

A Comparative Study between the Outcome of Using LigaSure® Versus Suture Ligation in Thyroid Surgery

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Abstract

Background: Thyroid surgery is one of the most performed operations; with the high vascularity of the thyroid gland and the importance of hemostasis to the surgical outcome, many surgeons have begun to use energy-based devices to perform thyroid surgical procedures, and numerous studies demonstrated the benefit of these devices. The aim was to compare the use of a vessel sealing device (LigaSure) with suture ligation in perioperative time, hypocalcemia, recurrent laryngeal nerve (RLN) damage, blood loss after surgery, hematoma formation, and period of the patient. **Materials and Methods:** In this study, 81 patients who underwent total thyroidectomy for different diseases, and divided into two groups corresponding to the hemostasis type: vessel sealing devices (LigaSure) group, and suture ligation group, these groups compared regarding operative time; hypocalcemia, RLN injury, blood loss after surgical procedure, hematoma formation, and period of hospital admissions. **Results:** The duration of surgery was more significant and shorter in the LigaSure® group 66.57 ± 8.93 min than suture ligation group 86.84 ± 17.5 min with $P = 0.0001$, with bleeding after surgery, was lesser in LigaSure® patients 52.76 ± 22.8 mL than suture ligation group 95.09 ± 39.91 mL with $P = 0.0001$; other outcomes (postoperative hematoma formation, injury to recurrent laryngeal nerve, hypocalcemia after surgery, and period of hospital admission), and there was no difference between the two groups mentioned above. **Conclusion:** The role of the LigaSure instrument in thyroidectomy surgery is to decrease the operative time duration and blood loss after surgery, with no effect on the incidence of recurrent laryngeal nerve damage, postoperative low serum calcium level, and hematoma formation.

Keywords: LigaSure®, suture ligation, thyroid surgery

INTRODUCTION

The history of thyroid surgery goes back to 952 AD when Abul Qasim (Al-Zahrawi) first performed the surgery.^[1]

There are limited advances in the procedural characteristics of thyroid operation from when the surgical methodology was designated by Kocher,^[2] with the fact that total thyroidectomy is widespread as part of endocrinology surgery, and they are important for treating multiple thyroid diseases.^[3,4]

The thyroid gland has a rich blood supply, which has a rich blood supply, and its neighborhood to recurrent laryngeal nerve and parathyroid glands puts them at risk of injury during thyroid surgery.^[5]

The suture ligation technique for hemostasis in thyroid operation depends on knot binding (with or no

electrocoagulation),^[6] while knot tying takes more time with the risk of slipping, while electrocautery has the risky effect of causing injuries to adjacent tissues due to its electrical current and heating effects.^[7]

William T Bovie found (1914–1927) alternating current with a frequency ranging between 250,000 and 2000,000 Hz could be applied to incise coagulated tissue and get hemostasis; then, he discovered an electrosurgical device. Harvey Cushing discovered the neurosurgery device in 1926 in neurosurgical surgeries; then it was used by other surgeons.^[8]

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New vessel-sealing methods containing electrothermal bipolar-activated systems (such as LigaSure® [LS]) are currently used in thyroid operations. In order to decrease bleeding, operation time and distance of skin incision. The LS abolishes the lumen by generating a seal using a mixture of pressure and electrothermal energy to transform the vessel wall configuration.^[5]

LigaSure vessel sealing system (LVSS) is discovered by Covidien; it is a bipolar instrument for sealing tissue with vascular bleeding during surgery by applying a high current and low voltage (180 V), and are resulting fusion of vessels. Applying a short LVSS system which gives a temperature of 1000°C, will affect hydrogen links to become ruptured and then denatured, resulting in a vascular seal with more powerful tensile strong, while collagen and elastin of vessels under high temperature provide a long-lasting plastic sealing that extends up to 7-mm diameter.^[9]

In this article, we shall highlight the differences in the occurrence of the most common and most important early complication following total thyroidectomy when using a tissue sealing device (LigaSure®) compared to the suture ligation, i.e., the early postoperative bleeding, the injury to the recurrent laryngeal nerve and hypoparathyroidism manifested by hypocalcemia, operative time count, and extend of hospital admission. The aim of the study is to compare the use of the tissue sealing device LigaSure® with suture ligation for total thyroidectomy in terms of nerve injury, operative time, hypocalcemia, hematoma formation, postoperative blood loss, and length of hospital stay.

MATERIALS AND METHODS

In total, 89 patients with different thyroid diseases were involved in this research [Figure 1]; they had a total thyroidectomy in AL-Hilla City from January 2018 to December 2020.

Exclusion criteria

- 1- Preoperative hypocalcemia and hypercalcemia.
- 2- Retrosternal goiter.
- 3- Previously operated goiter or history of neck surgery.
- 4- Patient with a bleeding disorder.
- 5- Single lobe or subtotal thyroidectomy.
- 6- History of recurrent laryngeal nerve palsy.

All patients were examined for:

1. Preoperative total serum calcium.
2. Thyroid function test (T3, T4, and TSH).
3. Neck ultrasound.
4. Preoperative indirect laryngoscopy for vocal cords assessment.
5. Fine needle aspiration for cytology for suspicious cases.

All patients with low- and high-serum thyroid hormones, including those with Graves' disease, were to receive drug treatments to resume a normal thyroid state (all serum thyroid hormone levels were within normal ranges).

Patients were chosen according to the method of hemostasis and were categorized into two main groups: 38 (42.7%) patients in the LigaSure® group and 51 (57.3%) patients in the suture ligation group.

The total patients were checked for preoperative mobility of the vocal cord, thyroid gland investigations, serum calcium, neck ultrasound, and fine needle aspiration cytology of suspicious nodules in addition to routine investigations.

Two surgeons were doing operations, in which one of them used suture ligation for hemostasis and the other used LigaSure® in hemostasis.

Verbal consent was obtained preoperatively from the patients regarding their participation in this study.

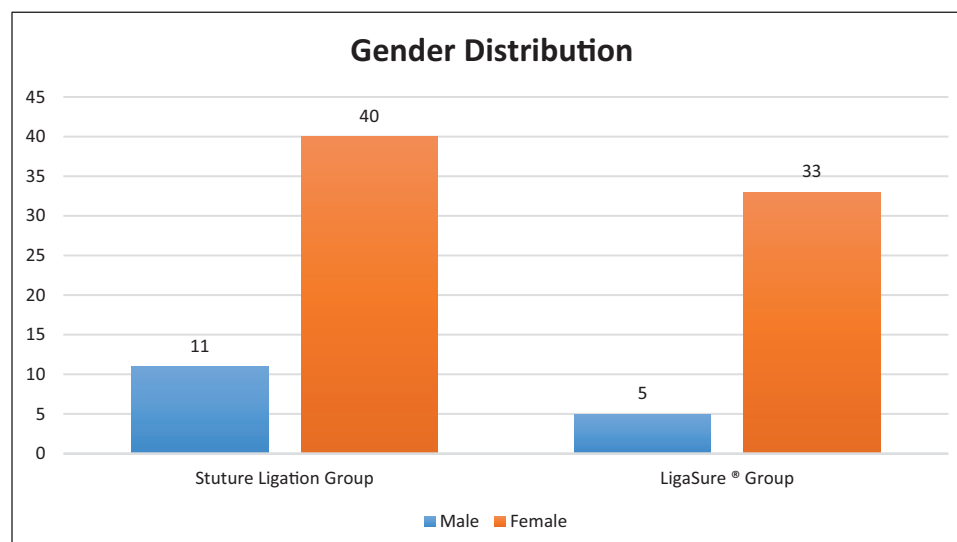


Figure 1: Gender distribution according to surgical technique

The surgery was beginning for general anesthesia with an endotracheal tube; the position of the patient was reverse Trendelenburg and draped in a classical manner, collar incision 4–6cm (length incision), the upper and lower subplatysmal flap created, open deep cervical fascia by a midline incision and thyroid gland delivered to the surgical field.

In the group of suture ligation, the ligation of thyroid vessels begins with the middle thyroid vein first, then superior thyroid vessels through the effect of vicryl 2/0 and vicryl 0, respectively, followed by inferior pedicle ligation near the thyroid lobe to preserve parathyroid blood supply, and all remaining blood vessels ligated using vicryl 2/0.

However, LigaSure® patients' group, the middle thyroid vein, superior pedicle, and inferior thyroid vessel were coagulating and dissected by LigaSure® small jaw sealer, and fine areolar tissue near the Berry ligament also dissected with LigaSure® small jaw sealer, with care had been taken to avoid recurrent laryngeal nerve injury and preserve parathyroid glands.

Two Radi-vac drains were inserted in the deep cervical plain with preservation between 24 and 48 h to compute the blood quantity that drained after the operation.

Then, wound was closed, and vocal cord mobility was examined after extubating by the direct laryngoscope.

The intraoperative factors were reported, involving operative time (from skin cutting until its closure) and recurrent laryngeal nerves function assessment.

After surgery, the parameters registered include the time needed for the patient to be discharged from the hospital after exiting the patient from the theater, the development of hematoma, and if there is damage to the recurrent laryngeal nerve (voice hoarseness, abnormal breathing, and examination the movement of vocal cord when there were any doubtful), looking for signs and symptoms of hypocalcemia, serum calcium measuring routinely on postoperative day one and blood quantity drain for 24 or 48 h was also calculated.

Follow up for 180 days for other complications such as hypocalcemia and permanent recurrent laryngeal nerve damage (if it continues more than 180 days after the operation).

Statistical analysis

The data were evaluated with the SPSS program (version 25); continuous numbers were described as mean $\pm$ standard deviation (SD), while categorical data were represented as frequency and percentage, in which applied Chi-square test was applied. The *P*-value was significant (less than 0.05).

Ethical approval

The study was conducted in accordance with the ethical principles that have their origin in the Declaration of

Helsinki. It was carried out with patients' verbal and analytical approval before the sample was taken. The study protocol, subject information, and consent form were reviewed and approved by a local ethics committee according to document number 1862 on November 30, 2018.

RESULTS

Of the 89 patients involved in this study, 73 patients (82%) were female, and 16 patients (18%) were male [Table 1].

The mean age was 37.11 years (range from 11 to 63), with an SD of 11.83.

The mean age in the suture ligation group was 36.82 years with an SD of 11.20; within LigaSure® group was 37.50 years with an SD of 12.77.

The operative time was significantly shorter in LigaSure® group than suture ligation group, 66.578 ± 8.937 versus 86.843 ± 17.505 min, respectively [Table 3].

Recurrent laryngeal nerve damage was not showing significance and was found in two cases (3.921%) in the suture ligation group versus no recurrent laryngeal nerve injury reported in LigaSure® group with a *P* value of 0.365; all nerve injuries were transient, unilateral, and no tracheostomies required, and recover within 6 months.

The bleeding quantity in the drain was lower in LigaSure® group (52.763 ± 22.800 mL) than in the suture ligation group (95.098 ± 39.918 mL); this was static significant with a *P* value < 0.001 .

The hematoma formation after the operation, suture ligation group showed one patient (1.960%), and no hematoma occurred in LigaSure® group; this hematoma was deep and tensioned, which direct draining of hematoma to relieve the pressure on the trachea, and ligation the source of bleeding (small oozing vessel in the thyroid bed), and securing the hemostasis a *P* value = 0.350.

Hypocalcemia developed in three cases (7.894%) in LigaSure® group and 10 cases (19.607%) in the suture ligation group and with a *P* value = 0.655, two patients (5.263%) in LigaSure® group and three patients (5.882%) in suture ligation group were symptomatic, treatment was addition drug with extra calcium, it was usually transient and improved within 180 days [Table 4].

Table 1: Gender distribution in this study

Gender	Frequency	Percentage
Female	73	82
Male	16	18
Total	89	100

DISCUSSION

In our study, 89 patients underwent total thyroidectomy for different thyroid diseases using two techniques, one suture ligation technique and the other using LigaSure®.

The suture ligation technique takes longer because it depends on knot and tie formation. At the same time, the energy-based technique can also cause thermal injury to neighboring nerve tissues and parathyroid glands.^[4,10] Consequently, we need a technique to be better-safe hemostasis with a reduced time needed.

In this present research, the mean age (years) of both groups was 37.11 ± 11.83 ; in the LigaSure® group, the mean age was 37.5 ± 12.778 , while in the suture ligation group was 36.82 ± 11.2 , with no significant difference between tow group (P value = 0.652); also the surgical method and related disease were found nearly same in both groups with no significant statistically [Table 2].

The present research showed that the role of LigaSure was significantly decreasing the operative time in total thyroidectomy by about 20min, which is significant (P value < 0.0001). These outcomes are nearly similar to Joliat's findings^[11] that show reducing in surgical time by approximately 31 min in LigaSure® hemostatic group, and a meta-analysis described a significant decrease in

operative time in the LigaSure group in comparison with the conventional suture ligation method ($P < 0.00001$).^[10]

In this current research, after thyroid operation, blood quantity was collected 24–48 h by two Radi-vac drains, which showed a significant difference in the blood quantity (P value < 0.0001) that drained from the LigaSure group was less by about 43 mL. In reference to Ahmeds' findings,^[12] these results suggest noteworthy implications, where this article shows reducing blood quantity loss (after thyroid surgery) by approximately 11.6 mL in the LigaSure® group comparable to the suture ligation. While Ciftcis' findings^[13] also showed that blood drained was 28 mL less with the use of LigaSure® group.

In general, recurrent laryngeal nerve damage is a more risky postsurgical complication in the thyroid gland, leading to vocal cord palsy, which is regarded as a temporary complication in most cases and returns to do their function within 6 months. Occasionally this nerve damage is permanent. Recurrent laryngeal nerve injuries are involved on both sides, so a tracheostomy is needed. This existent study demonstrates no significant associations regarding the incidence of recurrent laryngeal nerve (RLN) injury in both studying groups (P value = 0.355); one patient in the conventional hemostasis group and no injury in the bipolar cautery hemostasis group. RLN injury was short-term and improved within 90 days, and the resulting outcome is about the same as in another research.^[14,15]

Hematoma developed postoperatively in one patient in this study (in the suture ligation group); these complications are crucial and need surgical involvement to treat the hematoma. Retrospective research showed an incidence (1.5%) of postoperative hematoma. A similar study was stated in the paper (1.12%) with reducing in the incidence of hematoma (after surgery) by the effect of LigaSure® for hemostasis.^[16-18]

Regarding hypocalcemia postsurgery in the present research, 13 patients have hypocalcemia, and all patients receive calcium treatment and become healthier within 180 days, with no significant difference between the two groups (P value = 0.677).

Table 2: Mean age according to surgical technique

Operative technique	Mean age (years)	Number	Standard deviation
Suture ligation	36.823	51	11.201
LigaSure®	37.5	38	12.778
Total	37.112	89	11.834

P value = 0.652

Table 3: Operative time according to surgical technique

Operative technique	Time (min)	Standard deviation
Suture ligation	86.843	17.505
LigaSure®	66.578	8.937

P value = < 0.001

Table 4: Complications of thyroid surgery in relation to surgical technique and its significance

Outcome	Suture ligation	LigaSure®	P value
Operative time (min)	86.843	66.578	<0.001
Standard deviation	(17.505)	(8.937)	
RLN injury	2 (3.921%)	Zero (0%)	0.365
Hypocalcemia	10 (19.607%)	3 (7.894%)	<0.001
S. Ca++ <2.0 mmol/l			
Symptomatic hypocalcemia	3 (5.882%)	2 (5.263%)	0.655
Blood loss (mL)	95.098	52.763	<0.001
Standard deviation	(39.918)	(22.800)	
Tension hematoma	1 (1.960%)	Zero (0%)	0.350

RLN, recurrent laryngeal nerve

CONCLUSION

Using the LigaSure® device in thyroidectomy, the operative time is shorter, and post-operative blood loss is smaller, with no variability in the incidence of recurrent laryngeal nerve injury, postoperative hypocalcemia, and hematoma formation.

Authors' contribution

Salah K. Hadi (first author) wrote and edited the methodology, statistical analysis, and discussion (50%); Karrar I. Mahmood (second author) wrote the introduction, discussion, and conclusion (50%). The authors had agreed with the final manuscript. We can confirm that the manuscript has been read and approved by both named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that both have approved the order of authors listed in the manuscript of us.

Data availability statement

The authors confirm that all data supporting the findings of this study are available within the article.

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Conflicts of interest

There are no conflicts of interest.

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