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Comparison of Hospital Duration and Analysis of Harmonic Scalpel Surgery with Conventional Protocols in Patients Undergoing Thyroid Surgery

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ABSTRACT

A thyroidectomy is a common surgical procedure, and while traditional methods including electrocautery pose a danger of tissue damage, harmonic scalpels have recently seen a rise in their use for this purpose. **Objective:** To determine whether or not the Harmonic Scalpel is beneficial in dealing with patients who are undergoing thyroidectomy. **Methods:** This qusai-experimental study was performed at Department of Surgery, Ghulam Muhammad Mahar Medical College Sukkur from 1st October 2022 to 31st March 2023 and 60 patients were enrolled and divided into 2 equal groups for conventional and harmonic thyroidectomy. Patients with Basedow' illness or thyroid cancer were included regardless of lymph node dissection. For 5mm blood vessel division, 55kHz ultrasound pulses were employed for coagulation. Cutting and coagulation were done using active blade. A well-structured questionnaire recorded operation length, 24-hour drainage volume, hospital stay, post-operative hypocalcaemia, drain placement, RLN paralysis, and blood loss for each patient. **Results:** There were 78.3% females as compared to the males 21.6%. Less operation time was taken in surgery performed by harmonic scalpel as compared to conventional surgery. Significant difference was observed in intra-operative blood loss in study group. Harmonic scalpel lost 40ml blood whereas traditional surgery lost 124ml. Both research groups had similar post-operative problems. **Conclusions:** Harmonic scalpel thyroidectomy appeared to be the most reliable and feasible method as compared to conventional surgery protocol in relevance to intra-operative blood loss, surgery duration, total volume drainage.

INTRODUCTION

Thyroid surgery is considered as the most common endocrine surgery. In spite of the routine surgical procedure, various complications are associated with it including damage to superior laryngeal nerve/recurrent laryngeal nerve, bleeding, hypothyroidism. Another major complication which observed commonly is intra-operative bleeding which occurred due to presence of several blood vessels and narrow visual field. Bleeding leads to numerous post-operative complications and cause air passageway blockage. For that reason, haemostasis in dry field and dissection of blood vessel is imperative to minimize the adverse effects of post-operative bleeding [1-4]. Advance surgical methods have been developed to combat the negative outcomes of routine surgical procedures. Harmonic surgery is the latest surgical instrument that can cauterize and cut tissue simultaneously. Ultrasonic waves are mainly used in harmonic scalpel and this energy is converted into mechanical energy for blade activation. Activated blade performs the main function and delivers high-grade frictional force. On the other hand, inactivated upper arm helps in the maintaining the tissue position [5-8]. It helps in minimizing the procedure time, blood loss,

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volume of drainage in thoracic surgery, abdominal laparoscopic surgery and parotid surgery [7, 8]. Recent studies have also highlighted the role of harmonic scalpel surgery in reduction of surgical time and postoperative blood loss in thyroidectomy as well. Nowadays, harmonic scalpel surgery is actively used in thyroidectomy [9, 10].
Present study was designed for the comparison of hospital duration and analysis of harmonic scalpel surgery with conventional protocols in patients undergoing thyroid surgery.

METHODS

This qusai-experimental study was performed at Department of Surgery, Ghulam Muhammad Mahar Medical College Sukkur from 1st October 2022 to 31st March 2023 with IRB approval letter No. Gen. Surgery/SMBBMU/98. Patients with Basedow' disease or thyroid malignancy were included irrespective of the presence or absence of lymph nodes dissection. The sample size was calculated by using the WHO sample size calculator with psower of test (1-β)=80%, level of significance (α)=5%. The difference in the mean hospital stays in groups ligate and group Harmonic Scalpel was 2.18+0.72 and compared to 3.41+1.12 [11]. The sample size was calculated to be 30+30=60 patients. To adapt it to the circumstances, the non-probability purposive sampling method was tweaked. Those patients who were undergoing lobectomy or total thyroidectomy were included in this study. Those patients having complicated comorbidity or autoimmune disease, patient with Hepatitis B and C positive along with the patient with alcoholic abuse and pregnant ladies were excluded from the study. Patients in group A underwent conventional thyroidectomy performed (inferior middle and superior were tied using silk sutures3/0, and all other vessels were sutured by 4/0 or electro cauterized) and patients in group B were underwent thyroidectomy with harmonic scalpel ligated all thyroid vessels. A generator, a hand piece, and a blade make up the harmonic scalpel arrangement. A piezoelectric crystal stack, compressed between two metal cylinders, serves as the ultrasonic transducer in the hand piece. Mounting the transducer to the blade allows it to be securely fastened. A microprocessor controls the 110-volt generator, which is a high-frequency switching power source, and pulses AC current to the transducer in the hand piece. The transducer may vibrate at 55.5 kHz, its natural harmonic frequency, thanks to this current. The blade that is most commonly utilized in otolaryngological operations resembles a curved paddle. It has a rough outside radius for captive coagulating and a sharp inner beveled edge for cutting. A well-structured questionnaire was used for recording between 6.1-18%g surgery duration, volume of drainage in 24 hours of surgery, hospital stay duration, drain placement duration, post-operative hypocalcaemia RLN paralysis, and blood loss of individual patient. Post-operative hypocalcaemia was only noted in those patients who were receiving total thyroidectomy. Statistical analysis was performed by using SPSS version 26.0. Chi-square was applied to compare the following variables: time of operation, intraoperative blood loss in milliliters, volume of fluid drainage in milliliters, and number of days spent in the hospital. Student's t-test and the $\chi 2$-test were used to analyzes the results. Difference was considered as significant by considering p-value <0.05.

RESULTS

There were 78.3% females as compared to the males 21.6%. Forty cases of malignant and 20 benign cases were enrolled and divided equally in harmonic scalpel (HS) and conventional surgery (CS) group. Similarly, 30% of the participants in HS group underwent total thyroidectomy whereas 43% of the patients in CS group underwent total thyroidectomy (Table 1).

Table 1: Demographic Variables in the HS and CS Groups (n=60)

Variables	HS N (%) / Mean ± SD	CS N (%) / Mean ± SD
Gender		
Female	24 (80%)	23 (76.7%)
Male	6 (20%)	7 (23.3%)
Age (Years)	51.2 ± 10.79	56.9 ± 12.79
BMI (Kg/m^2)	22.9 ± 3.38	24.1 ± 3.89
Disease Nature		
Malignancy	20 (66.7%)	20 (66.7%)
Benign	10 (33.3%)	10 (33.3%)
Surgery Extent		
Partial Thyroidectomy	21 (70%)	17 (56.7%)
Total Thyroidectomy	9 (30%)	13 (43.3%)

Less operation time was taken in surgery performed by harmonic scalpel as compared to conventional surgery. Significant difference was observed in intra-operative blood loss in study group. Only 40ml blood was lost during HS whereas 124ml blood was lost during CS group. Overall blood drainage volume was also very less in HS group as compared to CS. No difference in hospital stay duration was observed in both study groups (Table 2).

Table 2: Post-Operative Surgical Complications in Study Groups

Variables	Harmonic Scalpel Mean ± SD	Conventional Surgery Mean ± SD	p-Value
Operation Time in Minutes	95.3 ± 18.4	112.2 ± 21.0	0.045
Intraoperative Blood Loss (mL)	40.1 ± 32.7	124.8 ± 39.6	0.055
Gender			
First 24 Hours Post-Surgery	54.4 ± 24.5	51 ± 22.7	0.041
Overall volume	119 ± 87.8	178 ± 91.6	0.049
Duration of drain placement (Days)	3 ± 1.5	4 ± 1.2	0.82
Hospital duration (Days)	3 ± 1.7	3 ± 1.4	0.61

Post-operative surgical complications were also assessed in present study. No significant variation was observed in terms of post-operative complications in either of the study group (Table 3).

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Table 3: Postoperative Surgical Complications Between the HS and CS Groups

Variables	HC N (%)	CS N (%)	p-Value
Complications	3 (10%)	4 (13.3%)	0.751
RLN Paralysis			
Temporary	2 (6.6%)	2 (6.6%)	0.652
Permanent	-	-	-
Hypocalcemia			
Temporary	2 (6.6%)	2 (6.6%)	0.652
Permanent	-	-	-
Hemorrhage Requiring Surgery	-	-	-
Surgical-Site Infection	-	-	-

DISCUSSION

Thyroidectomy is a routine surgical procedure which can be done through various ways. Conventional clamp/tie techniques are still being employed, however technological advancement is now shifting the trend towards harmonic scalpel surgery. Various adverse effects are associated with conventional procedure such as drainage volume, long procedure time and post-operative bleeding is appeared to be the major concern [12-14]. In the present study, harmonic scalpel surgery showed better outcome in shortening the procedure duration during thyroidectomy in contrast to conventional protocols. This might be attributable to the reason that harmonic scalpel helps in coagulation, detachment and dissection of tissue in a continuous-operation without need of changing instruments. Another important parameter that should be considered is recurrent laryngeal paralysis. It has been proven that lesser chances of RLN paralysis was associated with harmonic scalpel surgery [15-18]. However, in present study, RLN paralysis was not observed in both study groups. Shorter surgical duration minimizes the risk and chances of infections associated with surgeries. It helps in early hospital discharge and accelerates patient recovery process. Shorter surgical duration also linked with cost effectiveness of the procedure [19, 20]. Present study also highlights that shorter duration was observed in harmonic scalpel group as compared to the other group. Few limitations are also associated with this study. Small sample size and inclusion of both benign and malignant diseases might influence the study outcomes.

CONCLUSIONS

Harmonic scalpel thyroidectomy appeared to be the most reliable and feasible method as compared to conventional surgery protocol in relevance to intra-operative blood loss, surgery duration, total volume drainage. Post-operative complication rate of harmonic scalpel was similar to conventional method.

Authors Contribution

Conceptualization: DA
Methodology: DA
Formal analysis: MAK
Writing, review and editing: MN, AN, AHK, KM, RHU

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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