gland extends below the thoracic inlet with the patient in the surgical position [1–4]. The incidence ranges from 1.7% to 30%, depending on defining criteria, and it is more common in women and in the elderly [5–7]. When a SG originates from the posterior or lateral part of the gland and extends into the posterior mediastinum behind the recurrent laryngeal nerve (RLN) and vascular structures, surgical dissection and excision becomes more difficult [8]. The most common symptoms related to SG are due to compression of trachea, oesophagus, RLN and superior vena cava. This can lead to dyspnea, stridor, cough, dysphagia, dysphonia, *Horner's* syndrome, and cerebral edema; however, patients are asymptomatic in 30% of cases [9–12]. The preoperative imaging of choice is a computed tomography scan with multiplanar reformatting and volume-rendering reconstructions or magnetic resonance imaging [4,13,14]. Total thyroidectomy (TT) is the treatment of choice for SG [3,8,10,15–17].

TT with the "clamp-and-tie" technique was first described by Theodor Kocher in the 19th century and improved with the capsular dissection by Thompson [18] in 1974. It is a standardized procedure characterized by low morbidity and virtually no mortality, especially when performed in high-volume centers [3,19–24]. In the majority of cases, thyroidectomy can be performed using cervical access; however, a sternotomy or thoracotomy is necessary for primary SG, when the gland is predominantly intrathoracic, or when preoperative assessment suggests infiltration into surrounding structures [3,8,10,25,26]. When TT is performed for SG a high risk of morbidity is reported [26–32], as well as prolonged operative time as described in our previous experience [3,21].

New advanced vessel sealing devices (AVSD) have been introduced during the last decade for the control of vascular pedicles. In the setting of thyroid surgery, the two most widely used devices for sutureless thyroidectomy (ST) are the Harmonic Focus (HF; *Johnson and Johnson, Ethicon Endo-surgery, Cincinnati, OH, USA*) and the Ligasure Small Jaw (LSJ; *Covidien, Boulder, CO, USA*). Several studies have tested the employment of these two AVSD during TT for cervical disease [33–37], but no study has been found in literature for SG.

The aim of this study is to compare the outcome of TT performed for SG using the conventional technique (CT), HF, and LSJ.

2. Material and methods

At our Academic Hospital, between January 2011 and August 2014, 393 patients underwent TT for thyroid disease. Ninety-two patients (23.4%) were treated for substernal goiter, defined as at least 50% of the gland extending below the clavicle. Exclusion criteria were concurrent parathyroidectomy (n = 2, 2.2%), lymphadenectomy (n = 5, 5.4%), re-surgery (n = 4, 4.3%), surgery extending to adjacent organs (n = 1, 1.1%), and sternal split or thoracotomy (n = 5, 5.4%). Seventy-five patients (81.5%, 49 females, 26 males; mean age, 57.9 years; range, 28–83 years) were selected. This study was approved by the local Ethical Committee. After obtaining written informed consent, all TT were performed by a single highly experienced surgeon and patients were divided into three groups. The surgeon chose among the three technique using numbered and sealed envelopes that were opened at the beginning of the operation. In group A (n = 26) TT was performed using CT; in group B (n = 22), and in group C (n = 27) LSJ and HF were respectively employed. Demographic data, thyroid histology, operative time, time to drain removal, length of hospitalization, and postoperative complications were recorded.

Preoperative workup included measurement of thyroid function and autoantibodies, serum calcium, inorganic phosphorus, and magnesium. Ultrasound-colour Doppler imaging of the neck, plain chest and neck radiography, and evaluation of preoperative vocal cord function were performed. A fine-needle aspiration biopsy was limited to patients with suspected cervical nodules (n = 19, 25.3%), and malignancy was preoperatively diagnosed in 15 (20.0%) patients. A multidetector computed tomographic scan with multiplanar reformatting and volume-rendering reconstructions was performed in 60 patients (80.0%), when the caudal border of thyroid gland was not visible on ultrasound examination. Magnetic resonance imaging was performed in 20 (26.7%) patients, and in 5 patients (6.7%) both imaging techniques were carried out if any doubt persisted about relationship with the surrounding mediastinal structures.

All operations were performed using a standardized capsular dissection technique through a collar incision. Thyroid vessels were controlled individually and divided with conventional knot tying (Group A), LSJ (group B), and HF (group C). The thoracic component of the SG was manually retracted to the cervical region; however, when digital blunt dissection was considered dangerous, a manubriotomy was performed (these patients were excluded from the study). Electrocautery and bipolar pliers were adopted in all groups, however they were always avoided close to the nerves or parathyroid glands (PTs), as well as LSJ and HF, respectively employed in group B and C. PT glands and RLNs were meticulously dissected using 3× loupe magnification and microsurgical instruments [38]. A drain was placed in all cases. Postoperative clinical evaluation tested for vocal changes, dyspnea, dysphagia, numbness, paresthesia, facial muscle spasm, irritability, carpopedal spasm, weakness, and cardiac arrhythmias. Laryngoscopy was performed in patients with hypofunctioning vocal cords at extubation or with an immediate postoperative change in voice. Vocal cord palsy was considered permanent if palsy persisted six months after surgery. Serum calcium levels were routinely evaluated 2–3 times/day for 2 days after the operation, daily for 1 week and 2 times per week thereafter for up to 4 weeks. If levels of serum calcium were more than 10% lower than preoperative levels in asymptomatic patients or when symptomatic hypocalcaemia was evident, oral calcium carbonate (1–6 g/day) was administered. Hypoparathyroidism was considered permanent if the patient could not achieve eucalcaemia by six months after surgery despite calcium and vitamin D supplementation. No missing data was found.

2.1. Statistical analysis

Comparisons among groups were made using Student's *t*-test for independent samples. Frequencies were compared using the $\chi 2$ test or Fisher's exact test. A *P*-value <0.05 was considered statistically significant. Statistical analyses were performed using Stata 12 software (*StataCorp LSJ, CollegeStation, Texas, USA*).

3. Results

Demographic data and thyroid histology are summarized in Table 1. Mean duration of surgery was 136.5 ± 26.7 min in group A vs 110.5 ± 24.8 min in B, and 101.6 ± 25.4 min in C, with significant statistical differences (Fig. 1) between A vs B ($p < 0.005$) and C ($p < 0.0001$). There was no mortality. Overall morbidity was 29.3%. Postoperative complications are reported in Table 2, without significant differences among the three groups. No cases of hemorrhage were recorded. Duration of drain was 54.5 ± 17.7 h in group A, 58.9 ± 14.3 h in B, and 61.3 ± 21.4 h in C; length of hospitalization was 74.8 ± 32.1 h in A, 61.1 ± 14.3 h in B, and 64.9 ± 24.7 h in C,