

## Harmonic Scalpel versus Conventional Hemostatic Technique in Patients with Thyrotoxicosis undergoing Total Thyroidectomy

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### ABSTRACT

**Background** Total thyroidectomy for thyrotoxicosis is a difficult operation because of the high vascularity of the gland. It required a bloodless field for proper dissection and identification of important structure related to the gland. **Patients and Methods** From July 2012 till January 2016, 78 patients candidate for total thyroidectomy (TT) for thyrotoxicosis were enrolled. 39 patients with the use of harmonic scalpel (HS group) and 39 patients with the conventional hemostatic tie and knot technique with bipolar diathermy (CT group). Operations were done in the department of surgery at Ain Shams University hospitals. **Results:** The duration of surgery was significantly shorter in HS group ( $108 \pm 15.7$  minutes) versus ( $152 \pm 13.5$  minutes) in CT group ( $P < 0.001$ ). The amount of intraoperative blood loss was also significantly lower in HS group, being ( $65 \pm 25.3$  ml) and ( $105.2 \pm 26.4$  ml) in CT group ( $p = 0.022$ ) table 3. One patient in the HS group and two in CT group had transient recurrent nerve palsy ( $p = 0.46$ ). However, no patient developed a permanent recurrent paresis. One patient in the HS group and another one in CT group had transient hypocalcaemia ( $p = 0.674$ ). No other postoperative complication was noted. **Conclusion** Harmonic Scalpel reduced operative time and blood loss in thyrotoxic patients undergoing total thyroidectomy with no significance effect on recurrent nerve injury and transient hypocalcaemia.

**Keywords** Thyrotoxicosis. Harmonic scalpel. Hemostatic techniques. Total thyroidectomy.

### INTRODUCTION

Total thyroidectomy for thyrotoxicosis is a difficult operation because of the high vascularity of the gland. The parathyroid gland and the recurrent laryngeal nerve (RLN) are anatomically directly related to the thyroid gland. All of this required meticulous hemostasis and bloodless field during thyroidectomy for a successful outcome.

During the last decade, alternative techniques for improving safety, effectiveness, and even invasiveness of thyroidectomy have been proposed, including video-assisted, and endoscopic surgery, nerve monitoring, and less invasive forms of anesthesia.<sup>1</sup>

Effective vessel hemostasis can be achieved by using the conventional clamp-and-tie and electro-coagulation technique. Newer techniques of vessel hemostasis had been developed hope to be more rapid while achieving the same effectiveness.<sup>2</sup>

The successful introduction of the harmonic scalpel (HS), a device that cuts and coagulates simultaneously using high frequency mechanical energy vibrations at 55.5 KHz with minimal lateral thermal tissue damage.<sup>3</sup> was claimed to

shortening operative time in thyroid surgery. There have been previous reports on the use of harmonic scalpel in thyroid surgery.<sup>4,5</sup>

The aim of this study is to compare the use of the harmonic scalpel with conventional techniques in a homogenous group of patients with thyrotoxicosis.

### PATIENTS AND METHODS

#### Patients

From July 2012 till January 2016, 78 patients candidate for total thyroidectomy (TT) for thyrotoxicosis were enrolled. 39 patients with the use of harmonic scalpel (HS group) and 39 patients with the conventional hemostatic tie and knot technique with bipolar diathermy (CT group). Patients with age below 18 years, previous neck surgery or irradiation were excluded. Operations were done in the department of surgery at Ain Shams University hospitals.

#### Preoperative Preparation:

All patients included in this study were pre-treated with antithyroid drugs and they were all euthyroid at the time of surgery. All patients gave informed written consent. A full history and thorough physical examination were done to all

patients. Routine laboratory preoperative investigations, thyroid profile (T3, T4, and TSH), preoperative serum calcium, chest X-ray, ECG and neck ultrasonography were done to all patients. In addition, a pre-operative laryngoscopy was performed. Preoperative thyroid scanning and fine needle aspiration cytology were not routinely done.

#### **Surgical technique:**

Total thyroidectomy was done under general anesthesia and endotracheal tube insertion. A 5-7 cm lower collar incision was made. Subplatysmal flaps were developed and the strap muscles were separated at the midline and retracted laterally exposing the gland. Recurrent laryngeal nerves and parathyroid glands were routinely identified. The middle, superior and inferior thyroid vessels were identified and divided with the Focus harmonic scalpel (HS group) (figure 1, 2,3and4), or ligated using polyglycolic sutures in (CT) group. After removal of the gland, the wound was irrigated, and further hemostasis was done. A closed suction drain was inserted behind the strap muscles. Finally, strap muscles, platysma, and skin were closed.



**Fig. (1):** The vascularity of the gland



**Fig. (2):** The handle of the Focus harmonic ultrasonic dissector device



**Fig. (3):** Ligation of the inferior thyroid Vessels with The device



**Fig. (4):** The field before closure.

#### **Postoperative follow up:**

Plasma levels of serum calcium were measured on the first post-operative day. The need for oral substitution with calcium and/or vitamin D analogues during hospital stay and at patient discharge was recorded together with complications. Follow-up was performed 4 weeks and again 6 months after the operation. At follow-up, serum thyroid hormone concentrations and serum levels of total calcium were measured, and complications recorded. Postoperative laryngoscopy was performed within 4 weeks after surgery in all patients to evaluate vocal cord function. Patients with vocal cord palsy were scheduled at 1, 3, 6, 9, and 12 months after the operation to perform laryngoscopy by ENT specialists.

#### **Statistical Analysis**

Required data were collected tabulated and then statistically analyzed. Analysis of data was done using IBM SPSS software (statistical program for social science version 21). Data

analysis was performed by the usual methods of descriptive statistics frequencies and percentages for discrete variables, average, median, and standard deviations for continuous variables. The homogeneity of the data between the two groups was tested by the chi-square test for discrete variables and the t-test for independent data for continuous variables. The results were significant (S) with  $P < 0.05$  & highly significant (HS) with  $P < 0.01$ .  $P \geq 0.05$  were regarded non-significant (NS).

## RESULTS

### Enrolled Patients:

From July 2012 till January 2016, 78 patients candidate for total thyroidectomy (TT) for thyrotoxicosis were enrolled. 39 patients with the use of harmonic scalpel (HS group) and 39 patients with the conventional hemostatic tie and knot technique with bipolar diathermy (CT group). The mean age of the patients was 40 (18–62). Female: male ratio was 75:25. The two groups of patients were nearly same (Table 1).

**Table 1:** Patient demographics

No. of patients	HS group	CT group	P value
Age (year)	39 40± 5.7	39 41± 4.6	0.11
Sex			
Female	29(74%)	28(72%)	0.16
Male	10(26%)	11(28%)	

Preoperative thyroid function tests and serum calcium level were not statistically significant as shown in table2.

**Table 2:** Preoperative thyroid function tests in both groups.

	HS group	CT group	P value
free T3(pg/ml) (N=1.45-3.48)	2.8 ± 1.3	2.6 ± 1.4	0.280
free T4(ng/ml)(N=0.71-1.85 )	1.4 ± 2.3	1.5 ± 1.9	0.307
TSH (uIU/ml) (N=0.38-4.7)	1.6 ± 0.2	1.7± 0.27	0.230
serum calcium(mg/dl)	9.5 ± 0.5	9.3 ± 0.7	0.240

### Postoperative finding:

The duration of surgery was significantly shorter in HS group (108 ± 15.7minutes) versus (152 ± 13.5minutes) in CT group ( $P < 0.001$ ). The amount of intraoperative blood loss was also significantly lower in HS group, being (65± 25.3ml) and (105.2±26.4ml) in CT group ( $p$

=0.022) table 3. One patient in the HS group and two in CT group had transient recurrent nerve palsy ( $p=0.46$ ). However, no patient developed a permanent recurrent paresis. One patient in the HS group and another one in CT group had transient hypocalcaemia ( $p=0.674$ ). No other postoperative complication was noted.

**Table 3:** Operative and postoperative finding:

	HS group	CT group	P value
Operating time( min)	108 ± 15.7	152 ± 13.5	< 0.001
Intraoperative blood loss	65± 25.3	105.2 ± 26.4	0.022
RLN injury	1 (2.6%)	2 (5.1%)	0.46
Transient hypocalcaemia	1 (2.6%)	1 (2.6%)	0.674

## DISCUSSION

Total thyroidectomy for thyrotoxicosis is often considered to be the most difficult operation because of the high vascularity of the gland and the risk of bleeding. Proper hemostasis and bloodless field during thyroidectomy is essential for a successful outcome in thyrotoxic patients.

Ultrasonic shearing devices have been used in thyroid surgery as a new device for hemostasis. The device divides tissue by using high-frequency ultrasonic energy transmitted between the instrument blades<sup>6</sup>. This mechanical action disrupts protein hydrogen bonds within the tissue. The proteoglycans and collagen fibers in the tissue become denaturated and mix with intracellular and interstitial fluids to form glue like substance.<sup>7</sup>

Hemostasis during thyroidectomy for thyrotoxicosis can be achieved by conventional hemostatic tie and knot technique with bipolar diathermy but this is a time consuming.<sup>8</sup> Harmonic Scalpel uses high-frequency mechanical energy to cut and coagulate tissues and vessels simultaneously without the need for knot tying.<sup>9</sup>

In this study, there is a significant reduction in operating time in SH group compared to CT group which is comparable with many other studies.<sup>7, 10-12</sup> Bove and his colleagues have found that the only real advantage of the new device in thyroid surgery is the time saving.<sup>13</sup>

In this study, There was a significant decrease in blood loss in the SH group which is comparable with study done by Konturek et al.<sup>14</sup> On the other hand, Jeong and his colleagues didn't find this to be statistically significant.<sup>15</sup>

In this study the incidence of RLN palsy didn't show any statistical difference between two groups, one case in SH group and two patients in CT group. All the patients had temporary recurrent nerve palsy and at follow-up with indirect laryngoscopy, 4 to 6 weeks after the operation, all had normal vocal cord function. This result is comparable with other studies.<sup>13, 16</sup>

In this study the incidence of transient hypocalcaemia was the same in both groups, which is comparable with many other studies.<sup>11, 13</sup>

## CONCLUSION

Harmonic Scalpel reduced operative time and blood loss in thyrotoxic patients undergoing total thyroidectomy with no significance effect on recurrent nerve injury and transient hypocalcemia.

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