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Comparison Between Harmonic Scalpel And Conventional Hemostasis Techniques In Thyroid Surgery.

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Abstract
The harmonic scalpel has been emerging as an alternative surgical tool for dissection and hemostasis especially in the field of minimally invasive surgery. We have been studying the safety and efficacy of harmonic scalpel in performing thyroid surgery. The operative and morbidity details of fifteen patients who underwent thyroidectomy using a harmonic scalpel were compared with 15 matched controls operated using conventional hemostatic techniques. There was no significant difference noted in the operating time between the harmonic scalpel and conventional hemostasis group (130mins and 140mins, P>0.05). The blood loss (5ml and 20ml, P<0.001) was significantly lower in the harmonic scalpel group. There was no morbidity in the harmonic scalpel (HS)group when compared to 2 (13.3%) cases of temporary vocal cord palsy and 2 (13.3%) cases of transient hypocalcemia in the conventional hemostasis (CH) group. The use of a harmonic scalpel in thyroidectomy offers several advantages over the conventional hemostasis technique. There were no complications noted in the harmonic scalpel group when compared to the conventional hemostatic group. There was no significant difference in the operating time due to the learning curve but blood loss was reduced significantly

Keywords- *Harmonic scalpel (HS), Conventional Haemostasis (HS)*

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I. Introduction

The pioneers of thyroid surgery, Theodor Kocher and Theodor Billroth, developed an acceptable technique of standardized thyroid surgery between 1873 and 1883. By 1920, the principles of safe and efficient thyroid surgery were already established [1]. They consist of three basic phases: identification and ligation of vessels, the laryngeal nerves, and parathyroid glands. The surgical instruments used have not significantly changed; the main innovations described being new methods of coagulation and vascular section.

During the last decade, alternative techniques for improving the safety, effectiveness, and reducing the invasiveness of thyroidectomy have been proposed. These include video-assisted, and endoscopic surgery, nerve monitoring, and less invasive forms of anesthesia [2]. During thyroidectomy, bleeding can obscure the operative field, making safe dissection of the recurrent laryngeal nerve (RLN), and parathyroid glands difficult. Effective vessel hemostasis can be achieved by using the conventional clamp-and-tie technique. Newer techniques of vessel hemostasis are designed to be more rapid as well as effective. [3].

This study was designed to evaluate the efficacy and safety of HS use compared with conventional methods of hemostasis (CH) in open thyroid surgery.

II. Materials and Methods

This study was conducted at the Department of General Surgery, Christian Medical College and Hospital, Ludhiana (Punjab, India), 30 consecutive patients with benign or malignant thyroid disease underwent open thyroidectomy. This was performed by the same team of surgeons with experience in thyroid surgery. Patients were randomly assigned to either the HS group (15 patients in which the operation was performed entirely using the HS only for hemostasis) or the CH group (15 patients in which the operation was performed using classical techniques with absorbable ligatures and bipolar diathermy). Focus Ultracision Harmonic Scalpel (Ethicon Endo-Surgery, Inc, Cincinnati, Ohio, USA) was used in this study (Figure 1)

Figure 1.Harmonic scalpel. Hand Device.

The inclusion criteria were: (1) age >18 years, (2) acceptance to participate in the study (signed informed consent forms), and (3) scheduled total thyroidectomy for multinodular goiters or low-risk differentiated carcinoma (T1N0M0).

The exclusion criteria were: (1) preoperative medication including analgesics, corticosteroids, or non steroidal anti-inflammatory drugs; (2) coagulation disorders; (3) pregnancy; (4) cervicomediastinal goiters; (5) total thyroidectomy with need of lymph node block dissection as in patients with malignant invasive cancer; (6) concomitant parathyroid disorders; (7) previous neck surgery and (8) history of neck irradiation.

A complete preoperative assessment (thyroid function test, ultrasonography to evaluate nodule size and gland volume, and fine-needle aspiration cytology) was obtained for all patients. They were positioned and draped in the conventional manner. A 6 to 8 cm incision (depending on the size of the thyroid) was made over the level of the thyroid isthmus. Subplatysmal flaps were developed, and the strap muscles were separated in the midline and laterally reflected or divided. The inferior, middle, and superior thyroid vessels were then divided either with the HS or by conventional techniques. The thyroid lobe was then medially rotated, and the vessels in the ligament of Berry, with the RLN under direct vision, were clamped and tied in both groups. The same steps are repeated for the removal of the contralateral lobe. Finally, the wound was irrigated and closed using interrupted 3-0 polyglactin sutures (Vicryl, Ethicon) to approximate the strap muscles and the platysmal layer. The skin was closed using metal clips,4-0 Nylon or 3-0 monocryl.

Complication rates were observed in both groups. Two (13.3%) transient RLN palsies and two (13.3%) transient hypocalcemia were observed in CH group with no complications in the HS group. No patient developed a permanent vocal cord palsy in either group. Postoperative transient hypocalcemia occurred more frequently in the CH group than in the HS group. This difference was statistically significant (2/15, 13.3% in CH group; 0/15, 0% in HS group). All patients recovered completely with no definitive hypoparathyroidism (Table 1).

surgery related	HS group (n=15)	CH group (n=15)	P value
Operative time (mean ± SD) (range), min	130 ± 10	140 ± 10	P>.05, NS
Blood loss (mean ± SD) (range), mL	5 ± 2	20 ± 5	P<.001
Postoperative drainage at 24 h (mean ± SD) (range), mL	20 ± 5	45 ± 10	P<.001
surgery related	HS group (n=15)	CH group (n=15)	P value

Table 1. Surgery related Data

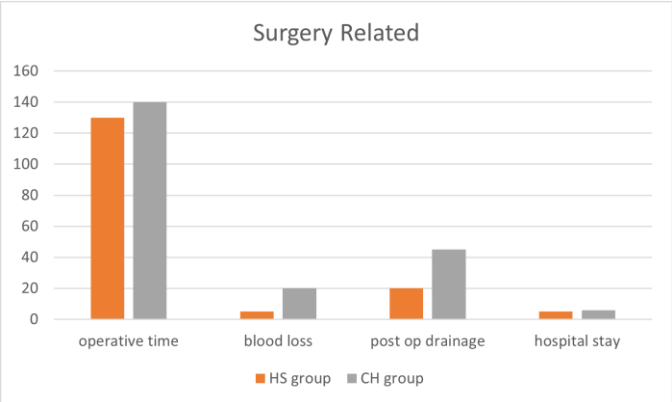

Figure 2

Postoperative complications			
	HS group	CH group	
Transient hypocalcemia	0	2	P<.01
Definitive hypoparathyroidism	0	0	NS
Transient recurrent laryngeal nerve injury	0	2	P<.01
Permanent recurrent laryngeal nerve palsy	0	0	NS

Table 2. Post Operative Complications

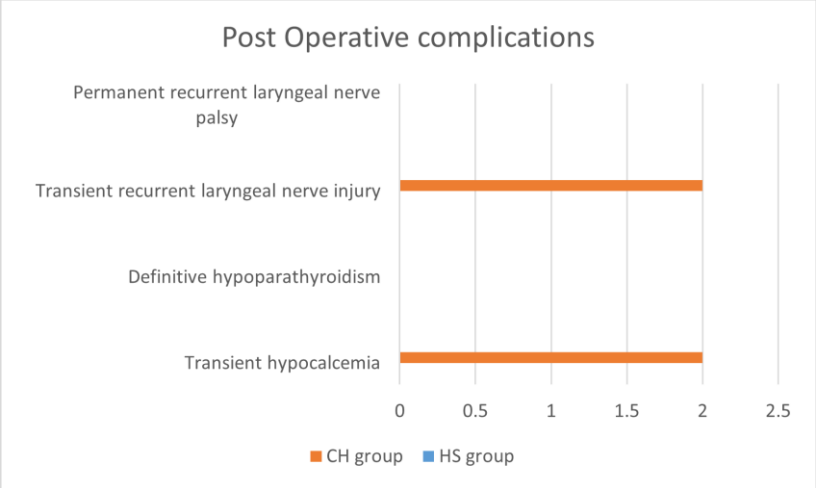

Figure 3

III. Discussion

Thyroidectomy is a surgical procedure that requires meticulous dissection, safe anatomical exposure, and effective hemostasis. Thyroidectomy is the treatment of choice for many thyroid diseases. This operation is performed frequently, with no mortality and a low morbidity. Morbidity results from postoperative laryngeal nerve palsy (transitory or definite) and hypocalcemia (clinical or nonclinical, transitory or definite). The range of incidence of RLN palsies reported in the literature varies widely from 0% to 23%, and transient asymptomatic hypocalcemia after total thyroidectomy is described in as many as 63% of operated cases [4].

The Harmonic scalpel is a useful new device that has been introduced to surgery . It uses high-frequency mechanical energy to cut and coagulate tissues at the same time. Ultrasonic coagulation achieved by the HS is similar to that of electrocautery in that the ultimate result remains a denatured protein coagulum that coapts and tamponades blood vessels. However, the mechanism by which the proteins become denatured is completely different for different modalities Both electrocautery and lasers form the coagulum by heating tissue to denature the protein. The HS denatures protein by means of ultrasonic vibration transferring mechanical energy sufficient to break tertiary hydrogen bonds [5]. At least two mechanisms exist by which the HS divides the tissues: cavitational fragmentation and mechanical cutting.

The blade vibrates at 55.5 kHz over a distance of 80 μm [6].Use of the HS results in a smaller area of lateral thermal damage compared with bipolar cautery [7].

During thyroidectomy, the dissection, ligation, and division of the major thyroid vessels are time-consuming. No reduction in the operating time in our small series using HS was probably related to the learning curve. Bleeding in thyroid surgery can occur from the main superior and inferior arteries and veins of the gland, small tributaries, or from the gland itself (due to inappropriate dissection resulting in ligation and inadvertent traction). The Ultracision HS has been approved by the United States Food and Drug Administration for the ligation of vessels up to 3 mm in diameter. Thermal damage is limited to 0–2 mm beyond the tissue grasped within the forceps of the device [8].

In our study, there was a significant statistical difference in the post-operative drainage in the HS group as compared to CH group, though a larger series would demonstrate greater significance. Several studies have shown that the use of harmonic scalpels leads to a decrease in postoperative wound drainage. This may reduce the incidence of surgical site infections. In our two groups we found that the amount of postoperative drainage in patients treated with harmonic scalpels was reduced compared with the CH group. We found that the reduction in intraoperative bleeding allowed more precise control of small vessel bleeding, which can contribute to the volume of postoperative drainage. The surgeons involved in our series preferred not to place drains in cases with low intraoperative bleeding; the number of such cases was higher in the HS group [9].

The major complications of RLN palsy and hypocalcemia were encountered only in our CH group with no such complications in the HS group. Some authors have attributed these two complications to the lateral thermal effect of harmonic excitation [10]. Several studies in the literature, however, show that harmonic scalpels can be used safely in thyroid surgery with no increase in the number of complications [11-13]. Our results seem to support the hypothesis that the reduced tissue injury resulting from less heat generated by the HS might lead to a reduced risk of impaired vascularity in the parathyroid glands. Randomized studies in larger prospective studies may demonstrate the strength of this trend towards lower complication rates A drawback to the use of the HS is its cost: it is disposable and expensive. From our experience, the use of harmonic scalpel has increased the cost of thyroid surgery and we plan review the cost implications in relation to the reduced incidence of complications..

IV. Conclusions

In conclusion we conclude from this study that the Harmonic scalpel is a reliable and safe tool in thyroid surgery . Its use has been shown to reduce blood loss and the incidence of significant complications for thyroid surgery and this would appear likely to apply to a wider range of neck surgery. The speed of surgery using the HS is likely to increase we feel with greater experience using this device, compared with the more conventional techniques for hemostasis

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