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Original Research

Comparison of Outcome of Ligaclip versus Traditional Suture Method in Total Thyroidectomy

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Name of Author:
Sheikh Muhammad Dayyan Ali[1*], Aamer Ayub Awan[2], Waseem Amin[3], Uzair Hassan[4],Tahir Rashid[5]

Affiliation: *[1,5]Department of Otorhinolaryngology (ENT Unit 1), Postgraduate Medical Institute/Lahore General Hospital, Lahore, Pakistan*
[2]Associate Professor, Department of Otorhinolaryngology (ENT Unit 1), Postgraduate Medical Institute/Lahore General Hospital, Lahore, Pakistan
[3,4]Postgraduate Resident, Department of Otorhinolaryngology (ENT Unit 1), Postgraduate Medical Institute/Lahore General Hospital, Lahore, Pakistan

Corresponding Author:
Dr. Sheikh Muhammad Dayyan Ali
Email: dayyanali7@gmail.com

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Abstract: **Objective:** To compare the surgical outcomes of Ligaclip and traditional suture methods in total thyroidectomy in terms of operative time, intraoperative blood loss, postoperative bleeding, postoperative hypocalcemia, and duration of hospital stay. **Study Design**, Place and Duration: Randomized controlled trial conducted in the Department of Otorhinolaryngology, Lahore General Hospital, Lahore. The duration of study was from August 2025 to November 2025. **Materials and Methods**: A total of 120 patients aged 18-60 years who were scheduled for total thyroidectomy were enrolled through non-probability consecutive sampling and allocated by lottery method to the Ligaclip group (n=60) or traditional suture group (n=60). Both groups underwent the same standard thyroid exposure. In Group A, thyroid vessels were secured with Ligaclip vascular clips; in Group B, vessels were ligated manually with sutures. Operative time, intraoperative blood loss, postoperative bleeding, postoperative hypocalcemia, and hospital stay were recorded. Data were analysed using SPSS version 26. Independent-samples t test, Pearson chi-square test, and Fisher exact test were applied as appropriate. **Results**: Baseline demographic and clinical characteristics were comparable between groups. Mean operative time was shorter with Ligaclip than with traditional suture ligation (84.6 ± 12.1 vs 94.9 ± 13.4 minutes; mean difference -10.3 minutes, 95% CI -14.9 to -5.7; $p<0.001$). Mean intraoperative blood loss was also lower (58.4 ± 18.6 vs 72.7 ± 21.3 mL; $p<0.001$). Postoperative hypocalcemia occurred in 3 (5.0%) patients in the Ligaclip group and 10 (16.7%) in the traditional suture group ($p=0.040$). Postoperative bleeding was uncommon and did not differ significantly (3.3% vs 8.3%; $p=0.439$). Hospital stay was similar between groups (2.4 ± 0.8 vs 2.7 ± 0.9 days; $p=0.056$). **Conclusion:** Ligaclip use during total thyroidectomy was associated with shorter operative time, less intraoperative blood loss, and a lower frequency of postoperative hypocalcemia. Postoperative bleeding and hospital stay were comparable between the two methods. The findings support Ligaclip as an alternative method of vessel control when appropriate surgical technique and careful identification of the recurrent laryngeal nerves and parathyroid glands are maintained.

Keywords: Total thyroidectomy; Ligaclip; vascular clips; suture ligation; hypocalcemia; intraoperative blood loss.

INTRODUCTION

Thyroidectomy is a well-established operation for a range of benign and malignant thyroid disorders. The procedure developed from a high-risk operation into a standardized form of endocrine surgery as anatomical knowledge, anesthesia, antisepsis, and techniques of vascular control improved.1,2 Total thyroidectomy is now performed for conditions including multinodular goiter, Graves' disease, compressive thyroid enlargement, and selected thyroid malignancies according to the clinical indication.3,4 Despite these advances, complications remain clinically relevant because the thyroid gland is highly vascular and lies close to the recurrent laryngeal nerves and parathyroid glands. Postoperative hemorrhage may compromise the airway, while hypocalcemia may follow parathyroid injury, devascularization, or inadvertent removal. Safe thyroidectomy therefore depends on precise dissection, preservation of adjacent structures, and reliable hemostasis.3,4

Conventional vessel control is usually achieved by clamp-and-tie suture ligation, with selective use of clips or electrocautery. Manual ligation is familiar and inexpensive but requires repeated isolation, clamping, knot placement, and division of vessels. Vascular clips offer a mechanical method of occlusion that can be applied rapidly without knot tying. The CLIVIT trial was designed specifically to compare vascular clips with ligatures in thyroid surgery, reflecting continued interest in whether clips can reduce operating time without increasing bleeding or nerve-related complications.5 Its multicentre results showed that clips were feasible and safe, although a clinically important reduction in resection time was not demonstrated.6 In parallel, sutureless and energy-based techniques have been investigated extensively and have often been associated with shorter operative time or lower blood loss than conventional ligation.7 Recent comparative reports continue to show variation according to the hemostatic method, operative setting, and outcome measured. Thayalan Dias et al. reported shorter operative time with sutureless thyroidectomy, while postoperative bleeding and hypocalcemia were uncommon in both groups.8 A Pakistani study comparing LigaSure with clamp-and-tie technique also reported lower operative time and intraoperative blood loss with the device-based approach.9 These findings cannot be directly transferred to mechanical Ligaclip use because energy-sealing devices and vascular clips have different mechanisms of action. Local comparative evidence for Ligaclip in total thyroidectomy remains limited. The present study therefore compared Ligaclip with traditional suture ligation in total thyroidectomy, focusing on operative time, intraoperative blood loss, postoperative bleeding, postoperative hypocalcemia, and duration of hospital stay.

MATERIALS AND METHODS

A randomized controlled trial was conducted in the Department of Otorhinolaryngology, Lahore General Hospital, Lahore. The duration of study was from August 2025 to November 2025. Ethical approval was obtained from the relevant institutional review authority, and written informed consent was obtained from all participants before enrolment. The sample size was 120 patients, with 60 participants in each group, calculated using the expected difference in postoperative hypocalcemia reported in the source study, with 80% power and a 95% confidence level. Patients were enrolled through non-probability consecutive sampling and were allocated to the two surgical groups by lottery method.

Patients aged 18-60 years of either sex who were scheduled for total thyroidectomy were included. Patients were excluded if they had previous thyroid surgery, severe cardiac, pulmonary, renal, or hepatic disease likely to complicate surgery or anesthesia, pregnancy, a contraindication to surgery because of anesthetic risk or severe comorbidity, or inability to provide informed consent. Baseline information included age, sex, diabetes mellitus, hypertension, indication for surgery, and preoperative hemoglobin. Total thyroidectomy was defined as complete removal of both thyroid lobes and the isthmus, with removal of the pyramidal lobe when clinically indicated. Operative time was measured from skin incision to completion of skin closure. Intraoperative blood loss was calculated from the increase in gauze weight together with the volume in the suction container after subtraction of irrigation fluid.

All procedures were performed under general anesthesia using a standard Kocher transverse cervical incision. The strap muscles were separated or retracted to expose the thyroid gland. In Group A, the thyroid vessels were isolated and secured using Ligaclip vascular clips before division. The gland was mobilized with direct identification and preservation of the recurrent laryngeal nerves and parathyroid glands and their vascular supply. In Group B, the same exposure and dissection were used, but the thyroid vessels were secured by conventional manual suture ligation before division. Hemostasis was checked before closure in both groups. Patients received routine postoperative monitoring. Postoperative bleeding was recorded when clinically significant bleeding required medical intervention, additional procedure, or prolonged observation. Postoperative hypocalcemia was identified clinically by symptoms such as perioral or distal paresthesia, muscle spasm, or tetany and biochemically by serum calcium below the local laboratory lower limit, consistent with established post-thyroidectomy assessment principles.[10] Duration of hospital stay was calculated from the day of operation to discharge.

Data were analysed using SPSS version 26. Continuous variables were assessed for approximate normality using the Shapiro-Wilk test and were presented as mean ± standard deviation. Categorical variables were presented as frequency and percentage. Between-group comparisons of age, preoperative hemoglobin, operative time, intraoperative blood loss, and hospital stay were performed using the independent-samples t test. Pearson chi-square test was used for categorical outcomes when expected cell counts were adequate, and two-sided Fisher exact test was used for sparse cells. Mean differences and risk differences were reported with 95% confidence intervals where appropriate. Stratified analyses were performed according to age, sex, comorbidity status, and indication for surgery. A p-value below 0.05 was considered statistically significant.

RESULTS

A total of 120 patients completed the study, with 60 participants in each treatment group. The mean age was 42.1 ± 10.0 years in the Ligaclip group and 42.9 ± 10.3 years in the traditional suture group. Females accounted for 45 (75.0%) and 43 (71.7%) participants, respectively. Multinodular goiter was the most frequent indication for surgery in both groups, followed by thyroid malignancy and Graves' disease. Diabetes mellitus, hypertension, and preoperative hemoglobin were similarly distributed. Baseline characteristics are shown in Table 1.

Table 1: Baseline Demographic and Clinical Characteristics of the Study Participants

Characteristic	Ligaclip (n=60)	Traditional suture (n=60)	Total (n=120)
Age, years	42.1 ± 10.0	42.9 ± 10.3	42.5 ± 10.1
Female sex	45 (75.0%)	43 (71.7%)	88 (73.3%)
Male sex	15 (25.0%)	17 (28.3%)	32 (26.7%)
Diabetes mellitus	8 (13.3%)	9 (15.0%)	17 (14.2%)
Hypertension	11 (18.3%)	13 (21.7%)	24 (20.0%)
Multinodular goiter	34 (56.7%)	33 (55.0%)	67 (55.8%)
Graves disease	12 (20.0%)	12 (20.0%)	24 (20.0%)
Thyroid malignancy	14 (23.3%)	15 (25.0%)	29 (24.2%)
Preoperative hemoglobin, g/dL	12.9 ± 1.2	13.0 ± 1.1	13.0 ± 1.1

Note. Continuous variables are presented as mean ± standard deviation and categorical variables as frequency (percentage). Baseline characteristics are presented descriptively because treatment allocation was randomized.

Operative time and intraoperative blood loss were lower in the Ligaclip group. Mean operative time was 84.6 ± 12.1 minutes compared with 94.9 ± 13.4 minutes in the traditional suture group, giving a mean difference of -10.3 minutes (95% CI -14.9 to -5.7; t= -4.42, p<0.001). Mean intraoperative blood loss was 58.4 ± 18.6 mL versus 72.7 ± 21.3 mL, with a mean difference of -14.3 mL (95% CI -21.5 to -7.1; p<0.001). Postoperative hypocalcemia occurred in 3 (5.0%) patients after Ligaclip and 10 (16.7%) after traditional suture ligation (risk difference -11.7%, 95% CI -22.6% to -0.7%; p=0.040). Postoperative bleeding occurred in 2 (3.3%) and 5 (8.3%) patients, respectively, and the difference was not statistically significant (Fisher exact p=0.439). Mean hospital stay was 2.4 ± 0.8 versus 2.7 ± 0.9 days (p=0.056).

Table 2: Comparison of Surgical and Postoperative Outcomes between the Two Groups

Outcome	Ligaclip (n=60)	Traditional suture (n=60)	Effect estimate (95% CI)	P
Operative time, min	84.6 ± 12.1	94.9 ± 13.4	MD -10.3 (-14.9 to -5.7)	<0.001
Intraoperative blood loss, mL	58.4 ± 18.6	72.7 ± 21.3	MD -14.3 (-21.5 to -7.1)	<0.001
Postoperative bleeding	2 (3.3%)	5 (8.3%)	RD -5.0% (-12.9 to 2.9)	0.439
Postoperative hypocalcemia	3 (5.0%)	10 (16.7%)	RD -11.7% (-22.6 to -0.7)	0.040
Hospital stay, days	2.4 ± 0.8	2.7 ± 0.9	MD -0.3 (-0.61 to 0.01)	0.056

Note. Continuous variables are presented as mean ± standard deviation and categorical variables as frequency (percentage). Independent-samples t test was used for continuous outcomes. Pearson chi-square test was used for postoperative hypocalcemia, and two-sided Fisher exact test was used for postoperative bleeding. MD = mean difference; RD = risk difference; CI = confidence interval.

The reduction in operative time with Ligaclip remained evident after stratification by age, sex, comorbidity status, and indication for surgery, with mean differences of approximately 10 minutes across the examined strata. Postoperative hypocalcemia was numerically less frequent with Ligaclip in each stratum, although the subgroup comparisons were not statistically significant because the number of events was small. There was no clear evidence from the stratified analysis that the direction of the treatment effect differed according to the examined baseline characteristics.

Table 3: Stratified Comparison of Operative Time and Postoperative Hypocalcemia

Stratifier	Stratum	Ligaclip operative time	Suture operative time	p	Ligaclip hypocalcemia	Suture hypocalcemia	p
Age	18-40 years	82.8 ± 11.6	92.7 ± 12.8	0.003	1/30 (3.3%)	4/29 (13.8%)	0.195
Age	41-60 years	86.4 ± 12.4	96.9 ± 13.8	0.003	2/30 (6.7%)	6/31 (19.4%)	0.255
Sex	Male	85.1 ± 12.6	95.7 ± 14.1	0.034	1/15 (6.7%)	3/17 (17.6%)	0.601
Sex	Female	84.4 ± 12.0	94.6 ± 13.2	<0.001	2/45 (4.4%)	7/43 (16.3%)	0.087
Comorbidity	Absent	84.0 ± 11.8	94.4 ± 13.2	<0.001	2/41 (4.9%)	6/38 (15.8%)	0.148

Stratifier	Stratum	Ligaclip operative time	Suture operative time	p	Ligaclip hypocalcemia	Suture hypocalcemia	p
Comorbidity	Present	86.0 ± 12.9	96.1 ± 14.0	0.025	1/19 (5.3%)	4/22 (18.2%)	0.355
Indication	Benign	84.2 ± 11.8	94.4 ± 13.0	<0.001	2/46 (4.3%)	7/45 (15.6%)	0.091
Indication	Malignant	85.9 ± 13.2	96.4 ± 14.7	0.051	1/14 (7.1%)	3/15 (20.0%)	0.598

Note. Operative time is presented as mean ± standard deviation and was compared using the independent-samples t test. Hypocalcemia is presented as n/N (percentage); two-sided Fisher exact test was used for subgroup comparisons because of sparse events. Comorbidity indicates diabetes mellitus and/or hypertension.

DISCUSSION

The present study compared Ligaclip vascular clips with traditional suture ligation during total thyroidectomy. Ligaclip was associated with a mean reduction of approximately 10 minutes in operative time and with lower intraoperative blood loss. Postoperative hypocalcemia was less frequent in the Ligaclip group, while postoperative bleeding and duration of hospital stay did not differ significantly. Baseline characteristics were similar between groups, and the direction of the operative-time difference remained consistent after stratification by age, sex, comorbidity, and surgical indication. These findings indicate that the principal differences between the two methods in this study were related to operative efficiency, blood loss, and early calcium-related morbidity rather than length of admission.

The operative-time finding should be interpreted in relation to previous work on vascular control in thyroid surgery. The multicentre CLIVIT randomized trial directly compared vascular clips with manual ligatures and found mean resection times of 63.5 and 66.1 minutes, respectively, without a significant difference.[6] In contrast, studies of sutureless systems have generally reported larger reductions in operative duration. Bhettani et al. observed a shorter operative time with LigaSure than with conventional suture tie, while a systematic review of prospective trials found that LigaSure reduced operative duration by about 12 minutes overall.[11,12] The ENERCON network meta-analysis similarly found shorter operating times with energy-based devices, particularly ultrasonic instruments, compared with conventional hemostasis.[13] The smaller time difference observed in the present study is clinically plausible because a mechanical clip avoids knot tying but does not combine tissue sealing and division in the same way as an energy device.

The lower intraoperative blood loss observed with Ligaclip was also consistent with the general principle that rapid mechanical occlusion may reduce repeated handling of small vessels. However, the evidence across hemostatic technologies is not uniform. Garas et al. reported lower blood loss with advanced hemostatic devices in a network meta-analysis, and Luo et al. found that both LigaSure and Harmonic systems reduced operative time, with some advantage in intraoperative blood loss compared with conventional techniques.[14,16] Singh et al., however, did not demonstrate a meaningful reduction in operative time with LigaSure compared with titanium clips and ties in a randomized trial.[15] Zhang et al. found lower operative time and perioperative blood loss with LigaSure Small Jaw compared with clamp-and-tie methods.[17] These differences are likely related to the device used, surgeon experience, thyroid pathology, gland size, and the exact definition of operative time.

Postoperative bleeding was uncommon in both groups and the between-group difference was not significant. This is important because postoperative cervical bleeding is infrequent but can threaten the airway. Large observational data have suggested that vessel-sealant devices may be associated with lower rates of postoperative neck hematoma than conventional hemostasis, although such findings concern energy-based devices rather than mechanical clips.[20,21] In the CLIVIT trial, postoperative bleeding and reoperation for bleeding were also similar between vascular clips and ligatures.[6] A meta-analysis of post-thyroidectomy hemorrhage identified patient and procedural factors, including older age, male sex, Graves' disease, antithrombotic therapy, previous thyroid surgery, and bilateral surgery, as relevant determinants of bleeding risk.[24] The low number of bleeding events in the present study limits the precision of the comparison.

Postoperative hypocalcemia occurred less frequently in the Ligaclip group. A direct causal explanation should be made cautiously because hypocalcemia after total thyroidectomy depends mainly on preservation of parathyroid tissue and its blood supply rather than on the hemostatic device alone. Systematic evidence has identified factors such as inadvertent parathyroid removal, Graves' disease, female sex, vitamin D deficiency, and perioperative calcium or parathyroid hormone changes as predictors of postoperative hypocalcemia.[10,23] Some device-based studies have nevertheless reported lower temporary hypocalcemia rates with sutureless techniques, and Liu et al. reported lower hypocalcemia after LigaSure Small Jaw than after clamp-and-tie thyroidectomy in a large series.[17,22] Energy-based devices also carry a potential risk of thermal injury near the recurrent laryngeal nerve and parathyroid vascular pedicles, so safe use depends on appropriate distance, activation time, and surgical technique.[18] Mechanical clips avoid thermal spread but still require careful placement to prevent traction or inadvertent inclusion of adjacent structures.

Hospital stay did not differ significantly between the two groups. Previous reports have been mixed on this outcome. Ruggiero et al. found comparable postoperative morbidity with two energy-based approaches, while broader comparative studies have reported modest reductions in hospital stay with newer hemostatic devices.[19,25] Length of admission after thyroidectomy is influenced by institutional discharge policy, drain use, calcium monitoring, comorbidity, and occurrence of postoperative symptoms. The absence of a significant difference in the present study therefore does not necessarily indicate that the operative-time reduction has no practical value, but it suggests that faster vessel control alone may not be sufficient to shorten admission in a setting where discharge follows a standard postoperative pathway.

The study has several strengths, including randomized treatment allocation, equal group sizes, standardized operative exposure, predefined clinical outcomes, and assessment of both efficiency and postoperative morbidity. The direct comparison is also relevant because published evidence specifically addressing vascular clips versus ligatures is less extensive than the literature on energy-based systems. Limitations include the single-centre setting, a relatively small number of postoperative bleeding and hypocalcemia events, lack of blinding of the operating surgeon, and absence of long-term assessment of recurrent laryngeal nerve function or permanent hypoparathyroidism. Device cost was not assessed, and the results should not be extrapolated directly to LigaSure, Harmonic, or other energy-based systems because their mechanisms differ from mechanical clips. Larger multicentre studies with standardized calcium and parathyroid hormone monitoring would provide a more precise assessment of complication rates and economic outcomes.

CONCLUSION

Ligaclip and traditional suture ligation were both effective methods of vessel control during total thyroidectomy. Ligaclip was associated with shorter operative time, lower intraoperative blood loss, and fewer cases of postoperative hypocalcemia, while postoperative bleeding and duration of hospital stay were comparable between the two groups. The choice of hemostatic method should remain based on safe surgical technique, careful preservation of the recurrent laryngeal nerves and parathyroid glands, device availability, and surgeon experience. Further multicentre studies are required to confirm the difference in postoperative hypocalcemia and assess cost-effectiveness.

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