

Harmonic Scalpel Compared to Conventional Homeostasis in Thyroid Surgery

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ABSTRACT

Aim: To decide whether conventional homeostasis (CH) or the Harmonic Scalpel (HS) brings about shorter agent times for thyroidectomy and also to compare the rate of postoperative intricacies among these two groups.

Methodology: this randomized control trail was conducted in general surgery department of Allied Hospital, Faisalabad. Total of 120 patients were enrolled in the study. for the duration of one year (November 2016 to November 2017). 50% of the total patients (n=60) were operated with (Harmonic Scalpel, HS Group) and 60(50%) were operated with Conventional Homeostasis (CH Group). The upshot of the study included operative time, the drainage volume in the suction balloon within first 24 hours of surgery, hospital stay and postoperative pain. The quantity of blood loss after the surgery was evaluated by drainage volume and it was used to determine the actual difference between the study groups.

Result showed that the mean operative time of the HS group and CH group was 44.91±2.55 minutes and 73.86±5.59 minutes respectively. The mean operative time of HS group was significantly shorter than that of CH group, (p=0.000). The mean postoperative drainage at 24 hours of the HS group and CH group was 36.61±5.39mL and 58.11±4.49mL respectively. The total drainage fluid volume was lower in the HS group than in the CH group. The mean hospital stay of HS group was shorter that of CH group. The difference was statistically significant, (p=0.000).

Conclusion: The use of Harmonic scalpel causes diminished postoperative complexities, lessen the span of hospital stay, reduces the intra operative time and proves to be more effective and proficient.

Keywords: Harmonic Scalpel, Homeostasis, Thyroidectomy.

INTRODUCTION

Not much of the advancements in the field of thyroid surgical techniques has been witnessed since the era of Kocher. The thyroid gland being the richly vascularized tissue brings forth an added challenge during its surgery¹. In order to perpetuate the thyroid gland parenchyma along with its neighbor tissues from hemorrhage, effective methods of hemostasis must be ensured during and after the surgery. To achieve this, the techniques of artery ligation and or clipping of blood vessels have been in practice for decades². These methods no doubt are effective but are also time consuming³. In the modern era of hustle bustle, any technique, instrument or device that accommodates the time of a surgeon while minimizing complications, must be taken into account for investigation and application into the field⁴.

The use of scalpel in thyroid surgery commenced about two decades ago. The device has the capability to cut and coagulate the tissue simultaneously with the help of mechanical vibrations operating at 55.5 kHz [5]. The scalpel in comparison to the traditional electro cautery offers a variety of

benefits including decreased rate of surrounding tissue damage, inability to stimulate neuromuscular junction, and illusion of electrical energy transmission within or through the patient⁶. The scalpel being the rapidly adapted new device in the present day has been documented successful in a number of surgical procedures⁷.

As reflected by many studies carried out in European research centers, the scalpel has made its way through the past decade proving quite propitious⁸. The device has shown consistent results when investigated for its efficiency in saving surgeon's time but opposing results when evaluated for other possible postoperative complications⁹. It must be noted that these complications are relatively uncommon and there is a very few number of such reported cases. The significant association between the use of HS and the complications faced thereby can be explained with the help of incorporation and consolidation of data¹⁰. Aim of our study was to decide if conventional homeostasis (CH) or the Harmonic Scalpel (HS) brings about shorter agent times for thyroidectomy.

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METHODOLOGY

The study was conducted on 120 patients during the duration of one year from November 2016 to November 2017. Out of 120 patients, 60 patients underwent the thyroid surgery that used the conventional method of ligating while upon 60 patients HS was used for vessel control. The patients having the lobectomy or total thyroidectomy were the candidates of the main focus.

After the routine preoperative evaluation, the cases and controls were approached with the same anesthetic procedure as well as hospital care facilities irrespective of the technique operated upon them. General anesthesia was introduced to the patients by endotracheal intubation and then total or near-total thyroidectomy was performed upon all cases having benign thyroid disease. A thorough preoperative evaluation including serum thyrotropin levels, Ultrasonographs describing the nodule size and gland volume, and fine needle aspiration cytology, were collected for each patient in the study. A skin incision of length 3-7 cm was made depending upon the extent of disease and size of the thyroid. After making the subplatysmal flaps, all the strap muscles were separated and reflected laterally. Thyroid vessels (superior, middle and inferior) were then divided with the help of either HS or conventional artery ligation. The same steps were performed for the other lobe. At the end, the wound was subjected to irrigation and suturing with the help of uninterrupted 3-0 polyglactin sutures in order to approximate the muscles and the platysmal layer. Finally, the skin was closed subcutaneously.

The upshot of the study included operative time, the drainage volume in the suction balloon within first 24 hours of surgery, hospital stay. The quantity of blood loss after the surgery was evaluated by drainage volume and it was used to determine the actual difference between the study groups. The drains were taken off after 24-36 hours of surgery. Diclofenec 1000mg was given to the patients every 8

hours for the first 24 hours after the surgery.

All recorded data was entered in SPSS version 24 and analyzed for mean and SD of numerical variables and number and percentages for qualitative data. Student's t-test and χ^2 -test was used for the analysis of data depending upon the size of data. A value of $P < 0.05$ was recognized as statistically significant.

RESULTS

Overall 120 patients were enrolled in this study, both genders. There were 60(50%) patients operated with (Harmonic Scalpel) (HS Group) and 60(50%) were operated with Conventional Hemostasis (CH Group). The mean age of the patients of HS group was 41.08 ± 2.86 years. There were 34(56.7%) males and 26(43.3%) females. The mean age of the patients in CH group was 37.83 ± 5.27 years. There were 31(51.7%) males and 29(48.3%) females. Simple multinodular goiter noted as 50(83.3%) and 45(75%) for the group HS and CH respectively. while, Toxic multinodular goiter noted as 10(16.7%) and 14(23.3%) for the group HS and CH respectively. The differences were statistically insignificant, except age ($p=0.000$) (Table.1).

The mean operative time of the HS group and CH group was 44.91 ± 2.55 minutes and 73.86 ± 5.59 minutes respectively. The mean operative time of HS group was significantly shorter than that of CH group, ($p=0.000$). The mean postoperative drainage at 24 hours of the HS group and CH group was 36.61 ± 5.39 mL and 58.11 ± 4.49 mL respectively. The total drainage fluid volume was lower in the HS group than in the CH group. The difference was also statistically significant, ($p=0.000$). The mean hospital stay of the HS group and CH group was 2.31 ± 1.20 days and 3.47 ± 1.10 days respectively. The mean hospital stay of HS group was shorter that of CH group. The difference was statistically significant, ($p=0.000$) (Table. II).

Table 1: Demographic among the study groups

Variables	HS Group (n=60)	CH Group (n=60)	Test of Sig.
Age (years)	41.08±2.86	37.83±5.27	t=4.19, p=0.000
Gender	M=56.7%, F=43.3%	M=51.7%, F=48.3%	$\chi^2=0.302$, p=0.583
Preoperative diagnosis			
Simple multinodular goiter	83.3% (n=50)	75% (n=45)	$\chi^2=1.263$, p=0.261
Toxic multinodular goiter	16.7% (n=10)	23.3% (n=14)	$\chi^2=0.833$, p=0.361

Table II: Operative and postoperative data in HS and CH groups

Variables	HS* Group (n=60)	CH* Group (n=60)	Test of Sig.
Operative time (minutes)	44.91±2.55	73.86±5.59	t=-36.43, p=0.000
Postoperative drainage at 24 h (mL)	36.61±5.39	58.11±4.49	t=-23.69, p=0.000
Hospital stay	2.31±1.20	3.47±1.10	t=-5.46, p=0.000

* Harmonic Scalpel; Conventional Homeostasis

DISCUSSION

The results of our study depict that harmonic scalpel is much more time efficient than conventional hemostasis methods. The comparison was made on the ability to decrease operative time, volume of drainage fluid and duration of hospital stay among the patients of thyroid surgery.

Luca Revelli et al¹¹ claimed in their study that HS TT proved to be a safe, useful and fast alternative to conventional TT. The newer HF can also reduce the rate of hypocalcemia. He also suggested further research should be conducted to explore other beneficial aspects of HS such as postoperative complications, cost effectiveness and cosmetic results.

When Yun-Fei Duan et al¹², compared the two groups of his study (group 1 being the one upon which conventional method was used, while group 11 were operated with Focus harmonic scalpel.), he deduced a remarkable difference between these groups. He found out not only surgical time was decreased, but also the candidates of group 11 experienced much lesser symptomatic hypocalcemia. Furthermore, the use of scalpel also reduced the duration of hospital stay of patients.

In a study conducted by Zhen-Hu Ren et al¹³, it was revealed that surgical time using harmonic scalpel was reduced by 29.3 minutes, there was also a marked decrease in the intraoperative bleeding by 141.1 milliliters. The volume of drainage fluid also declined by 64.9 ml. Whereas, the study showed no difference in the duration of hospital stay when compared with the conventional methods of knot tying. The use of harmonic scalpel was declared "safe and effective for neck dissection."

Similar results were obtained by Matteo Angelo et al¹⁴. The research showed that surgical time was significantly decreased with the use of HS vs the use of conventional hemostasis i.e., 79.36±21.88 min vs 110±25.80 respectively. The study also confirmed that postoperative blood volume was reduced among the HS group i.e 68.72±40.86 ml vs 97.38±35.55 ml in the Conventional group. The study further claimed that hospital stay among HS group was shortened by 1.93±0.496 days vs. 2.75±0.739, while the serum calcium levels showed no significant difference among both groups after 12 and 24 hours.

Another study conducted by Sista F.A et al¹⁵ reflected that the harmonic scalpel is not only effective in various neck dissections but also beneficial when used at other sites for surgical procedures. One such example is right colon surgery. The study depicted HS by the use of its ultrasonic energy caused minimal damage to the surrounding

tissues due to minimal heat production by the device. Since HS has the ability to coagulate a vessel of up to 5mm in diameter, therefore it not only controls the bleeding efficiently but also controls the lymphorrhea. Similarly, the amount of drainage fluid was found to be less than that of conventional methods. All in all the study concluded that harmonic scalpel is a useful device for colon surgery. It decreases operative time, blood and lymphatic losses while facilitating the surgical maneuvers.

A study by Petri E et al¹⁶ declared the scalpel to be a "suitable tool" for multiple thyroid surgeries. However it was warned that device must be put to use after a practice of at least ten hours. the study also suggested that in order to minimize the selection bias, the surgeon experience must be controlled.

Similarly, Voutilainen PE1 et al¹⁷ reported that ultrasonically activated sheer (UAS) greatly reduces the operating time in surgeries of thyroid gland and elsewhere. There was a spare of approximately 54 minutes using UAS. Studies conducted by Adrienne L et al¹⁸ and Yener O et al¹⁹ reported similar findings that harmonic scalpel is more effective and efficient as compare to conventional homeostasis method.

CONCLUSION

From the above discussion and results, we can infer effectively that the Harmonic Scalpel is more propitious than the beforehand utilized customary techniques. It spares time and is more proficient. It has different focal points and demonstrates to spare the surgeon's time while lessening the span of hospital stay. The use of scalpel causes diminished postoperative complexities as compared to the conventional methods of knot tying. It ended up being a remarkable invention in the field of surgery.

REFERENCE

1. Christoffer HolstHahn, Waldemar Trolle, Christian Hjort Sørensen. Harmonic focus in thyroidectomy for substernal goiter. *Auris Nasus Larynx*. 2015; 42(5): 311-317
2. Pietro Contin, Käthe Gooßen, Kathrin Grummich, Katrin Jensen, Hubertus Schmitz-Winnenthal, Markus W. Büchler, et al. Energized vessel sealing systems versus CONventional hemostasis techniques in thyroid surgery—the ENERCON systematic review and network meta-analysis. *Langenbeck's Archives of Surgery*. 2013; 398(8): 1039-1056
3. Antakia Ramez, Edefe Ovie, Uttley Lesley, and Balasubramanian Saba P. Effectiveness of Preventative and Other Surgical Measures on Hypocalcemia Following Bilateral Thyroid Surgery: A Systematic Review and Meta-Analysis. *Thyroid*. January 2015; 25(1): 95-106

4. Randall P. Scheri Julie A. Sosa Sanziana A. Roman. Advances in Thyroid and Parathyroid Care. Technological Advances in Surgery, Trauma and Critical Care. 2015; Springer, New York, NY. pp 209-219
5. Emanuele Ferri, Enrico Armato, Giacomo Spinato, Marcello Lunghi, Giancarlo Tirelli, Roberto Spinato. Harmonic Scalpel versus Conventional Haemostasis in Neck Dissection: A Prospective Randomized Study. International Journal of Surgical Oncology. 2013; 2013, Article ID 369345, 8 pages.
1. 6 .Anandaravi B. N., Mohammed Anwar Aslam, Praveen P. Nair. Prospective randomised study using focus harmonic scalpel versus conventional hemostasis for vessel ligation in open thyroid surgery. International Surgery Journal. 2017; 4. Print ISSN: 2349-3305.
6. Roberto Ruggiero, Ludovico Docimo, Salvatore Tolonea, Maurizio De Palmis, Mario Musella, Angela Pezzollad, et al. Effectiveness of an advanced hemostatic pad combined with harmonic scalpel in thyroid surgery. A prospective study. International Journal of Surgery. 2016; 28(1): S17-S21
7. Vanella S., Crocco A., Traini E., Lombardi C.P., Raffaelli M. Hemostatic Devices. In: Lombardi C., Bellantone R. (eds) Minimally Invasive Therapies for Endocrine Neck Diseases. 2016. Springer, Cham. pp 237-248.
8. Arun Upadhyaya, Tianpeng Hu, Zhaowei Meng, Xue Li, Xianghui He, Weijun Tian Qiang Jia, et al. Harmonic versus LigaSure hemostasis technique in thyroid surgery: A meta-analysis. Biomedical Reports. 2016; pp 221-227.
9. Saadia Muhammad Ali, Jahangir Sarwar Khan, Muhammad Mussadiq Khan. Harmonic Scalpel vs. Knot tying in open thyroidectomy. Ann. Pak. Inst. Med. Sci. 2014; 10(1): 50-53 .
10. Luca Revellia, Gianfranco Damianib, Caterina Bianca Neve Aurora Bianchic, Serafino Vanellaa, Walter Ricciard et al. Complications in thyroid surgery. Harmonic Scalpel, Harmonic Focus versus Conventional Hemostasis: A meta-analysis. International Journal of Surgery. 2016; 8(1): S22-S23.
11. Yun-fei Duan, Wei Xue, Feng Zhu and Dong-lin Sun. FOCUS harmonic scalpel compared to conventional hemostasis in open total thyroidectomy - a prospective randomized study. Journal of Otolaryngology - Head & Neck Surgery. 2013; 42(62)
12. Ren Z-H, Xu J-L, Fan T-F, Ji T, Wu H-J, Zhang C-P (2015) The Harmonic Scalpel versus Conventional Hemostasis for Neck Dissection: A Meta-Analysis of the Randomized Controlled Trials. PLoS ONE. 2015;10(7):e0132476.
13. Matteo Angelo Cannizzaro, Salvatore Lo Bianco, Laura Borzi, Andrea Cavallaro, Antonino Buffone. The use of FOCUS Harmonic scalpel compared to conventional haemostasis (knot and tie ligation) for thyroid surgery: a prospective randomized study. SpringerPlus. 2014; 3(639)
14. Sista F.a, Abruzzese V.a, Schietroma M.a, Cecilia E.M.a, Mattei A.b, Amicucci G. New Harmonic Scalpel versus Conventional Hemostasis in Right Colon Surgery: A Prospective Randomized Controlled Clinical Trial. Dig Surg 2013;30:355-361.
15. Petri E. Voutilainen and Caj H. Haglund. Ultrasonically Activated Shears in Thyroidectomies. Annals of surgery. 2000 Mar; 231(3): 322–328.
16. Voutilainen PE1, Haapiainen RK, Haglund CH. Ultrasonically activated shears in thyroid surgery. Am J Surg. 1998 Jun;175(6):491-3.
17. Adrienne L. Melck and Sam M. Wiseman, "Harmonic Scalpel Compared to Conventional Hemostasis in Thyroid Surgery: A Meta-Analysis of Randomized Clinical Trials," International Journal of Surgical Oncology. 2010;2010:p0-8.
18. Yener O, Demir M, Yılmaz A, Yığıtbaşı R, Atak T. Harmonic Scalpel Compared to Conventional Hemostasis in Thyroid Surgery. Indian J Surg. 2014;76(1):66-69.