Original Article

Early Experience with LigaSure Thyroidectomy in a Nigeria Teaching Hospital

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ABSTRACT

Background: The principles of safe and efficient thyroid surgery had been established and the technique has remained the same for over the century without any major significant changes. The introductions of electrosurgical devices constitute a major shift in the technique of thyroid surgery. **Objective:** We present our early experience with the use of LIGASURE vessel sealing system for the procedure of thyroidectomy. **Materials and Methods:** This was a quasi-experimental study comparing outcome of LigaSure thyroidectomy in a prospective nonrandomized cohort with another retrospective cohort of preintervention clamp-and-tie thyroidectomy. **Results:** A total of 30 patients with a clinical diagnosis of goiter were recruited into the study. There were two males and 28 females with a mean age of 42.6 years. Diagnosis was simple multinodular goiter 24 (80%), controlled toxic nodular goiter 3 (10%), grave disease 1 (3.3%), and multinodular goiter with retrosternal extension 2 (6.7%). The mean thyroid weight was 121.0 g. The mean duration of surgery was 59 min compared to 128 min for traditional technique ($P < 0.01$). The mean blood loss of 116 ml was significantly less than 328 ml following the traditional technique ($P < 0.01$). Mean duration of hospital stay was 1.9 days, compared to 3.55 days in the traditional technique group ($P = 0.02$). Troubling postoperative complications of change in voice quality occurred in only one patient (3.3%). **Conclusion:** LigaSure thyroidectomy was found to be easier and faster to carry out with no learning curve and easy to learn and adapt.

Keywords: *Goiter, LigaSure thyroidectomy, Nigeria, sutureless thyroidectomy*

Introduction

Thyroid disorders are one of the most common endocrine disorders worldwide.[1-3] This is particularly so in some mountainous ridge of granite and granite mountain of West Africa belt, spanning countries such as Ghana, Cameroun, and Nigeria.[4] Goiter characterized by enlargement of the thyroid gland is common in this environment. Most patients with goiter present to hospital for treatment and surgery for cosmetic reason; therefore, surgery for goiter should be safe and be associated with little or no complication as much as possible. Theodor Kocher and Theodor Billroth developed an acceptable technique of standardized thyroid surgery between the years 1873 and 1883. By 1920, the principles of safe and efficient thyroid surgery had been established.[5,6] The technique so described by the duo has remained the same over the century without any major significant changes. It was not until recently that new innovation and technique are being developed and introduced in the surgical procedure of thyroidectomy. The development of various types of energy devices in surgery such as electric energy, ultrasonic device, and laser energy led to the era of introduction of energy device in the procedure of thyroidectomy. These

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energy devices have been used for devascularization and mobilization of the gland in thyroid surgery, with encouraging results for some of them.[7]

The LigaSure Vessel Sealing System (Valleylab, Boulder, CO, USA) is a new surgical device, an energy-based method that works by applying a precise amount of pressure and bipolar energy to the tissue, which permits vessel sealing to be achieved by changing the nature of the vessel wall (collagen and elastin within the vessel wall fuse and re-form into a single structure obliterating the lumen) and reducing the risk of hemorrhage.[8,9] The LigaSure generator is a computer-controlled electrosurgical unit with two distinct receptacles. The LigaSure vessel sealing receptacle diagnoses the tissue within the jaws of the instrument and delivers the optimal amount of energy necessary to fuse the vessel wall and create a permanent seal. The bipolar receptacle provides both bipolar and macro-bipolar outputs.

To the best of our knowledge, this is the first report of use of LigaSure Bipolar Diathermy System for tissues dissection, devascularization, and operation of thyroidectomy in Nigeria. We hereby report our experience with this novel dissecting system.

Materials and Methods

This was a quasi-experimental study comparing the outcome of LigaSure thyroidectomy in a prospective nonrandomized cohort with another retrospective cohort of preintervention clamp-and-tie thyroidectomy. The study was carried out on patients with goiter at a Nigerian teaching hospital.

LigaSure a bipolar diathermy as a new device for hemostasis and tissue dissection was just introduced into our hospital surgical practice in January 2016. The LigaSure system was used for thyroidectomy for all cases of thyroidectomies since this period when it was introduced (between January 2016 and December 2017). Ethical approval from the Institution Review Board was sought and given for the study. Consecutive, consenting patients with goiter were recruited into the study. A total number of 30 patients presenting with goiter had total, near-total, or subtotal thyroidectomy done, depending on the indication for thyroidectomy, with the Ligasure Vessel Sealing System. The physical and physiological attribute, diagnosis, surgical procedures, operation time, time of thyroid dissection, blood loss, complication, and length of hospital stay of these patients were compared with the last 30 patients who had thyroidectomy done with the traditional and conventional clamp-and-tie technique we have been using before the introduction of the LigaSure Blood Sealing System.

Surgical technique

The major steps of the operation are as follows. With the patient under general anesthesia by endotracheal intubation and administration of intravenous anesthetic agents, the patient was positioned in a reverse Trendelenburg position and head tilted 15° upward. Standard thyroid draping was applied after routine skin preparation. A standard Kocher's incision was made along skin crease about a fingers breadth above the suprasternal notch. The platysma was divided, and upper and lower subplatysmal skin flaps were raised using sharp and blunt dissection with the LigaSure system.

The dissection and devascularization of the thyroid gland properly began with sealing the branches of the middle thyroid vein with the LigaSure Vessel Sealer; the division of the sealed thyroid vein was also carried out with the LigaSure system. Consecutively, the vessels of the superior pole were identified and ligated and divided with the LigaSure Vessel Sealer; at this point, attempt was made to identify and prevent and preserve the superior parathyroid glands. The ligation of the superior thyroid vessel was also done as close to the thyroid gland as possible to avoid injury to the branch of superior laryngeal nerve. Dissection then continued on the lateral part of this lobe, and the small fibrous vascular attachments laterally were ligated, with use of LigaSure, as they entered the thyroid capsule. The inferior pole of this lobe was then dissected free. Again, the ligation of the vessels of the inferior pole was performed with LigaSure Vessel. The recurrent laryngeal nerves were identified, and care was taken to avoid injury or trauma to the nerves while mobilizing the thyroid from the lateral and anterior parts of the trachea. Furthermore, attempts were made to identify and preserve the inferior parathyroid glands at this region. After completing the dissection of the upper and lower lobe on one side, attention was directed to the other side of the gland. The same technique was used for the resection of the contralateral lobe of the thyroid. The dissection was completed by mobilizing the isthmus and pyramidal lobe. After complete dissection and subsequent excision of the thyroid gland mass, hemostasis was fully secured with the LigaSure Vessel Sealing System, with the additional use of diathermy where necessary. The need to place a vacuum wound drain was at the discretion of the operating surgeon and was dictated by factors as inability to secure a dry, clean, and clear nonbleeding thyroid gland bed after excision of the thyroid gland. The midline muscle and the cervical fascia were thereafter sutured and the skin was closed with subcuticular nylon suture.

The packed cell volume of the patients was assessed both pre- and post-operatively; clinical symptoms and signs of possible complication such as hypocalcemia, airway obstructive symptoms, and compressive hematoma were carefully assessed and looked for in the postoperative period. Vocal cord function was observed before operation by means of indirect laryngoscopy in all patients and voice quality was clinically assessed both pre- and post-operatively.

Results

A total of 30 patients with a clinical diagnosis of goiter were recruited into the study. Total thyroidectomy using the LigaSure Vessel Sealing system was successfully completed in all the 30 patients recruited into the study; there was no need for additional suture knot and tie during the procedure. Dissection with LigaSure was easy, smooth, and proceeded expeditiously; hemostasis was safely secured using LigaSure in each patient. Figure 1 shows the used of the LigaSure vessel sealing system to raise the superior myocutanous flap. Figure 2 shows the process of devascularization of the thyroid gland; the LigaSure is being used here to ligate the superior thyroid pedicle. Figure 3 shows the process of completing the dissection and excision of the thyroid gland.

There were two males and 28 females giving a male to female ratio of 1:14. The specific clinical diagnosis of the goiter is stated in Table 1 with simple multinodular goiter accounting for the majority of the cases (24:80%), followed by toxic multinodular goiter that had been rendered euthyroid (3:10%). The results of the study regarding operative time, thyroid gland weight, intraoperative and postoperative blood loss, and length of postoperative hospital stay are summarized in Table 2. The mean duration of surgery was 59.33 min and average blood loss was 116.72 ml in the cohort. Table 3 shows the pattern of complication in the cohort of patients; the complication assessments were based on clinical symptom and sign and patients were followed up in the clinic for 3 months period. Twenty-five patients (25:83.3%) had no complication when followed up in the clinic; three patients (10%) had initial hoarseness of voice with reduced voice quality, which was presumed to be due to partial injury to the recurrent laryngeal nerve. All the patients regained their voice quality within the 3 months follow-up. One patient (3.3%) had subcutaneous hematoma, which eventually progressed to seroma, and about 60 ml of serous fluid was aspirated cumulatively. Another patient had severed laryngeal edema that necessitated immediate postoperative reintubation and observation in the intensive care unit for 72 h. The patient was subsequently extubated after 72 h without needing tracheostomy tube placement. He had complete resolution of the laryngeal edema with no obstructive airway symptom. The voice

Figure 1: Raising the superior myocutanous flap with LigaSure

Figure 2: Ligating the superior thyroid pedicle with LigaSure

Figure 3: Completing excision of thyroid gland after dissection with LigaSure

Table 1: Patients characteristics

	n (%)
Sex	
Male	2 (6.70)
Female	28 (93.30)
Clinical diagnosis	
Controlled toxic multinodular goiter	3 (10.00)
Grave's disease	1 (3.30)
Simple multinodular goiter with retrosternal extension	2 (6.70)
Simple multinodular goiter	24 (80.00)
Type of operation	
Subtotal thyroidectomy	20 (66.700)
Near total thyroidectomy	7 (23.30)
Total thyroidectomy	3 (10.00)

Table 2: Intraoperative and perioperative events

	Mean	Range	Standard deviation
Duration of surgery (min)	59.33	66 (28-94)	18.55
Duration of thyroid dissection (min)	22.00	28 (12-40)	6.98
Blood loss (ml)	116.72	300 (100-400)	85.06
Preoperator packed cell volume (%)	38.00	15 (33-48)	3.83
Postoperator packed cell volume (%)	36.00	16 (29-95)	4.35
Thyroid gland weight (g)	121.00	347.00 (12.8-360)	90.01
Ultrasound thyroid volume (mm^3)	134	270.50 (286-15.50)	92.97
Length of hospital stay (days)	1.93	4 (1-5)	1.06
Mean age of patients (years)	42.61	67 (16-83)	14.31

Table 3: Postoperative complications

Complication	*n* (%)
Nil complication	25 (83.3)
Transient change in voice quality postoperator	3 (10)
Subcutaneous seroma	1 (3.3)
Severe laryngeal edema needing intubation	1 (3.3)
Total	30 (100)

quality was excellent without any affectation of his tone and was discharged home on the 4th postoperative day. He was the patient with longest admission on the ward. The most common surgical procedure performed for the goiter patients was subtotal thyroidectomy which accounted for 20) 66.7%) of cases followed by near-total thyroidectomy. The choice of surgery was usually determined on the operating table taking into consideration extent of the thyroid gland involved in the disease process and the assessment of the viability and functionality of the thyroid lobe supposedly being planned to be left behind. All our patients are routinely placed on supplement L-thyroxin regardless of the type of thyroidectomy performed. Patient are routinely admitted on the ward postoperative and are monitored closely for sign of immediate postoperative complication in the first 24 h after which they are discharged to be followed up in the clinic.

Discussion

The traditional use of conventional hand-tied ligature for control and prevention of bleeding vessels during dissection of thyroid surgery has been established in our practice and stood the test of time. However, the recent introduction of various surgical energy devices, such as bipolar electrocautery, LigaSure Vessel Sealing System, and harmonic devices, is changing how many surgical procedures are carried out. The introduction of the use of such energy devices to the procedure of thyroidectomy is promising to take it to the next level. Introduction of any new surgical technique should have immediate advantages such as ease of carrying out the procedure, less blood loss, reduced operation time, less complication, overall better outcome of the procedure, and improved patients satisfaction before it can become generally acceptable and replacing the traditional method of surgical operation.

The outcome of thyroidectomy using LigaSure Vessel Sealing system in previous studies has been controversial. Petrakis *et al*. in a retrospective case–control study

Table 4: Comparison LigaSure with traditional suture Knot technique

Variable	LigaSure thyroidectomy	Suture Knot thyroidectomy	*P*
Age (years)	45.3	41.6	0.188
Type of surgery (%)	Subtotal thyroidectomy - 66.7	Subtotal thyroidectomy - 50	0.42
	Near-total thyroidectomy - 23.3	Near total thyroidectomy - 33.3	
	Total thyroidectomy - 10	Total thyroidectomy - 16.7	
Duration of operation	59.93	128	0.001
Duration on admission postoperatively	1.9	3.55	0.02
Intraoperative blood loss (ml)	116	328	0.001
Use of wound drain (%)	4 (13.3)	9 (31)	0.1
Frequency of postoperative complications (%)	6 (20)	9 (30)	0.26

reported fewer complications and shorter operative and hospitalization times in the LigaSure group.[10,11] Other retrospective and prospective but not randomized studies did not find any differences between complication rates and hospitalization times.[12-14] In our study population, we found overall reported complication rate to be less in the group of patients who had LigaSure thyroidectomy six patients (20%) compared to the nine patients in the traditional clamp-and-tie technique thyroidectomy group. The common complication seen in the LigaSure thyroidectomy group are seroma in two patients (6.7%), temporary change in voice quality two patients (6.70%) permanent change in voice quality one patient (3.3%), and transient laryngeal edema in one patient (3.3%) [Table 4].

The overall duration of surgery and time for thyroid dissection, devascularization, and removal were also noted to be significantly lower in the group of patients who had LigaSure thyroidectomy compared with the traditional clamp-and-tie thyroidectomy. The mean time for overall duration of surgery was 59.93 min versus 128 min in the clamp-and-tie group. The mean time for thyroid dissection in the LigaSure thyroidectomy group was 24 min although we could not get the mean duration for thyroid dissection in the traditional clamp-and-tie group because it was retrospective data and the timing of thyroid dissection was not routinely recorded at that period. It can be seen that the overall operative period was about half of the time usually spent during the traditional tie-and-clamp technique. This time gain is very significant as it would allow more operative procedure to the carried out on the surgical elective list for the day. The LigaSure thyroidectomy technique has ensured that thyroidectomy is completed within an hour in our center. The reduced operation time was also observed by other studies on LigaSure thyroidectomy.[11,15] Safe thyroidectomy involves the ligation of three major vessel groups and multiple miniature vessels and tissue bundles on the bed of thyroid glands lying on the trachea. It is the clamping tying and suture ligation of these tiny bleeders that tend to take chunk of the surgery time during traditional thyroidectomy, therein lays the advantage of using LigaSure vessel sealing system that is able to coagulate the tiny vessel by inducing protein denaturation in the wall of the blood vessel and at the same time able to cut and divide the vessel. The combination of these two steps markedly shortens the overall period for operation during LigaSure thyroid surgery.

Reduced overall blood loss and reduced requirement for blood transfusion were other clear advantages seen in the use of LigaSure for thyroidectomy. The mean blood loss in the LigaSure thyroidectomy group was 116 ml compared to mean blood loss of 328 ml in the traditional clamp-and-suture thyroidectomy. There was significant difference in the volume of blood loss in the two groups. This finding was not particularly surprising because the LigaSure vessel sealing system has effective hemostatic mechanism, thus reducing the amount of inadvertent blood loss while sealing a vessel, most especially the tiny blood vessel in the bed of thyroid gland that tends to ooze uncontrollably during the traditional clamp-and-suture tie thyroidectomy. Although none of our traditional clamp-and-tie thyroidectomies had need for blood transfusion, the average blood loss reported in another series of traditional clamp-and-tie thyroidectomies from a Nigeria teaching hospital by Kpolugbo *et al*.[16] was 334.3 ml. In this series of 75 patients, two of their patients had need for blood transfusion postthyroidectomy. However, many researchers reported significant reduction of intraoperative blood loss by the use of LigaSure system in total thyroidectomy when compared with the conventional suture ligation technique.[17-19] With a reduced blood loss and secured hemostasis provided by the LigaSure Vessel Sealing System, there may not be need for routine grouping and cross-matching of blood for all thyroid surgery again as has been the practice in our center.

In this study, the cohort of patient who had LigaSure thyroidectomy had shorter hospital stay with a mean length of hospital admission being 1.90 days compared with 3.55 days of hospital admission stay in the clamp-and-tie group. The early recovery from surgery, less postoperative pain, and less requirement for postoperative analgesia in the LigaSure thyroidectomy group are the main reasons for shorter hospital stay and early resumption of normal physical activity and workplace resumption. Finer tissue dissection, less thermal energy spread, and less blood loss would mean less metabolic response to trauma and faster recovery from surgery. Although some authors did not find significant difference with respect to the length of hospitalization in patient who had LigaSure thyroidectomy compared with the clamp-and-tie thyroidectomy,[11,15] Barbaros *et al*.[20,21] and Marrazzo *et al*.[21] reported significantly shorter hospitalization of 2 and 3 days, respectively, after LigaSure thyroidectomy. Moreover, Youssef *et al*. reported earlier pain-free return to normal activity and to work.[22]

Conclusion

In this study, we found the LigaSure Vessel Sealing System instrument handy, easy to use, simple, and straightforward to apply to ligate blood vessels supplying the thyroid gland. The learning curve of the

LigaSure system was considerably minimal. We also found the use of the LigaSure vessel sealing system in thyroidectomy to be safe and effective. The LigaSure resulted in reduction of the operative time minimizes intraoperative blood loss. There was also less attendant postoperative complication with its use and a significant modification of the postoperative outcome regarding the length of hospitalization and early return of patient to full physical activity.

Limitation

The authors of this study recognize some inherent limitation in this study, the two groups of patients, LigaSure thyroidectomy and traditional clamp-and-tie thyroidectomy were not compared head-to-head, in fact one group was retrospective record and the other was prospectively collected data; we recognize that this may introduce bias and limit the level of evidence generated from the study. This is an initial experience being compared with what normally obtain before the introduction of the procedure. We are also limited in carrying out cost analysis assessment of the two types of procedure; we also recognize this as a limitation.

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Conflicts of interest

There are no conflicts of interest.

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