Monobloc Total Thyroidectomy Using Sealing Devices: Preliminary Results and Comparative Analysis

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Rezumat

Tiroidectomia totală monobloc cu instrumente de hemostază-sigare: rezultate preliminare și analiza comparativă

Background: Dorința unei hemostaze perfecte a determinat industria echipamentelor medicale să producă instrumente „ideale” necesare unei tiroidectomii sigure. Astfel, instrumentele de hemostază-sigare, cum ar fi LigaSure™ Small Jaw, Thunderbeat™ Open Fine Jaw și Harmonic™ Focus au fost concepute pentru chirurgia tiroidiană.

Scop: Scopul acestui studiu este de a prezenta rezultatele inițiale ale utilizării acestor trei instrumente chirurgicale pentru efectuarea tiroidectomiei monobloc.

Materiale and Metodă: Am efectuat un studiu prospectiv între ianuarie 2014 și iulie 2019, în care am inclus toți pacienții operați de același chirurg folosind aceste 3 dispozitive de sigilare. Tiroidectomiile au fost efectuate folosind LigaSure™ Small Jaw (grupul 1), Thunderbeat™ Open Fine Jaw (grupul 2) și Harmonic™ Focus (grupul 3). Grupurile au fost comparate statistic din punct de vedere al duratei intervenției chirurgicale și a spitalizării, complicațiilor postoperatorii timpurii, precum și alterarea vocii sau apariția insuficienței respiratorii acute.

Rezultate: Nu s-au observat diferențe semnificative între grupuri în ceea ce privește datele demografice a pacienților, diagnosticul patologic preoperator, complicațiile postoperatorii precoce și durata spitalizării. Timpul operator a fost mai scurt în grupul 1.

Concluzii: Noile instrumente chirurgicale au proprietăți benefice,

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inclusiv scurtarea timpului operator, menținerea unui câmp de operare curat și minimizarea fumului degajat în timpul intervenției chirurgicale.

Cuvinte cheie: Tiroidectomie, LigaSure™ Small Jaw, Thunderbeat™ Open Fine Jaw, Harmonic™ Focus

Abstract

Background: The desire for perfect haemostasis has led the medical equipment industry to produce “ideal” instruments for safe thyroidectomy. Thus, haemostasis and sealing instruments such as the LigaSure™ Small Jaw, Thunderbeat™ Open Fine Jaw and Harmonic™ Focus have been indicated for thyroid surgery.

Aim: The purpose of this study is to present the initial results of using these three surgical instruments for performing monobloc thyroidectomy.

Material and Methods: We performed a prospective study between January 2014 and July 2019 in which we included all the patients operated by same surgeon using those 3 sealing devices. Thyroidectomies were performed using LigaSure™ Small Jaw (group 1), the Thunderbeat™ Open Fine Jaw (group 2) and Harmonic™ Focus (group 3). The groups were statistically compared in term of duration of surgery and hospitalisation, early postoperative complications as well as voice alteration or acute respiratory failure.

Results: No significant differences were observed among groups in terms of patient demographics, pathological diagnoses, postoperative complications, length of hospitalization, and clinical outcomes. Operating time was shorter in group 1.

Conclusions: New surgical instruments have beneficial properties, including shortening the operative time, maintaining a clean operating field, and minimising smoke released during the operation.

Key words: Thyroidectomy, LigaSure™ Small Jaw, Thunderbeat™ Open Fine Jaw, Harmonic™ Focus

Introduction

Total thyroidectomy, as it is known today, began in the late 19th century, when Theodor Kocher underwent a meticulous thyroidectomy, reducing the mortality of this surgery to less than 1% (1).

Although the technique of thyroidectomy has changed very little over the years, different techniques for haemostasis have been developed in addition to conventional methods (2).

The desire for perfect haemostasis has led the medical equipment industry to produce “ideal” instruments for safe thyroidectomy. Thus, haemostasis and sealing instruments

such as the LigaSure™ Small Jaw, Thunderbeat™ Open Fine Jaw and Harmonic™ Focus have been indicated for thyroid surgery (3,4,5).

The purpose of this study is to present the initial results of using these three surgical instruments for performing monobloc thyroidectomy, also reported to the literature.

Material and Methods

We performed a prospective study in the General Surgery Clinic 1 of the Emergency Clinical County Hospital of Târgu Mureș, between 1 January 2014 and July 2019. A total of 45 successive patients were divided

into groups of 15, in which thyroidectomy was performed using different sealing devices. The LigaSure™ Small Jaw was used for group 1, the Thunderbeat™ Open Fine Jaw was used for group 2 and the Harmonic™ Focus was used for group 3. All patients underwent a complete evaluation preoperatively, including biochemical parameters, fine needle biopsy puncture and otology examination, as well as gynaecological evaluation for women. A post-operative examination was performed by the otologist only if there were phonation disorders or signs of respiratory failure. Patients with a known history of neck surgery and/or radiation therapy or dysphonia were excluded from the study, as was one patient undergoing treatment with TNF- α inhibitor (adalimumab) who had elevated eosinophils (6). The groups were statistically compared in terms of duration of surgery and hospitalisation, early postoperative complications as well as voice alteration or acute respiratory failure.

All patients were informed about the characteristics of these devices and of the possible implicit complications.

The study was performed in accordance with the Declaration of Helsinki, Good Clinical Practice, and applicable regulatory requirements. Written consent was obtained from all patients before the initiation of surgery.

Surgical Technique

The surgery was performed by a single surgeon with experience in endocrine surgery, following the same operative steps, with the only difference being the sealing-haemostasis device used. The surgery begins with a Kocher-type arched incision in the anterior cervical region of 3–5 cm, approximately 1 cm below the cricothyroid cartilage. The subcutaneous cell tissue and platysma muscle are sectioned and then the two flaps are prepared. The upper flap is suspended using a thread to the chin, then the median raphe of the muscles is divided and the thyroid lodge is opened.

The monobloc thyroidectomy is performed

in a motion like pulling a toy brick, from left to right as in browsing the tabs of a book, by sealing the inferior thyroid pedicle (*Fig. 1*).

The surgical intervention continues with the sealing of the middle and superior pedicles. The dissection proceeds from left to right, cutting the posterior ligaments of Berry (*Fig. 2*), detaching the isthmus and entering the right thyroid lodge (*Fig. 3*).

Following the same intraoperative steps, the right lobe is dissected, and the last step is sealing the superior thyroid pedicle of the right lobe (*Fig. 4*). In this way, the monobloc thyroid specimen is obtained for histopathological examination (*Fig. 5*).

The thyroid lodge is drained, followed by suture of the median raphe, resorbable suture of the subcutis and intradermal skin suture. Monopolar cautery is used as an auxiliary method of haemostasis in all patients.

Figure 1. Sealing the inferior pedicle of the left lobe

Figure 2. Sectioning of the suspensory ligaments and further dissection towards the upper pedicle. A traction thread is used to facilitate mobilisation of the thyroid lobe.

Figure 3. Entering the right thyroid lodge

Figure 4. Sealing the upper thyroid pedicle of the right lobe

Results

Monobloc thyroidectomy was performed in all patients, with no reported deaths or wound infections.

Quantitative data were expressed as mean $\pm$ standard deviation (SD), while qualitative data (sex and biopsy puncture result) were expressed as percentages or numbers.

The demographic and clinical data of the three patient groups were similar, and are represented in *Table 1*.

The operative time was measured from incision to skin suture, without significant statistical differences. The results are represented in *Table 2*.

The hospitalisation periods were similar.

Figure 5. Thyroid monobloc specimen

All patients had a minimum of two days, and the maximum for each group was six or seven days (*Table 3*). Applying the ANOVA test to

Table 1. Clinical and demographic data

	Group 1 LigaSure™	Group 2 Thunderbeat™	Group 3 Harmonic™
Median age	58.26 $\pm$ 8.18	61.66 $\pm$ 9.65	64.6 $\pm$ 9.84
Women/Men	14/1	13/2	12/2
<i>Preoperative histopathological diagnosis</i>			
Nodular goitre	11	11	10
Malignancy	2	3	4
Basedow-Graves disease	2	1	1

Table 2. Operative times in minutes

Operative time	Group 1 LigaSure™	Group 2 Thunderbeat™	Group 3 Harmonic™
Mean	67.66	79.13	76.66
Minimum	40	55	45
Maximum	110	100	110
SD	22.5	13.38	18.58

Table 3. Hospitalisation period

Hospitalisation	Group 1 LigaSure™	Group 2 Thunderbeat™	Group 3 Harmonic™
Mean $\pm$ standard deviation	3.06 $\pm$ 1.53	4 $\pm$ 1.41	3.6 $\pm$ 1.24
Minimum	2	2	2
Maximum	7	7	6

compare the means of the three groups showed no statistically significant difference ($p = 0.1998$).

There were no manifestations of permanent hypocalcaemia in the studied groups. Transient disturbances of calcium balance were countered by calcium administration intravenously and then orally.

In the three groups of patients, some phonation complications and some post-operative haematoma occurred, as shown in *Table 4*.

Discussion

Total monobloc thyroidectomy can be performed safely with a low complication rate. This requires a good command of the surgical technique, knowing the local anatomy and ensuring rigorous haemostasis.

The use of the LigaSure™ Small Jaw device in complete total thyroidectomy has been shown to be safe and effective in reducing operative time, intraoperative blood loss and postoperative fluid drainage. This sealing device yields better results regarding the function of the recurrent laryngeal nerves and the condition of the parathyroid glands (7,8)

The Thunderbeat™ Open Fine Jaw is the only device currently available in the world capable of simultaneously providing frictional

thermal energy through ultrasound and bipolar power generation (9). Years of study on this device have shown that this combination of bipolar and ultrasonic energy is more beneficial in surgery compared to devices using only ultrasound (Harmonic Focus™) or only bipolar energy (LigaSure™ Small Jaw). The efficiency and versatility offered by this device are very useful and represent an important step towards achieving perfection in modern surgery (10).

Operative time is greatly influenced by the surgeon's experience, as shown by Patoir et al (11). The mean operating time in this study was not statistically significantly different between groups, or from the average time of 86 minutes reported in the literature. However, the group using the LigaSure™ Small Jaw had a mean operating time 11.47 minutes shorter than the Thunderbeat™ group, and 9 minutes shorter than the Harmonic™ group.

The average length of hospitalisation was similar for all groups. The mean value was higher compared to data in the literature, which suggests that the average hospitalisation period is two days (12). Recent studies suggest that thyroidectomy should be performed under day conditions, dependent on the surgeon, patient and hospital (13).

The use of sealing devices was effective in all groups in the present study. All vascular

Table 4. Number of patients affected by early postoperative complications

Complication	Group 1 LigaSure™	Group 2 Thunderbeat™	Group 3 Harmonic™
Dysphonia	3	3	2
Acute respiratory failure	0	1	0
Haematoma	2	1	2

structures were successfully sealed without the need for other haemostasis adjuvants during surgery.

Regarding complications, a patient belonging to group 2, whose postoperative evaluation was apparently favourable, unfortunately presented on the second day with acute respiratory failure that did not recover conservatively. The patient was transferred to the otology department, where a tracheostomy was performed.

The authors' overall view is that the LigaSure™ Small Jaw device has an advantage due to its ergonomics and easy handling compared to the other devices.

Conclusions

Monobloc total thyroidectomy is a feasible therapeutic method for the surgical treatment of thyroid disorders.

New surgical instruments have beneficial properties, including shortening the operative time, maintaining a clean operating field, and minimising smoke released during the operation.

The ergonomics of the sealing instruments used in this study, as well as the fact that they need not be changed during surgery, bring added bonuses for surgical comfort.

Conflict of Interests

The authors declare no conflicts of interests.

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