

# THE USE OF THE HARMONIC SCALPEL IN THYROID SURGERY. OUR EXPERIENCE

Arif Raza Khan<sup>1</sup>, Muhammad Rashid Waheed<sup>2</sup>, Muhammad Asad Ullah Arif<sup>1</sup>

<sup>1</sup>Department of Otorhinolaryngology, Khyber Teaching Hospital, Peshawar - Pakistan

<sup>2</sup>Department of General Surgery, Khyber Teaching Hospital, Peshawar - Pakistan

## ABSTRACT

**Objective:** To evaluate the potential advantages of the use of Harmonic Scalpel in thyroidectomies in terms of operative time and complications.

**Material and Methods:** This prospective study was conducted in private sector 2 hospitals, Said anwer medical centre, and Abaseen Hospital, dabgari Gardens ,Peshawar-Pakistan. The study period was from January 2017 to March 2019 A total of 130 cases were recruited for thyroid surgery, 15 patients were dropped out due to different reasons. In 68 patients thyroidectomies were performed using harmonic scalpel FOCUS (group A), & in 47 without it (group B).

**RESULTS:** Mean operative time was 120 minutes in group A and 150 minutes in group B with a mean difference of 30 minutes (14.9%). 55 patients in group A (81.35%) and 34 in group B (73.4%) were discharged in second postoperative day. In group A, hypoparathyroidism was present in 34 patients at discharge (48%), in 23 at 6 months (3.38%) and in 10 at 12 months (2.13%), in group B, in 25 at discharge (54.26%), in 61 at 6 months (12.98%) and in 28 at 12 months (5.96%).

**Conclusion:** The use of Harmonic Scalpel in thyroid surgery is safe and effective and is associated with a significant reduction in operative time, postoperative hypocalcaemia and hospital stay, without increasing complications rate.

**Key Words:** Thyroidectomy, Bleeding, Operative time, Harmonic, Scalpel.

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## INTRODUCTION

The standardized thyroid surgery developed by Theodor Kocher and Theodor Billroth, the pioneers of thyroid surgery, has not undergone a major change in operative technique in the last century<sup>1</sup>. Even if alternative surgical methods in thyroid gland, including endoscopic surgery or recurrent laryngeal nerve stimulation, have been tried during the last decade, they have not been widely accepted<sup>2,3</sup>. Recently, there was a major development in the device using ultrasonic energy and it has been using for various surgeries, especially by laparoscopists. The ultrasonically activated scalpel (harmonic scalpel) that uses high frequency mechanical

energy makes it possible to cut and coagulate tissues and vessels simultaneously, without the need of knot tying<sup>4</sup>. Therefore, this device might be useful to reduce operation time and hypoparathyroidism since in thyroid surgery that requires a large amount of knot tying and may impair the pedicle of parathyroid gland during knot tying<sup>5-7</sup>. The present study was conducted to evaluate the strength and weakness of the harmonic scalpel by comparing two groups that used the conventional technique (knot tying) and the harmonic scalpel in thyroid surgery.

## MATERIAL AND METHODS

This prospective study was conducted in private sector 2 hospitals, Said anwer medical centre, and abaseen Hospital, dabgari Gardens, Peshawar-Pakistan. The study period was from January 2017 to March 2019 A total of 120 cases were recruited for thyroid surgery, 15 patients were dropped out due to different reasons. In 68 patients thyroidectomies were performed using

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**Dr. Arif Raza Khan** (Corresponding Author)  
Chairman & HOD  
Department of Otorhinolaryngology Khyber Medical College, Peshawar - Pakistan  
E-mail: arifraza\_k@yahoo.com  
Contact: +92 - 333-9167305  
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harmonic scalpel FOCUS (group A), & in 47 without it (group B).

We performed the hemithyroidectomy and total thyroidectomy in 130 patients with thyroid benign and malignant nodules, from January 2017 to March 2019. Among them, 15 patients who were associated with toxic goiter and who underwent complete thyroidectomy or total thyroidectomy with lateral neck dissection were excluded. Thus, a total of 115 patients were included in the study population. Institutional ethical board approval and preoperative informed consent from all patients were obtained. All patients were explained in the price and functions of harmonic scalpel and then harmonic scalpel was used only in patients with permission to use it. According to the use of harmonic scalpel, the patients could be divided into two groups, prospectively: the conventional technique (CT) group of tying and knots (hemithyroidectomy, n=40; total thyroidectomy, n=07) and the harmonic scalpel (HS) group (hemithyroidectomy, n=60; total thyroidectomy, n=08). All patients were examined about age, gender, operation time, postoperative drainage (duration and volume), hospital stay, and postoperative complication including bleeding, recurrent laryngeal nerve palsy, and hypoparathyroidism. Operation time was defined as the time between skin incision and skin closure. Vacuum drains were placed in all patients, and postoperative drainage was estimated every morning. When the drainage volume was less than 20 mL per 24 hours, the suction device was removed. All patients who were removed suction device were discharged from the hospital the next day. In the patients who underwent total thyroidectomy, a series of serum calcium levels were obtained every postoperative day until patients were discharged. All the patients with serum calcium levels of less than 2.10 mmol/L (reference range, 2.10-2.60 mmol/L) during the first 3 postoperative days were considered as having hypocalcemia and received oral calcium carbonate and vitamin D3 supplementation. If serum calcium levels returned to normal within 6 months, hypoparathyroidism was classified as transient, and in the other cases, it was classified as permanent. Surgical technique All patients had the same anesthetic and hospital care and the patients were positioned and draped in the conventional manner. About 5 cm incision was made over the level of the thyroid isthmus. After elevation of subplatysmal flaps, the strap muscles were separated in the midline and laterally reflected. The superior and inferior thyroid vessels were then divided either with the

harmonic scalpel with the CS-14C handpiece (Harmonic Synergy Curved Blade, Ethicon Endosurgery Inc., Cincinnati, OH, USA) or with conventional knot tying and electric cauterization. The only small vessels in the ligament of Berry were clamped with clips in both groups. After that, the wound was irrigated and closed using absorbable suture material to approximate strap muscle, platysmal layer, and subcutaneous layer. Then, the skin was sutured with non-absorbable material. The indications of hemithyroidectomy were benign nodule and single micropapillary carcinoma (1 cm and less) without nodal metastasis or extrathyroid spread. In the other malignant nodule, total thyroidectomy with central neck dissection (level VI) was performed. Statistical analysis Hemithyroidectomy and total thyroidectomy groups were divided into two groups using either the HS or conventional knot tying. All the patients who were to undergo surgery during the study period were selected using simple random sampling. Each group was analyzed to estimate the usefulness of HS. Statistical analysis was performed using the independent t-test, the Pearson  $\chi^2$  test, and Fisher's exact test to compare the series. For all tests, a probability of less than 0.05 was accepted as statistically significant. All statistical analyses were done with SPSS software version 12.0 (SPSS Inc., Chicago, IL, USA)

## RESULTS

Both groups were similar regarding age and change in sex, Difference between harmonic scalpel group and conventional technique group according to clinical factors in patients who underwent the hemithyroidectomy Clinical factors Hemithyroidectomy (n=47, HS), CT (n=68) Age range was from  $50.6 \pm 13.2$  years, Female to Male ratio was 4 : 1, Operation time was 120 minutes in Harmonic scalpel group versus 150 minutes by conventional method. Drainage volume POD 1st was 150ml in conventional group than 60 ml in Harmonic group. Total Hospital stay was 05 days in conventional group than 2 days in HS group. (CT: conventional technique, HS: harmonic scalpel, POD: postoperative day.)

For total thyroidectomy with central neck dissection, there was no difference of drainage volume of first postoperative day between the 2 groups. However, operation time (p=0.001), total drainage volume (p= 0.001), drain removal date (p=0.007), and hospital stay date (p=0.001) were significantly different between them. There was no significant difference according to tumor volume and malignancy between the 2 groups. In terms of postoperative complication, postoperative

hemorrhage and transient recurrent laryngeal nerve palsy occurred in one patient each (1%) who underwent hemithyroidectomy with the CT. Among the patients who underwent total thyroidectomy with central neck dissection (CND) with the HS, only one patient (2.9%) showed transient recurrent laryngeal nerve palsy. The incidences of these complications were too low to reach statistical significance, with the exception of transient hypoparathyroidism that showed significantly Usefulness of the Harmonic Scalpel in Thyroid Surgery 141 J Korean Thyroid Assoc lower incidence in the HS group than in the CT group

### DISCUSSION

The meticulous hemostasis is important in thyroid surgery because the thyroid gland has an extensive vascular network<sup>8</sup>. Especially, the control of small vessels around recurrent laryngeal nerve and parathyroid gland on preserving their function is a time consuming step in thyroid surgery. To date, various techniques, including knot-tying, electric cauterization and HS to cutting and hemostasis in surgery have been used<sup>9,10</sup>. Among them, knot-tying has been the most frequently used technique and relatively safe and reliable ligation without injury of adjacent structure. However, it requires good skill and has a tendency to delay the operation time. On the other hand, electrical cauterization can reduce the operation time but usually injure the adjacent tissue and its use around a nerve is dangerous<sup>11,12</sup>. However, the use of ultrasonic energy recently made it possible to cut tissue and perform hemostasis at the same time with minimal injury to the adjacent tissue<sup>13</sup>. The HS using the ultrasonic energy has been used for cardiac, abdominal, and gynecologic surgery because of its ability to access narrow operating fields<sup>14,15</sup>. In addition, the usefulness of the HS in thyroid surgery has been reported and it provides an alternative method to conventional hemostasis technique<sup>16,17</sup>. All these studies have shown that the HS is a safe method for controlling bleeding and shortens the operation time, same as our study. While a majority of studies used only the HS, we used hemoclips for small vessels around the ligament of Berry because of the relatively blunt tip of HS. In case of the patients who underwent total thyroidectomy with CND and had a plan of postoperative radioactive iodine ablation, the complete resection of thyroid tissue is a very important prognostic factor. Therefore, the exclusive use of HS may result in incomplete removal of thyroid tissue. In addition, since there is a recurrent

laryngeal nerve near the ligament of Berry, the blunt tip of HS may make a recurrent laryngeal nerve palsy. In the studies that described postoperative recurrent laryngeal nerve palsy in detail, the incidence rate of transient injury of recurrent laryngeal nerve was from 3% to 10.5%<sup>18-20</sup>. In our study, transient recurrent laryngeal nerve palsy was observed in one case (2.9%) of total thyroidectomy with CND group, using the HS, and it may result from the handling of HS around the ligament of Berry. However, except for this weak point of HS, the reduction of operation time, postoperative drainage, and hospital stay was shown in a majority of previous studies. In our study, there was a significant difference of the incidence of transient hypoparathyroidism between HS and conventional technique groups in cases of total thyroidectomy with CND. Although a similar study, which transient hypoparathyroidism was reduced in the cases that used the HS, was reported, a majority of the other studies have reported that the difference of transient hypoparathyroidism was not statistically significant<sup>21,22</sup>. The discrepancy between these studies may result from the difference of time for estimating postoperative serum calcium. Controversy exists concerning the best time for estimation of serum calcium in predicting postoperative transient or permanent hypoparathyroidism<sup>23,24</sup>. Some previous studies have suggested that decreasing serum calcium levels within the first 48 hours after surgery may be a predictor of postoperative hypoparathyroidism and the other study described serum calcium level at the first 72 hours after surgery as a better predictor<sup>25,26</sup>. Therefore, we routinely measured serum calcium levels during 72 hours after surgery and this may explain higher incidence of transient hypoparathyroidism and significantly different incidence of transient hypoparathyroidism between HS and CT groups in contrast with the previous studies<sup>27-30</sup>. Transient hypocalcemia may result from mechanical force or perioperative hemodilution<sup>31,32</sup>. However, hypocalcemia within the first 3 days postoperatively may be caused by the stretching or heating during operation<sup>33</sup>. Consequently, our results seem to support that the low heat generation and gentle cutting without stretching by the HS may lead to reduce the injury of parathyroid gland vascularity<sup>34</sup>.

The major benefit of Harmonic Scalpel used during thyroidectomy is the reduction in the time of operation. All studies but one to date have reported reductions in operative time, ranging from 6 to 78 minutes with a 10% to 35% savings in operative time and this

was confirmed in our study. A reduction of hypoparathyroidism, particularly transitory, and in length of hospital stay was reported in some studies and confirmed in our experience.

### **LIMITATIONS**

The sample size was small and facilities of Harmonic surgery was unaffordable to majority of cases

### **CONCLUSION**

Harmonic Scalpel Surgery is very safe & useful in expert hands in terms of less operating time and bleeding.

### **REFERENCES**

1. Nenkov R, Radev R, Madzhov R. Minimally Invasive Open Access Thyroid Surgery - Main Point, Indications and Effectiveness. *Surgery*. 2009 LXV(1):24-27.]
2. Bellantone R, Lombardi CP, Raffaelli M, Rubino F, Boscherini M, Perilli W. Minimally invasive, totally gasless video-assisted thyroid lobectomy. *Am J Surg*. 1999 Apr;177(4): 342-343.]
3. Ikeda Y, Takami H, Tajima G, Sasaki Y, Takayama J, Kurihara H, et al. Total endoscopic thyroidectomy: axillary or anterior chest approach. *Biomed Pharmacother*. 2002 56 Suppl 1:72s-78s
4. Miccoli P, Berti P, Bendinelli C, Conte M, Fasolini F, Martino E. Minimally invasive video-assisted surgery of the thyroid: a preliminary report. *Langenbecks Arch Surg*. 2000 Jul;385(4):261-264.
5. Nenkov R, Radev R, Kuzmanov Y, Kornovski S, Kuzmanov S, Nanev B, et al. Argon plasma resection of the REFERENCES: thyroid gland - nature and advantages. *Surgery*. 2005 LXI(3):19-22.
6. Sartori PV, De Fina S, Colombo G, Pugliese F, Romano F, Cesana G, et al. Ligasure versus Ultracision in thyroid surgery: a prospective randomized study. *Langenbecks Arch Surg*. 2008 Sep;393(5):655-8.
7. He Q, Zhuang D, Zheng L, Zhou P, Chai J, Lv Z. Harmonic focus in total thyroidectomy plus level III-IV and VI dissection: a prospective randomized study. *World J Surg Oncol*. 2011 Oct 31;9:141.
8. Siperstein AE, Berber E, Morkoyun E. The Use of the Harmonic Scalpel vs Conventional Knot Tying for Vessel Ligation in Thyroid Surgery. *Arch Surg*. 2002 Feb;137(2):137-142.
9. Cordón C, Fajardo R, Ramírez J, Herrera MF. A randomized, prospective, parallel group study comparing the harmonic scalpel to electrocautery in thyroidectomy. *Surgery*. 2005 Mar; 137(3):337-341.
10. Ecker T, Carvalho AL, Choe JH, Walosek G, Preuss KJ. Hemostasis in thyroid surgery: harmonic scalpel versus other techniques-a metaanalysis. *Otolaryngol Head Neck Surg*. 2010 Jul;143(1):17-25.
11. Foreman E, Aspinall S, Bliss RD, Lennard TW. The Use of the Harmonic Scalpel in Thyroidectomy: 'Beyond the Learning Curve'. *Ann R Coll Surg Engl*. 2009 Apr;91(3):214-216.
12. Markogiannakis H, Kekis PB, Memos N, Alevizos L, Tsamis D, Michalopoulos NV, et al. Thyroid surgery with the new harmonic scalpel: a prospective randomized study. *Surgery*. 2011 Mar;149(3):411-5.
13. Miccoli P, Donatini G. Use of the Harmonic Scalpel in Thyroid Surgery - Review of the Literature. *European Endocrine Disease*. 2006:54-58.
14. Becker WF. Presidential address: Pioneers in thyroid surgery. *Ann Surg* 1977;185(5):493-504.
15. Chowbey PK, Mann V, Khullar R, Sharma A, Bajjal M, Vashistha A. Endoscopic neck surgery: expanding horizons. *J Laparoendosc Adv Surg Tech A* 1999;9(5):397-400.
16. Echeverri A, Flexon PB. Electrophysiologic nerve stimulation for identifying the recurrent laryngeal nerve in thyroid surgery: review of 70 consecutive thyroid surgeries. *Am Surg* 1998;64(4): 328-33.
17. Amaral JF. The experimental development of an ultrasonically activated scalpel for laparoscopic use. *Surg Laparosc Endosc* 1994;4(2):92-9.
18. Rothenberg SS. Laparoscopic splenectomy using the harmonic scalpel. *J Laparoendosc Surg* 1996;6 Suppl 1:S61-3.
19. Amaral JF. Laparoscopic cholecystectomy in 200 consecutive patients using an ultrasonically activated scalpel. *Surg Laparosc Endosc* 1995;5(4):255-62.
20. Wolf RK, Ohtsuka T, Flege JB Jr. Early results of thoracoscopic internal mammary artery harvest using an ultrasonic scalpel. *Eur J Cardiothorac Surg* 1998;14 Suppl 1:S54-7.
21. Robbins ML, Ferland RJ. Laparoscopic-assisted vaginal hysterectomy using the laparoscopic coagulating shears. *J Am Assoc Gynecol Laparosc* 1995;2(3):339-43.
22. Siperstein AE, Berber E, Morkoyun E. The use of the harmonic scalpel vs conventional knot tying for vessel ligation in thyroid surgery. *Arch Surg* 2002;137(2):137-42.
23. Shemen L. Thyroidectomy using the harmonic scalpel: analysis of 105 consecutive cases. *Otolaryngol Head Neck Surg* 2002; 127(4):284-8.
24. Ortega J, Sala C, Flor B, Lledo S. Efficacy and

- costeffectiveness of the UltraCision harmonic scalpel in thyroid surgery: an analysis of 200 cases in a randomized trial. *J Laparoendosc Adv Surg Tech A* 2004;14(1):9-12.
25. Voutilainen PE, Haglund CH. Ultrasonically activated shears in thyroidectomies: a randomized trial. *Ann Surg* 2000;231(3): 322-8.
26. Karvounaris DC, Antonopoulos V, Psarras K, Sakadamis A. Efficacy and safety of ultrasonically activated shears in thyroid surgery. *Head Neck* 2006;28(11):1028-31.
27. Koutsoumanis K, Koutras AS, Drimousis PG, Stamou KM, Theodorou D, Katsaragakis S, et al. The use of a harmonic scalpel in thyroid surgery: report of a 3-year experience. *Am J Surg* 2007;193(6):693-6.
28. Miccoli P, Berti P, Dionigi G, D'Agostino J, Orlandini C, Donatini G. Randomized controlled trial of harmonic scalpel use during thyroidectomy. *Arch Otolaryngol Head Neck Surg* 2006;132(10):1069-73.
29. Koh YW, Park JH, Lee SW, Choi EC. The harmonic scalpel technique without supplementary ligation in total thyroidectomy with central neck dissection: a prospective randomized study. *Ann Surg* 2008;247(6):945-9.
30. Asari R, Passler C, Kaczirek K, Scheuba C, Niederle B. Hypoparathyroidism after total thyroidectomy: a prospective study. *Arch Surg* 2008;143(2):132-7;
31. Adams J, Andersen P, Everts E, Cohen J. Early postoperative calcium levels as predictors of hypocalcemia. *Laryngoscope* 1998; 108(12):1829-31.
32. Luu Q, Andersen PE, Adams J, Wax MK, Cohen JI. The predictive value of perioperative calcium levels after thyroid/ parathyroid surgery. *Head Neck* 2002;24(1):63-7.
33. Bentrem DJ, Rademaker A, Angelos P. Evaluation of serum calcium levels in predicting hypoparathyroidism after total/neartotal thyroidectomy or parathyroidectomy. *Am Surg* 2001;67(3): 249-51; discussion 51-2.
34. McHenry CR, Speroff T, Wentworth D, Murphy T. Risk factors for post thyroidectomy hypocalcemia. *Surgery* 1994;116(4).232-36

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#### **AUTHOR'S CONTRIBUTION**

Following authors have made substantial contributions to the manuscript as under:

**Khan AR:** Main Idea, Operating Surgeon, Overall Supervision.

**Waheed MR:** Data collection, follow up.

**Arif AU:** Bibliography, follow up.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.