Ligasure Vessel Sealing Versus Conventional Suture Ligation in Thyroidectomy

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Abstract

Objective: To evaluate the efficacy of ligature sealing versus standard suture sealing for multinodular goiter patients after thyroidectomy.

Method: The aim of our study is to evaluate the efficacy of ligature sealing versus standard suture sealing for multinodular goiter patients after thyroidectomy. The research was done in the Mayo Hospital in Lahore, Pakistan, specifically in the General Surgery Division. Ligasure-sealed patients made up Group A, while those in Group B were treated with traditional suture-ligation. The average duration of surgery, the average amount of discomfort felt by the patient afterward, and the average amount of drain fluid collected after surgery were all recorded.

Results: Eighty people in total participated in the study. Patients in Group-A had an average operation time of 67.3±6.9 minutes, while those in Group-B averaged 85.6±8.3 minutes; this difference was statistically significant (p0.000001). Patients in group A reported an average of 2.6±1.3 units of pain, while those in group B reported 1.7±0.7 units of pain; this difference was statistically significant (p 0.001). Patients in Group-A had a mean drain output of 53.5±4.9 ml following surgery, while those in Group-B had an output of 68.2±7.3 ml; this difference was statistically significant (p = 0.0001).

Conclusion: Thyroid surgery using ligature sealing is an effective and safe alternative to the standard approach, resulting in significantly less downtime, less discomfort, and less drainage after the procedure.

Keywords: Ligasure Sealing, Conventional Technique, Multinodular Goiter, Thyroidectomy.

How to cite: *Rafique A, Hameed F, Jameel MK, Alam H, Arshad HS, Kaleem A, Qazi M. Ligasure Vessel Sealing Versus Conventional Suture Ligation in Thyroidectomy. Esculapio - JSIMS 2023;19(01):3-8*

DOI: https://doi.org/10.51273/esc23.251911

Introduction

Ligasure is an electro thermal bipolar tissue sealing device used in many surgeries, and numerous diathermy approaches have been used to decrease intra-operative blood loss.[1-3] The Ligasure is an automatic feedback-controlled response system with high-current, low-voltage bipolar radiofrequency which automatically interrupts power in accordance with the composition and impedance of the tissue between the instrument's jaws.[4]

Although total thyroidectomy is the surgical treatment for benign and malignant thyroidal diseases, problems might arise from overly aggressive excision.[5] Bleeding during thyroidectomy can make it difficult to safely separate the recurrent laryngeal nerve and parathyroid gland. Thyroid surgery requires careful devascularization of the gland, as the thyroid has one of the greatest blood supply of any organ due to the large number of blood arteries and plexuses that penetrate its parenchyma. Therefore, it is crucial to achieve hemostasis prior to gland excision by separating the different arteries.[6]

Newer methods of vessel haemostasis, such as ligasure, offer an alternative to the more invasive bipolar surgical

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Submission Date: 11-01-2023
1st Revision Date: 27-02-2023
Acceptance Date: 06-03-2023

diathermy system and can achieve the same hemostasis results as the suture knot tying procedure.[7] Due to the considerable resection undertaken, postoperative bleeding problems and hematoma formation are slightly more common after complete than partial thyroidectomy.[8]

Thyroid surgery requires careful hemostasis due to the abundant blood flow provided by the gland's many blood arteries. Hemostasis is typically achieved during dissection by ligating both ends of the vessels; a process traditionally accomplished using hand-tied ligatures or sutures. Hemostasis can be achieved with the use of several cutting devices (bipolar electrocautery, lasers, clips, and staples) that have been developed over the past few decades.[12]

The purpose of this study is to evaluate the efficacy of ligature sealing versus standard suture sealing for multinodular goiter patients after thyroidectomy.

Material and Methods

The research was done in the Mayo Hospital in Lahore, Pakistan, specifically in the General Surgery Division. Between June 10th and November 10th, 2019, the research was conducted. A cross-sectional design was used for this study. Simple comparative analysis was employed for this research.

With an expected mean operative time of 127.1± 20.95 minutes using conventional suture- ligation and 115.54± 15.35 minutes using ligasure sealing in patients with multinodular goiter undergoing thyroidectomy, a sample size of 80(40 in each group) is estimated using 95% confidence interval and 80% power of test.[9]

Patients of both sexes, aged 18-60 years, undergoing thyroidectomy for MNG (as per operational definition), were included; however, those with Graves' disease (also known as diffuse toxic goiter, an autoimmune disease characterised by hyperthyroidism due to circulating auto antibodies against TSH receptors) or toxic MNG (a multinodular goiter with clinical symptoms (heat tolerance, weight loss, palpitations) and signs (T4 and TSH receptor antibodies), Neck irradiation history, malignancy in the MNG confirmed prior to surgery, Presence of metastases (as determined by a physical exam), evidence of recurrence of cancer (as documented in the medical record), and an insufficient FNAC sample prior to surgery.

Eighty patients were enrolled from the Surgical Wards of the Department of Surgery at Mayo Hospital in Lahore after receiving approval from the hospital's ethics council. There were 80 patients total, and they were split evenly between Group A (40 people) and Group B (20 people). Ligasure sealing was used on patients in Group A, while traditional suture ligation was used on patients in Group B.

Patients gave their consent after being fully informed about the trial. Each patient's name, age, and gender were recorded. After the patient was admitted to the hospital, a full history and physical examinations were performed to arrive at the preliminary diagnosis. Blood tests and ultrasound of the neck were used to determine the prevalence of nodules and calcification in each patient. Then patients underwent thyroidectomy with predictable safety of recurrent laryngeal nerve and parathyroid gland.

The same general surgical team performed all of the surgeries, which were all done while the patient was under general anaesthesia. Patients were moved to the ward when surgery was completed. Metrics such as drain output, surgical time, and postoperative discomfort were recorded. A pre-made Performa was used to collect all of the information.

SPSS v25.0 was used to enter and process all data. Mean with S.D. was used to characterize the ages of the subjects, the duration of the procedures itself, the volume of drainage from the surgical incision, and the severity of the pain experienced after surgery. Frequencies and percentages were used to characterize the gender distribution. To account for potential effect modifiers, data were stratified by age, body mass index, and gender. Groups were compared using a t-test after they were stratified. We regarded a p-value less than 0.05 to be statistically significant.

Results

Total 80 patients enrolled in this study were divided in two groups i.e. Group-A (Ligasure Sealing) and Group-B (Conventional Technique). Group-A had 19(47.5%) males and 21(52.5%) females. In group-B, 16(40.0%) were males and 24(60.0%) females. In group-A, there were 3(7.5%) in 18-30 years age group, while 22(55.0%) and 15(37.5%) were in 31-45 years and 45-60 years age groups respectively. In group-B, there were 9(22.5%) in 18-30 years age group, while 16(40.0%) and 15(37.5%) were in 31-45 years and 45-60 years age groups respectively. In group-A, there were 28(70.0%) who had normal BMI, while 10(25.0%) and 2(5.0%) were overweight and obese respectively. In group-B, there were 25(62.5%)

Table 1: *Comparison of variables according to the number of patients.*

		Groups		Total
	Gender	Ligasure Sealing	Conventional Technique	
Comparison of gender distribution between groups	Male	19	16	35
		47.5%	40.0%	43.8%
	Female	21	24	45
		52.5%	60.0%	56.3%
	Total	40	40	80
		100.0%	100.0%	100.0%
	Age groups	Group		Total
		Ligasure Sealing	Conventional Technique	
Comparison of age groups between groups	18-30 years	3	9	12
		7.5%	22.5%	15.0%
	31-45 years	22	16	38
		55.0%	40.0%	47.5%
	45-60 years	15	15	30
		37.5%	37.5%	37.5%
	Total	40	40	80
		100.0%	100.0%	100.0%
	BMI	Groups		Total
		Ligasure Sealing	Conventional Technique	
Comparison of BMI between groups	Normal (18-24.9)	28	25	53
		70.0%	62.5%	66.3%
	Overweight (25-29.9)	10	12	22
		25.0%	30.0%	27.5%
	Obese (>30)	2	3	5
		5.0%	7.5%	6.3%
	Total	40	40	80
		100.0%	100.0%	100.0%

who had normal BMI, while 12(30.0%) and 3(7.5%) were overweight and obese respectively. The mean operative time of patients in group-A was 67.3±6.9 minutes and in group-B was 85.6±8.3 minutes with p-value of 0.000001 which is statistically significant. The mean pain score of patients in group-A was 2.6±1.3 and in group-B was 1.7±0.7 with p- value of 0.001 which is statistically significant. The mean post-operative drainage of patients in group-A was 53.5±4.9 ml and in group-B was 68.2±7.3 ml with p-value of 0.000001 which is statistically significant.

Discussion

With one notable exception being the technique for performing a thyroidectomy, which saw no advancements other than the adoption of monopolar electrocautery for dissection due to several routine, practical, and technical issues. Staplers, which are not only prohibitively expensive, are also too limited in their applications to be useful during thyroid surgery. Both lasers and bipolar electrocautery pose risks to nearby essential organs, vessels and nerves e.g recurrent laryngeal nerves, parathyroid glands.[13]

Ultrasonically activated shear introduced in 1990s is an alternative way of achieving hemostasis. This apparatus works on the principle that ultrasonic energy can be transformed into mechanical motion.[14] A novel Hemostatic system is the Sealing Precise Diathermy Technology used in both open and endoscopic surgical procedures, with a decrease in the operating time and fewer intraoperative complication faced in the OR due to bleeding. A number of surgical procedures, including those involving the abdomen, the chest and many others, have been found to benefit from shorter operating times.[17-18]

We compared a total of 80 patients, 40 patients who underwent total thyroidectomy using Ligasure Sealing, 40 patients who underwent total thyroidectomy using conventional method. Ashkenazi et al.[19] reported sutureless thyroidectomy using LS, and reported the main advantage of using Ligasure device for achieving hemostatic is the reduced operation time duration and the reduction of risks associated with using sutures and clips. Another study by Sandonato et al.[20] documented that 67 patients underwent total thyroidectomy with the help of LS, and noted that complications, such as transient recurrent nerve palsy and hypo-parathyroidism,

Table 2: *Operative time, Pain Score and Drainage Comparison between Two Groups*

Comparison of operative time between groups	Operativetime (minutes)	Groups	n	Mean	Std. Deviation	p-value
		Ligasure Sealing	40	67.3	6.9	0.000001
		ConventionalTechnique	40	85.6	8.3	
Comparison of pain score between groups	Pain score	Ligasure Sealing	40	2.6	1.3	0.001
		Conventional Technique	40	1.7	0.74	
Comparison of drainage between groups	Drainage (ml)	Ligasure Sealing	40	53.5	4.9	
		Conventional Technique	40	68.2	7.3	0.000001

Table 3: *Overall the Results are showing the Percentage of each Variable with Significant the P-value between Two Groups.*

Stratification of operative time between groups with respect to gender	Operativetime (minutes)	Gender	Groups	n	Mean	Std. Deviation	p-value
		Male	Ligasure Sealing	19	66.5	6.5	
			Conventional Technique	16	85.1	8.4	0.000001
		Female	LigasureSealing	21	68.1	7.3	0.000001
			Conventional Technique	24	85.9	8.4	
Stratification of pain score between groups with respect to gender	**Pain score**	Male	Ligasure Sealing	19	2.6	1.3	0.020
			Conventional Technique	16	1.7	0.6	
		Female	Ligasure Sealing	21	2.5	1.5	0.024
			Conventional Technique	24	1.8	0.7	
Stratification of drainage between groups with respect to gender	**Drainage (ml)**	Male	Ligasure Sealing	19	54.1	4.7	0.000001
			Conventional Technique	16	68.3	7.1	
		Female	Ligasure Sealing	21	52.9	5.1	0.000001
			Conventional Technique	24	68.1	7.6	
Stratification of operative time between groups with respect to age	**Operativetime (minutes)**	18-30 years	Ligasure Sealing	3	68.1	8.1	0.014
			Conventional Technique	9	85.8	9.2	
		31-45 years	Ligasure Sealing	22	66.8	6.7	0.00001
			Conventional Technique	16	84.3	7.9	
		45-60 years	Ligasure Sealing	15	67.9	7.4	0.0001
			Conventional Technique	15	86.8	8.6	
Stratification of pain score between groups with respect to age	**Painscore**	18-30 years	Ligasure Sealing	3	2.3	1.5	0.429
			Conventional Technique	9	1.7	0.8	
		31-45 years	Ligasure Sealing	22	2.5	1.3	0.023
			Conventional technique	16	1.6	0.7	
		45-60 years	Ligasure Sealing	15	2.8	1.5	0.042
			Conventional Technique	15	1.8	0.7	
Stratification of drainage between groups with respect to age	**Drainage (ml)**	18-30 years	LigasureSealing	3	57.3	2.8	0.025
			ConventionalTechnique	9	70.1	7.9	
		31-45 years	LigasureSealing	22	53.4	4.9	0.0001
			Conventional Technique	16	67.7	7.7	
		45-60 Years	Ligasure Sealing	15	52.8	5.1	0.0001
			Conventional Technique	15	67.6	6.9	
Stratification of operative time between groups with respect to BMI	**Operative time**	Normal (18-24.9)	Ligasure Sealing	28	67.1	6.7	0.0001
			Conventional Technique	25	84.1	8.7	
		Overweight (25-29.9)	Ligasure Sealing	10	68.8	7.2	0.00001
			Conventional Technique	12	87.8	7.3	
		Obese (>30)	Ligasure Sealing	2	63.1	9.8	0.0001
			Conventional Technique	3	89.6	7.7	
Stratification of pain score between groups with respect to BMI	**Painscore**	Normal (18-24.9)	Ligasure Sealing	28	2.5	1.4	0.008
			Conventional Technique	25	1.6	0.7	
		Overweight (25-29.9)	Ligasure Sealing	10	2.8	1.3	0.101
			Conventional Technique	12	2.1	.7	
		Obese (>30)	Ligasure Sealing	2	2.1	.7	0.219
			Conventional Technique	3	1.3	0.5	
Stratification of drainage between groups with respect to BMI	**Drainage (ml)**	Normal (18-24.9)	Ligasure Sealing	28	53.4	5.4	0.0001
			Conventional Technique	25	69.2	7.8	
		Overweight (25-29.9)	LigasureSealing	10	52.9	3.6	0.00001
			Conventional Technique	12	66.8	6.1	
		Obese (>30)	LigasureSealing	2	57.1	2.8	0.285
			Conventional Technique	3	65.3	8.3	

were significantly less frequent than they had reported in another analysis of 579 total thyroidectomy cases.[21]

Operation time, pain rating, and volume of postoperative drain output were all significantly different between the Ligasure Sealing and conventional methods in our study. Operating time for Patients in the ligature sealing group was 67.3±6.9 minutes, while those in the conventional group underwent surgery for a mean of 85.6±8.3 minutes. Patients in the ligature sealing group reported a mean pain score of 2.6±1.3, while those in the traditional group reported a score of 1.7±0.7. Patients in the ligasure sealing group had a mean drainage of 53.5±4.9 ml, while those in the traditional group had a mean drainage of 68.2±7.3 ml.

Conclusion

Ligasure sealing is a safe alternative to conventional technique in thyroid surgery, allowing for a significant reduction of operative time, pain score and post-operative drainage.

Source of Funding: *None*

Conflict of Interest: *None*

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Authors Contribution

AR: Conceptualization of Project
FH, HA: Data Collection
AR: Literature Search
MKJ: Statistical Analysis
HSA, AK: Drafting, Revision
HSA: Writing of Manuscript