

COMPARISON OF LIGASURE VERSUS CLAMP AND KNOT TECHNIQUE FOR TOTAL THYROIDECTOMY IN TERMS OF INTRAOPERATIVE BLOOD LOSS

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Published: 15 December 2025

ABSTRACT

Objectives

To compare the effectiveness of the LigaSure vessel sealing system with the conventional clamp-and-knot ligation technique in total thyroidectomy, focusing on operative time, intraoperative blood loss, and postoperative complications.

Methodology

This randomized controlled trial was conducted in Surgical Unit II, DHQ Hospital Gujranwala during July 2025 and November 2025. A total of 60 patients aged 18–70 years with clinically diagnosed multinodular goiter and euthyroid status were enrolled through non-probability consecutive sampling. Patients were randomly allocated into two groups: Group A underwent thyroidectomy using LigaSure, and Group B underwent conventional thread ligation. All procedures were performed by a single surgical team. Quantitative variables, including operative time and blood loss, were analyzed using an independent sample t-test, while qualitative outcomes, including wound infection and seroma formation, were compared using the chi-square test. A p-value ≤ 0.05 was considered significant.

Results

Baseline demographic and clinical characteristics were comparable between the two groups ($p > 0.05$). The mean operative time was significantly shorter in the LigaSure group (68.4 ± 6.9 minutes) compared to the conventional group (83.1 ± 7.4 minutes; $p < 0.001$). Similarly, mean intraoperative blood loss was significantly lower in Group A (60.7 ± 4.5 mL) versus Group B (72.9 ± 4.1 mL; $p < 0.001$). Postoperative wound infection and seroma rates were lower in the LigaSure group but were not statistically significant.

Conclusion

LigaSure significantly reduced operative time and intraoperative blood loss without increasing postoperative complications, demonstrating a safe and efficient alternative to the conventional clamp-and-knot technique for total thyroidectomy.

Keywords: LigaSure, thyroidectomy, hemostasis, intraoperative blood loss, operative time, surgical outcomes.

INTRODUCTION

Thyroid surgery used to be performed regularly after numerous modifications in the surgical method but still, efforts are being made to develop safe and easy techniques. Thyroid surgery has evolved over the period in terms of surgical techniques and the ratio of complications encountered during surgery.^{1,2} Securing hemostasis is the foremost important thing during surgery in terms of intraoperative bleeding, good visualization of the field and prevention of vital structures such as parathyroid and laryngeal nerves. Injury to thyroid vessels and parenchyma are the main sources of hemorrhage during and after surgery.^{3,4} During thyroid surgery excessive bleeding can obscure the operative field making it difficult to visualize parathyroid glands and recurrent laryngeal nerves, prolonging the operative time. Hemostasis can be secured by suture knot tying technique or new techniques of hemostasis by using energy devices such as ligasure as an alternative bipolar surgical diathermy system. The use of sutures and their application comes after a very long learning curve and years of experience.^{5,6} By using energy

devices such as ligasure, operative time can be reduced as well tissue identification becomes easy. Over the last few years, sutureless thyroid surgery has gained popularity by using different sealing devices such as ligasure. This technique has been found to be effective safe and faster as compared to the conventional cut-and-tie technique described by early surgeons. This device is used for cutting and hemostasis by vessel ligation and division without increasing post-operative complications.^{7, 8}

The purpose of using these energy devices was to minimize blood loss, operative time and length of skin incision. The mechanism of ligasure is to obliterate the lumen of the vessel by creating a seal with pressure and electrothermal energy to change the vessel wall structure.⁹ Mosalam et al., conducted a trial and found that mean operative time with ligasure method was 47.13 ± 2.84 min that was significantly less than conventional method i.e. 75.38 ± 8.76 min ($p < 0.05$). But there is no difference in the postoperative complications including seroma formation (10% vs. 20%) and wound infection (10% vs. 10%).⁶ In one trial, the reported mean intraoperative blood loss was 61.31 ± 4.37 ml with ligasure and 72.11 ± 3.83 ml with conventional thread method (p -value = 0.0001).¹⁰

The aim of this trial is to compare total thyroidectomy using a ligasure vessel sealing system in comparison with the conventional thread ligation method. Literature showed that ligasure has better control over intraoperative blood loss than conventional method as well as it can also help to reduce operative time, which also reduces several intraoperative and post-operative complications. Also, the risk of postoperative infections is low. But limited work has been done in local population before and currently, conventional method is applied in routine in different clinical setting. Therefore, this study has been planned to get evidence for local population so that ligasure could be adopted with confidence and morbidity related to blood loss can be prevented. This will also help to improve our practice and outcomes of thyroidectomy.

METHODOLOGY

This study was a prospective randomized controlled trial involving two parallel groups that was carried out in Surgical Unit II, DHQ Hospital, Gujranwala from July 2025 to November 2025 after approval by the Institutional Ethical Review Committee.

Calculation of the sample size was performed by using OpenEpi Version 3.01 taking into account the mean value of intraoperative blood loss in a previously conducted study (61.31 ± 4.37 mL for the LigaSure group and 72.11 ± 3.83 mL for the conventional group) with the 95% confidence level, 90% statistical power, and 1:1 allocation ratio. The sample size was 60 subjects (30 subjects per treatment group).

Patients coming to the surgical outpatient department fulfilling the criteria for inclusion were included in the study in consecutive order till the required sample size was obtained. Criteria for inclusion of the study were that the patients were male or female and aged between 18 to 70 years old, having clinically diagnosed benign multinodular goiter and were clinically and biochemically euthyroid and scheduled for total thyroidectomy under general anesthesia. Patients previously operated for thyroid disease, malignant thyroid, solitary thyroid nodule, retrosternal goiter, or having bleeding diathesis (INR >2 or PTT >15 s) were excluded from the study.

Informed written consent was taken from all participants, and then randomly divided in a 1:1 ratio into Group A (LigaSure group) and Group B (conventional clamp-and-tie group) using a lottery method. Allocation was done just before operation. All operations were done under general anesthesia by an experienced surgical team.

Age, sex, BMI, duration of disease, nodule size, smoking habit, alcohol habit, diabetes mellitus, hypertension, hemoglobin level, and TSH level were recorded using a standardized proforma.

The primary outcome measures were the operation time and intra-operative blood loss. The operation time was measured from the time of making the initial incision to when the skin was sutured. Intra-operative blood loss was quantified based on the pre-determined operational parameters. Post-operation wound infection and seroma were assessed among patients 15 days after the surgical procedure in the outpatient department.

The data were analyzed using SPSS version 25 software. Continuous data were presented in the form of mean $\pm$ SD while the categorical data were presented as frequency and percentages. Comparison of baseline characteristics was done to determine if the randomization was adequate. The independent sample t-test was used to compare operative time and intra-operative blood loss, while the chi-square test or Fisher's exact test, depending on circumstances, was used for comparison of categorical outcomes. Stratified analysis was done to determine the effect of age, gender, BMI, duration of disease, nodule size, smoking, diabetes mellitus, hypertension, hemoglobin and TSH levels.

RESULTS

This randomized controlled trial was conducted in the Surgical Unit II of DHQ Hospital Gujranwala over a period of six months following synopsis approval. A total of 60 patients meeting the inclusion criteria were enrolled through non-probability consecutive sampling and were randomly allocated into two equal groups: 30 patients in Group A (LigaSure) and 30 in Group B (Conventional Clamp-and-Knot Technique).

The demographic and clinical characteristics of both groups were comparable at baseline. The mean age of patients in Group A was 42.6 ± 11.3 years, and in Group B it was 44.2 ± 10.7 years. Females comprised 73.3% of Group A and 76.7% of Group B. The mean BMI was 26.4 ± 3.2 kg/m² in Group A and 26.1 ± 3.6 kg/m² in Group B.

Both groups demonstrated a similar distribution of comorbidities, including smoking, diabetes, and hypertension. No significant differences were observed in baseline TSH level, hemoglobin level, duration of disease, or nodule size ($p > 0.05$ for all).

Table 1: Baseline Demographic & Clinical Characteristics of Patients (n = 60)

Variable	Group A (LigaSure) n=30	Group B (Conventional) n=30	p-value
Age (years)	42.6 ± 11.3	44.2 ± 10.7	0.52
Gender (Male/Female)	8 / 22	7 / 23	0.76
BMI (kg/m ²)	26.4 ± 3.2	26.1 ± 3.6	0.71
Duration of disease (years)	3.8 ± 1.9	4.0 ± 2.1	0.63
Nodule size (cm)	4.6 ± 1.2	4.8 ± 1.3	0.48
Smoking (%)	5 (16.7%)	6 (20%)	0.74
Alcoholism (%)	2 (6.7%)	3 (10%)	0.64
Diabetes (%)	7 (23.3%)	8 (26.7%)	0.76
Hypertension (%)	9 (30%)	11 (36.7%)	0.59
Hemoglobin (g/dL)	12.8 ± 1.4	12.6 ± 1.6	0.62
TSH (mIU/L)	2.43 ± 0.91	2.38 ± 0.88	0.84

No statistically significant difference was found in baseline variables between both groups ($p > 0.05$). The mean operative time was significantly shorter in the LigaSure group. Group A demonstrated an average operative duration of 68.4 ± 6.9 minutes, whereas Group B required 83.1 ± 7.4 minutes ($p < 0.001$). The LigaSure group also showed significantly reduced blood loss. Mean intraoperative blood loss in Group A was 60.7 ± 4.5 mL, compared to 72.9 ± 4.1 mL in Group B ($p < 0.001$). These findings closely align with the values used during sample size calculation. Wound infection occurred in 1 patient (3.3%) in Group A and 3 patients (10%) in Group B; however, this difference did not reach statistical significance ($p = 0.29$). Seroma formation was observed in 2 patients (6.7%) in Group A and 5 patients (16.7%) in Group B, also statistically non-significant ($p = 0.23$).

Table 2: Comparison of Surgical Outcomes between Groups

Outcome	Group A (LigaSure) n=30	Group B (Conventional) n=30	p-value
Operative time (minutes)	68.4 ± 6.9	83.1 ± 7.4	<0.001*
Blood loss (mL)	60.7 ± 4.5	72.9 ± 4.1	<0.001*
Wound infection	1 (3.3%)	3 (10%)	0.29
Seroma formation	2 (6.7%)	5 (16.7%)	0.23

*Statistically significant at $p \leq 0.05$.

LigaSure significantly reduced operative time and intraoperative blood loss. Rates of wound infection and seroma formation were lower in the LigaSure group, although differences were not statistically significant.

DISCUSSION

This randomized controlled trial was carried out in Surgical Unit II of DHQ Hospital Gujranwala over a six-month period following the approval of the synopsis. A total of 60 patients who met the inclusion criteria were enrolled through non-probability consecutive sampling and were randomly assigned into two equal groups: 30 patients in Group A (LigaSure) and 30 patients in Group B (Conventional Clamp-and-Knot Technique).

According to a study conducted in 2021, the LigaSure Vessel Sealer was found to be a feasible and reliable surgical modality, demonstrating significantly better outcomes than the conventional clamp-and-knot technique in terms of postoperative bleeding, operative time, postoperative pain, and hospital stay. However, the difference in calcium levels was not statistically significant¹¹. In the present study, the demographic and clinical characteristics of both groups were comparable at baseline. The mean age of patients in Group A was 42.6 ± 11.3 years, whereas in Group B it was 44.2 ± 10.7 years. Females constituted 73.3% of Group A and 76.7% of Group B. The mean BMI was 26.4 ± 3.2 kg/m² in Group A and 26.1 ± 3.6 kg/m² in Group B. Both groups exhibited a similar distribution of comorbidities such as smoking, diabetes, and hypertension. No significant differences were noted in baseline TSH levels, hemoglobin levels, duration of disease, or nodule size ($p > 0.05$). A study conducted in 2013 reported that LigaSure hemostasis during total thyroidectomy improved surgical outcomes by significantly reducing operative time, wound-drainage duration, and hospital stay. Furthermore, the use of LigaSure significantly lowered wound-pain scores and decreased the need for rescue analgesia¹².

In the current research, no statistically significant difference was found in baseline variables between the two groups ($p > 0.05$). However, the mean operative time was significantly shorter in the LigaSure group. Group A had an average operative duration of 68.4 ± 6.9 minutes, compared with 83.1 ± 7.4 minutes in Group B ($p < 0.001$). The LigaSure group also demonstrated significantly lower intraoperative blood loss, with a mean of 60.7 ± 4.5 mL, whereas Group B recorded 72.9 ± 4.1 mL ($p < 0.001$). Similarly, a 2021 study found that thyroid surgery performed using LigaSure resulted in markedly shorter operative times and reduced postoperative blood loss compared with the traditional approach¹³. The present findings closely align with the initial estimates used for sample size calculation. Wound infection occurred in 1 patient (3.3%) in Group A and in 3 patients (10%) in Group B, but this difference was not statistically significant ($p = 0.29$). Seroma formation was seen in 2 patients (6.7%) in Group A and 5 patients (16.7%) in Group B, also without statistical significance ($p = 0.23$). In 2007, another study demonstrated that the use of LigaSure was as safe and effective for vessel division and hemostasis as the clamp-and-tie technique, while achieving a statistically significant—though modest—reduction in operative time. This slight decrease in operative duration could allow more total thyroidectomies to be performed annually, offsetting the higher cost of the device¹⁴. In summary, our study found that the use of LigaSure significantly reduced operative time and intraoperative blood loss. Although rates of wound infection and seroma formation were lower in the LigaSure group, the differences were not statistically significant. Consistent with these findings, a 2022 study reported that, compared with the conventional clamp-and-tie method, the LigaSure technique reduced surgical time, intraoperative blood loss, the need for postoperative drainage, the likelihood of hematoma formation, the risk of parathyroid injury, and the risk of recurrent laryngeal nerve damage¹⁵.

CONCLUSION

LigaSure proved to be a safe and effective alternative to the conventional clamp-and-knot technique for total thyroidectomy. It significantly reduced operative time and intraoperative blood loss without increasing postoperative complications such as wound infection or seroma formation. Although both groups showed comparable baseline characteristics, the efficiency and improved surgical handling with LigaSure suggest meaningful clinical advantages. These findings support the adoption of LigaSure in thyroid surgery to enhance operative outcomes and reduce surgical morbidity.

Limitation:

The present research study is based on a single-center approach with a fairly small sample size, and this might affect the generalization of the results achieved during the research. In addition, due to the short duration of the follow-up of 15 days, it was impossible to evaluate the results in the long term after surgery.

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