ORIGINAL RESEARCH PAPER

Volume-8 | Issue-5 | May-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# A COMPARATIVE STUDY BETWEEN HARMONIC SCALPEL VERSUS DIATHERMY IN HEAD AND NECK SURGERY.

General Surgery

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## ABSTRACT

**PURPOSE OF STUDY:-** The aim of this study was to compare operative factors, postoperative outcomes, and surgical complications of the head and neck dissection (ND) when using the harmonic scalpel (HS) versus Diathermy.

**OBJECTIVES:-**

1.To assess the amount of blood loss, post operativepain relief and duration of the operation.

2. To assess the use of ultrasonic energy in comparison with diathermy.

3. To assess intra and postoperative complication.

**METHODS:-** The material for the present study comprises of 60 cases admitted to Department of General Surgery in Padmashree Dr. D.Y.Patil hospital & research institute, Kolhapur from may 2015 to may 2017 a period of 24 months.

The cases confirmed by the clinically palpable head and neck swelling or Mass and routine work were done and randomly selected for planned head and neck surgery using harmonic scalpel or Diathermy and observed for intraoperative blood loss, duration of operation, postoperative pain relief and complications.

**RESULTS:-** The use of the HS reduced significantly the operating time, the intraoperative blood loss, the postoperative pain, and the volume of drainage. No significant difference was observed in mean hospital stay and postoperative complications.

**CONCLUSION: -**The Harmonic Scalpel is a reliable and safe tool for reducing intraoperative blood loss, operative time, the volume of drainage and postoperative pain in patients undergoing head and neck dissection.

## KEYWORDS

–Harmonic scalpel, Diathermy, Head & neck.

## INTRODUCTION

Major Head and neck procedures are often complicated by challenging anatomy, complex reconstructions, and long operative time[1].

Surgery is often the first line treatment option for head and neck cancers. Some patients may be treated with surgery alone; for others, combining surgery with radiation therapy and/or chemotherapy may be appropriate.

Head and neck cancer (HNC) accounts for approximately 6% of all human cancers. Major head and neck procedures are often complicated by challenging anatomy, complex reconstructions, and long operative time[1,2].

Head & neck dissection (HND) has been recognized as an integral part of the surgical therapy since the 19th century. Due to associated comorbidity of the patient, they are highly prone to complications,such as hematoma, wound infection, chylous leakage, etc. All these lead to prolonged hospital stay[1,2].

Major head and neck resections are commonly performed using a variety of instruments including sharp dissection and electrocautery as well as suture ligatures and surgical clips for additional hemostasis [3,4]. Electrosurgical instruments are used increasingly for tissue dissection, concerns about excessive scarring; higher wound infection rate and poor wound healing have curtailed the widespread use of surgical diathermy[3].

Minimally invasive surgeries cause less surgical trauma and less pain and may result in a shorter hospital stay.

New surgical devices and technologies that focus on reducing operative time, blood loss, and other complications have been investigated and the results have been favorable[2].

The harmonic scalpel (HS ) / Ultrasonic energy device was introduced in the early 1990s and has 4 functions during the surgery: cutting of the tissues, cavitations, coaptation of the tissues and coagulation with high frequency (55,500 Hz /second) mechanical energy to cut and coagulate tissues at the same time. The ultrasonic energy device is made up of three parts: a generator, a handpiece and the scissors and it does not conduct electric current and has high activity of hemostasis.

Mechanism of ultrasonic energy device depends on denaturation of protein by using ultrasonic vibration to transfer mechanical energy sufficient to break tertiary hydrogen bonds. Simultaneous dissection and secure hemostasis ensure a clean, dry surgical field[1,2,5].

Whether the harmonic scalpel (HS) can reduce the operative time and intraoperative bleeding in neck dissection remains controversial[2].

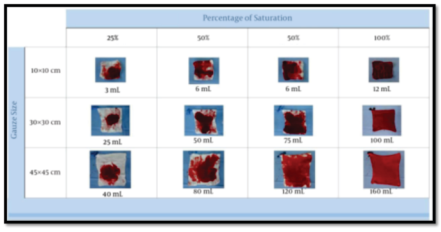
## METHODOLOGY

A Comparative study between Harmonic scalpel versus Diathermy in Head and Neck Surgery" comprises of 60 cases admitted to Department of General Surgery in Padmashree Dr. D.Y.Patil Hospital & Research Institute, Kolhapur from may 2015 to may 2017. All

patients were studied in detail clinically and investigated thouroughly.

The method for the study included a random selection of patient with head and neck swelling/mass. Inclusion criteria - 1.Benign or Malignant swelling of the oral cavity, 2. Benign or Malignant Thyroid swelling, 3.Other Benign or Malignant swelling of Head and neck. Exclusion criteria: 1. Nodes involving Carotid(Great) Vessels, 2. Malignancy involving infratemporal fossa, 3. Advanced Malignant condition.

All the patients were received symptomatic treatment. Following evaluation, the patient will be subjected randomly for the operative procedure using harmonic scalpel or diathermy and the amount of blood loss by visual estimation, and duration of operation was noted.




**All the patients were operated by single Surgeon.**

Postoperatively cases were checked for pain relief according to wong baker Pain scale. Drain output in 24 hours and postoperative complication. The drain was removed when the output was less than 10ml.Post operative follow up.

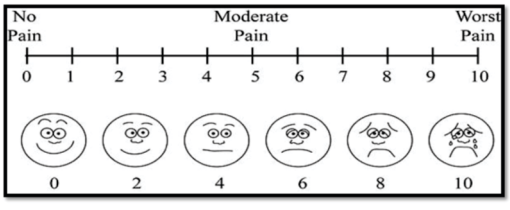



**Figure showing Wong baker visual Pain scale**

## RESULTS

This study included 60 cases that were studied prospectively over a period of 24 months, from may 2015 to may 2017.

**Table 1: Duration of operation (hr/min) distribution in two groups**

For patients undergoing RND / thyroidectomy, the mean duration of surgery using the harmonic scalpel was lower than that of surgery using the Diathermy. (P=0.430). In Hemiglossectomy, Harmonic scalpel significantly reduces operating time compare to Diathermy.

| Duration of operation (hr/min) | Group H | Group D | Total |
|---|---|---|---|
| <2 | 20(66.7%) | 16(53.3%) | 36(60%) |
| 2-3 | 10(33.3%) | 14(46.7%) | 24(40%) |
| >3 | 0(0%) | 0(0%) | 0(0%) |
| Total | 30(100%) | 30(100%) | 60(100%) |

**Table 2: Blood loss (during the procedure) ML distribution in two groups**

The intraoperative blood loss was significantly smaller in the HS group ( HS vs Diathermy 114.17±32.62 versus 175.83±33.79, < 0.001) Significant .

| Blood loss (during procedure)ML | Group H | Group D | Total |
|---|---|---|---|
| <100 | 5(16.7%) | 0(0%) | 5(8.3%) |
| 100-200 | 25(83.3%) | 29(96.7%) | 54(90%) |
| >200 | 0(0%) | 1(3.3%) | 1(1.7%) |
| Total | 30(100%) | 30(100%) | 60(100%) |
| Mean ± SD | 114.17±32.62 | 175.83±33.79 | 145.00±45.29 |

**Table 3: Post Operative distribution of pain relief and Drain output in two groups**

The quantity of neck drainage in postoperative days was smaller in Harmonic Scalpel group than in Diathermy. According to the visual analogic scale (vas) wong baker faces (pain rating scale), patients of the HS group experienced less postoperative pain compared with patients of the Diathermy group.

| Post Operative | Group H (n=30) | Group D (n=30) | Total (n=60) | P value |
|---|---|---|---|---|
| Drain removed on postoperative day | | | | |
| • <4 | 2(6.7%) | 0(0%) | 2(3.3%) | <0.001** |
| • 4-6 | 28(93.3%) | 18(60%) | 46(76.7%) | |
| • >6 | 0(0%) | 12(40%) | 12(20%) | |
| Post op pain (max.) acc. to wong baker faces | | | | |
| • <4 | 0(0%) | 0(0%) | 0(0%) | <0.001** |
| • 4-6 | 23(76.7%) | 1(3.3%) | 24(40%) | |
| • >6 | 7(23.3%) | 29(96.7%) | 36(60%) | |

**Table 4: Post-operative complication distribution in two groups**

Complications rate was observed in both groups. Three(5%) patients had wound dehiscence was observed in Diathermy group and no one (0%) in the HS group.

| Postoperative complication | Group H | Group D | Total |
|---|---|---|---|
| Negative | 30(100%) | 27(90%) | 57(95%) |
| Positive | 0(0%) | 3(10%) | 3(5%) |
| Total | 30(100%) | 30(100%) | 60(100%) |

## DISCUSSION

Head and neck cancer (HNC) accounts for approximately 6% of all human cancers, and Surgery is often the first line treatment option for head and neck cancers. In surgery, the success of a certain kind of procedure can be evaluated based on its safety, efficiency, complications and recurrences, surgical technique and acceptance from the patients.

Acceptance from the patients is determined by postoperative pain, need for analgesics, length of hospital stay and recovery rate which are, as well as complications, determined by tissue trauma level and organism stress caused by operation[16].

Innovative advances have recently occurred regarding instrumentation energy sources and devices aimed at facilitating surgical procedures in terms of efficient hemostasis, tissue ligation, and dissection, as well as a reduction in surgical time.

Our experience shows that the Harmonic Scalpel(HS) reduces the need for ligatures by simultaneous cutting and coagulation. The blood loss during the dissection could be significantly diminished as a result of the shortened operation time and the more precise hemostasis with clear operative area[17]. Thermal damage to tissue seems to be the reason for increased postoperative pain and delay in wound healing.

In this study we investigated two of the most common scalpels in head and neck surgery — that is, Diathermy and Harmonic Scalpel[18].

Ultrasonic scalpels are currently used in surgery. It was originally developed for its applications in laparoscopic surgery but has found its way successfully into the specialty of head and neck surgery. The primary applications for the HS in the head and neck literature pertain to its uses for tonsillectomy and thyroidectomy. The use of the HS has also been described in excising the cancer of the tongue and soft palate, submandibular sialadenectomy , parotidectomy.

Unlike the variable results described the literature is consistent concerning the usefulness of the harmonic scalpel in head and neck surgery.

New surgical Instrument as HS is being developed to enable surgeons to increase their speed and efficiency. The HS is a new device that uses high-frequency mechanical vibration to cut and coagulate tissues at the same time. The coagulation achieved by the HS is similar to that of electrocautery, However, the mechanism by which the proteins become denatured is completely different in HS, the ultimate result remains a denatured protein coagulum that coapts and tamponades blood vessels.

The ultrasonic energy device denatures protein by using ultrasonic vibration to transfer electronic energy to mechanical energy sufficient to break tertiary hydrogen bonds. HS cuts by two mechanisms:

cavitational fragmentation and mechanical cutting. This blade vibrates at 55.5 kHz over a distance of 80 m. When the temperature reaches 60 C, the proteins begin to denature, transforming from the colloidal state into an insoluble gel, which is necessary for vessel coagulation[23]. HS showed a smaller area of lateral thermal damage compared to the Diathermy

HS (Harmonic Scalpel) is even more appropriate since it is approved for closing vessels up to 5mm in diameter, as the facial artery and branches of external carotid artery, lingual artery, superior thyroid artery, and occipital artery are the largest arteries that have to be ligated during head and neck dissection without any failure. These types of features facilitate the use of the HS in tight spaces or close to vital structures, where accuracy is essential. The managing of the ultrasonic scalpel does not require special skills from the doctor since it only alternatives the conventional electronic scalpel.

The hemostasis by HS rarely does not occur; in this case, we identified the bleeding vessel and ligated with a conventional hand-tie ligature. Harmonic scalpel not only reducing the conventional hand-tied ligation but also ease and speed up the dissection in RND and MRND.

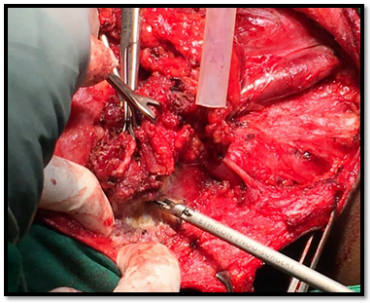


**Figure showing Dissection with Harmonic in Radical neck dissection**

Head and neck dissection(HND) is a basic surgical procedure in head and neck oncology. There have been a few Studies showing the utility of HS in HND, both RND, and MRND.

In 2008 Salami et al, In 2009 Miccoli et al, In 2011 Walen et al, and recently, in 2012 Shin et al. Studied the safety and the efficacy of HS in patients who underwent Neck Dissection with primary head and neck malignancy resection showing a significant reduction of operative time and blood loss in HS group.

In our study operating time was slightly shorter for the HS and longer for Diathermy method but this was found to be statistically insignificant (P=0.430, Not Significant).

In our study, the blood loss during the head and neck dissection could be significantly reduced as a result of the shortened operation time and more precise hemostasis. (Mean ± SD ; 114.17±32.62 versus 175.83±33.79, < 0.001) Ours results were almost consistent with the iterature.

Postoperative pain is one of the essential components of patients accepting a new operational procedure, therefore calculating its depth is one of the unavoidable guidelines in grading the success rate of a fresh method. Postoperative pain depth is measured straight, using designed scales. For direct calculating of postoperative pain intensity, we used the visual analog pain scale (VAS) due to its adequate sensitivity. There have been no statistically significant differences in postoperative pain intensity in our research.

Several studies have demonstrated that the usage of harmonic scalpels led to a lowering of postoperative drainage, which also prevents postoperative surgical site infections.

In our study, we found the total amount of postoperative drainage in patients treated with harmonic scalpels was decreased compare to diathermy group. The decrease in intraoperative bleeding allows an even more precise control of small vessels, which plays a role in the lowering of postoperative drainage. Surgeons preferred not to put drains in cases with low intraoperative bleeding; the amount of these cases was higher in the HS group.

The most regularly occurring postoperative complication in head and neck surgery is seroma formation. However, in our study appearance in both HS and diathermy groups are relatively rare and compare to diathermy the harmonic scalpel have fewer chances of developing postoperative wound dehiscence.

Finally, we did not carry out an economic evaluation of the use of HS in head and neck dissection. In our opinion, these limitations do not invalidate our results and our conclusions about the efficacy and safety of HS-aided head and neck dissection.

## CONCLUSION

- The Harmonic Scalpel is a reliable and safe device for head and neck surgery,
- It gives sufficient hemostasis.
- Reduced operative time,
- Good postoperative recovery and shorter postoperative stay and reduce postoperatively drainage and complications,
- It can be used as dissection tool, this device should be considered the most suitable hand- a piece of head and neck surgery.
- In a thyroidectomy, its use is more effective than Diathermy.
- Our experience shows that the Harmonic Scalpel reduces the need for ligatures by simultaneous cutting and coagulation.
- Harmonic Scalpel is more superior than diathermy.

## REFERENCES


1. Emanuele Ferri et al. international journal of surgical oncology, volume 2013, article id 369345, 8 pages, accepted 1 December 2013.
2. Zhen-hu ren et al.* plos one | doi:10.1371/journal.pone.0132476 july 10, 2015.
3. Kumar, et al.: scalpel versus surgical diathermy, indian journal of cancer april–june 2011 volume 48.
4. Dieter k. Fritz et al. Journal of otolaryngology - head and neck surgery (2016) 45:58 doi 10.1186/s40463-016-0173-z.
5. Yetişir f et al. (2012) the impact of harmonic scalpel on complications after neck dissection in papillary thyroid carcinoma. Thyroid disorders ther 1:117. Doi:10.4172/2167-7948.1000117.
6. Ann r coll surg engl 2010; 92: 541–547 doi 10.1308/003588410x126996639052 fifteen years' experience in thyroid surgery ,john c watkinson.
7. international scholarly research network,isrn surgery,volume 2012, article id 547017, 10 pagesdoi:10.5402/2012/547017
8. Deborah d lamb, cst,page no 448 -454, assciation of surgical techanologist, radical Neck dissection" the surgical technologist " october 2010.
9. Neck dissections:classifications, indications, and techniques, christopher d. Muller university of texas medical branch, department of otolaryngolog, grand rounds presentation,january 16, 2002.
10. The sages manual on the fundamental use of surgical energy(fuse) Feldman,l:fuschshuber,p.:jones.d.b(eds.) 2012,xv,266 p. 139 ilus.,126 ilus.in colour.,softcover' isbn: 978-1-4614-2037-6.
11. Article - esu testing (60601-2-2) electrosurgical history & theory, esu testing and calibration training focus -hf leakage testing.
12. Hazards of surgical diathermy makama j. G.,facs dept. of surgery, abu teaching hospital, shika – zaria, nigerian journal of medicine, vol. 16, no. 4, october- december 2007.
13. Common uses and cited complications of energy in surgery ganesh sankaranarayanan et al, , and suvranu de1,. Author manuscript; available in pmc 2014 september 01.
14. Bailey & love short practice of surgery, 49-oropharyngeal cancer, international standard book number-13: 978-1-4665-8514-0.
15. Lymph node levels of the neck ,a.prof frank gaillard et al., Articles/lymph-node-levels-of-the-neck.
16. D. Kozomara et al.: harmonic scalpel vs. Monopolar diathermy in mastectomy, coll. Antropol. 34 (2010)suppl.1: 105–112
17. New trends in head and neck surgery: a prospective evaluation of the harmonic scalpel angelo salami et al. morae department of otorhinolanyngology, university of genoa, italy.
18. Annals of otology, rhinology & laryngology,2015 reprints and permissions: sagepub.com/journalspermissions.nav doi: 10.1177/0003489415588556