

## EVALUATION OF POSTOPERATIVE COMPLICATIONS FOLLOWING TOTAL THYROIDECTOMY: THE ROLE OF INTRAOPERATIVE BIPOLAR CAUTERY

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### Abstract

**Introduction:** Post-operative complications following thyroidectomy are not uncommon even in the hands of experienced surgeons. Majority of complications arise due to injury to the vital structures in relation to the gland. By achieving a proper haemostasis intraoperatively, the complications can be avoided. This study evaluates the role of bipolar cautery on post-operative complications, focusing on hypocalcaemia, nerve injury and hematoma. **Materials and Methods:** Patient underwent total thyroidectomy during the period June 2023-June 2024 at a tertiary care centre in Kerala were included in the study. **Results:** In our study of 38 total thyroidectomy patients (6 males and 32 females), the average operative time was 54.3 minutes. Post-operative complications included hypocalcaemia in 5 patients (13.3%) and nerve damage in 6 patients (15.8%). One patient required surgical re-exploration for surgical site haematoma. **Conclusion:** Bipolar diathermy devices can be considered as an alternate method in thyroid surgeries to achieve haemostasis. The use of this thermal device is found to reduce operative time significantly and associated with less complications rates.

## INTRODUCTION

Total thyroidectomy is a widely performed surgical procedure indicated for various pathologies associated with the thyroid gland, including multinodular goiter, malignancies of the thyroid gland, and some severe cases of parathyroid gland pathologies. Adequate exposure of the surgical field aided by meticulous dissection and proper hemostasis is a crucial factor in reducing post-operative complications in any neck surgery. Though advancements in clinical operative techniques have shown improvement in patient outcomes, post-procedure complications such as hypocalcemia, recurrent and superior laryngeal nerve injury, and hematoma formation still remain as frequent concerns. Prolonged hospital stays as a result of troublesome complications can have a negative impact on the patient's quality of life.<sup>[1-5]</sup> Bipolar cautery has emerged as one of the preferred methods in achieving hemostasis due to its precision and ability to minimize collateral tissue damage. The heat dissipation with bipolar cautery is considered to be less than that of monopolar devices, as the former works on a closed circuit

system without the patient's body as a part of the conducting circuit system. By providing controlled delivery of electrical energy, bipolar electrocautery is believed to reduce the risk of thermal injury to surrounding structures, especially parathyroid glands and branches of the vagus nerve. The use of bipolar diathermy in major pedicle ligation in thyroid surgery is not well evaluated. The other popular tools head and neck surgeons make use of in achieving hemostasis are ligature clips, harmonic scalpel, and vessel sealer.<sup>[6-10]</sup>

This study aims to assess the impact of intraoperative bipolar cautery usage on the incidence of post-operative complications following total thyroidectomy, by analyzing outcomes such as hypocalcemia, nerve injury, and post-operative hematoma or bleeding.

## MATERIALS AND METHODS

This prospective observational study was conducted on patients who underwent total thyroidectomy at a tertiary care medical college in Kerala during the period from June 2023 to June 2024. Patients who underwent near-total thyroidectomy and revision or

completion thyroidectomy after hemithyroidectomy were excluded from the study population. Patients with known bleeding disorders, patients on anticoagulants, undergoing neck dissection or underwent neck dissection previously, and known cases of parathyroid disorders were also excluded from the study.

**Surgical Technique:** Under general anesthesia with an endotracheal tube or Tracheostomy tube, the patient in an extended neck position, a transverse incision is made. The superior subplatysmal flap is raised till the level of the thyroid notch and the inferior subplatysmal flap is elevated till the level of the sternal notch. The subplatysmal flap is raised using careful dissection using bipolar cautery without causing any skin defects. Once the flaps are raised, they are positioned away from the surgical field using Joule's retractor. The midline raphe is identified, and strap muscles are divided in the midline and retracted laterally to expose the thyroid gland with its capsule. The thyroid gland is made free of its attachments, and pedicle ligation is carried out. In case the middle thyroid vein is present, the ligation of this vessel is performed first. In all other cases, the inferior pedicle is identified and the pedicle is cauterized close to the gland using bipolar cautery forceps. Next, the superior pedicle is dissected and cauterized. During the use of cautery, gentle saline irrigation is done over the surrounding tissues to reduce thermal injury. The thyroid gland is removed using the same cautery forceps. A suction drain is placed and fixed using sutures. Strap muscles are sutured back using 3-0 absorbable sutures, and wound closure is done in a two-layered fashion.

**Post-operative care:** 6 hours post-surgery- Wound examination to look for active ooze or hematoma formation.

**12 hours post-surgery-** Wound examination to look for signs of ooze or hematoma formation. On post-operative day (POD) 1- Estimation of Hemoglobin and packed cell volume and also look for signs of hypocalcaemia. Patients are started on thyroxine supplementation according to body weight. (Thyroxine sodium -1.2mcg/kg/day). In cases of pre-operative fine needle aspiration cytology report with suspicion of malignancy; the patient was advised to withhold thyroxine supplementation until the histopathology report is available. Videolaryngoscopic examination was also performed to know the status of vocal cord movements.

**POD 2-** Estimation of corrected serum calcium levels and detailed clinical examination to rule out hypocalcaemia. In cases where serum calcium is found to be low, appropriate dosage of calcium supplementation was advised.

**POD 3 OR 4-** Suction drain is removed and patient is discharged from hospital. If the histopathological examination is showing features of malignancy, patient is transferred to oncology unit for further evaluation. A repeat Videolaryngoscopic

examination was also performed before sending the patient back to home.

**POD 7-** Suture or stapler's removal and wound re assessed

**POD 30-** Estimation of TSH, T3 AND T4 values and thyroxine supplementation titrated accordingly.

**Data collection:** Details such as patient age, gender, pre-operative diagnosis, operative time (from the time of incision to wound closure), post-operative drain volume on day 1, day 2 and day 3, incidence of hypocalcaemia, vocal cord paresis or palsy, hematoma formation were entered into Microsoft excel sheet and data analysis were performed using SPSS software version 27.

## RESULTS



**Figure 1: Showing identification of thyroid vascular pedicle**



**Figure 2: Showing use of bipolar cautery in achieving haemostasis of vascular pedicle**

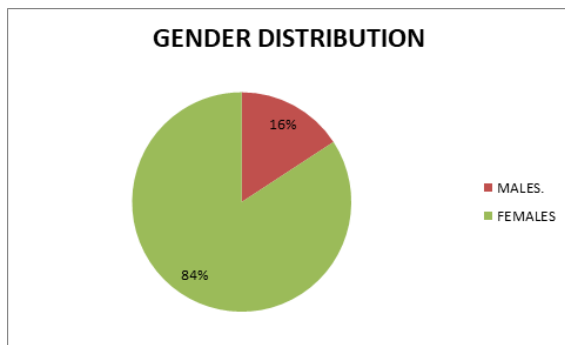


Figure 3: Showing gender distribution of study population

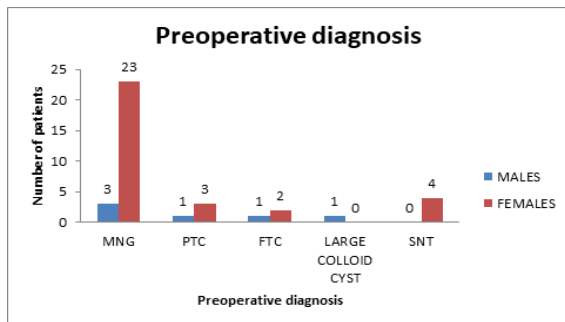


Figure 4: Graph showing distribution of preoperative disease condition. [MNG-Multinodular goitre, PTC-Papillary thyroid carcinoma, FTC-Follicular thyroid carcinoma, SNT-Solitary nodule thyroid].

38 patients who underwent total thyroidectomy fulfilling the inclusion criteria were included in the

study. Out of 38 patients, 6 were males and 32 were females. Multinodular goiter (MNG) followed by papillary thyroid carcinoma (PTC) with preoperative node negative cases were the common diagnosis in the study group [Table 1, Figure 3 and 4]. The average operative time was 54.3 minutes. The suction drain volumes on day 1, 2 and 3 showed average values of 26.3ml, 15ml and 5.8ml respectively. Two patients had asymptomatic hypocalcaemia and 3 patients developed symptomatic hypocalcaemia. The symptoms of hypocalcaemia noted were tingling and numbness of hands in one patient, carpedal spasm and perioral numbness in 2 cases. In all three cases calcium supplementation administered intravenously and symptomatic improvement was noted. In these patients serum calcium estimation was done on POD 7 and POD 30. Oral calcium supplementation was advised accordingly. Six patients found to have nerve damage. The nerve injury presented as voice change and on endoscopic evaluation the vocal cords on the affected side showed reduced movement suggestive of neuropraxia or axonotmesis. Surgical site haematoma was seen in one patient, for which wound re-exploration was done. Evacuation of hematoma was performed and no active bleeders were noted. Wound was reclosed and patient was put on observation for additional two days. Details of the post-operative complications are given in [Tables 2 and 3].

Table 1: Demographic details of the study population.

Variable	Categories	Males (%)	Females (%)	N (%)
Age (In Years)	< 30 YEARS	1 (16.67)	4 (12.50)	5 (13.16)
	31-40	1 (16.67)	7 (21.88)	8 (21.05)
	41-50	2 (33.33)	8 (25.00)	10 (26.32)
	51-60	2 (33.33)	8 (25.00)	10 (26.32)
	>60	0	5 (15.62)	5 (13.15)
Total		6	32	38

Table 2: Showing post-operative complications

Post operative complication	Males	Females	Total
Haematoma	1	0	1
Hypocalcemia	3	2	5
Vocal cord paresis	1	5	6

Table 3: Post-operative complication associated with disease condition

Disease condition	Complication			Total
	Hematoma	Hypocalcaemia	Vocal cord injury	
MNG	1	1	0	2
PTC	0	2	2	4
FTC	0	1	2	3
COLLOID CYST	0	1	1	2
SNT	0	0	1	1
Total	1	5	6	12

[MNG-Multinodular goitre, PTC-Papillary thyroid carcinoma, FTC-Follicular thyroid carcinoma, SNT-Solitary nodule thyroid].

## DISCUSSION

Total thyroidectomy is a complex procedure that carries inherent risks of post-operative complications such as hypocalcemia, recurrent

laryngeal nerve injury (RLN Injury), hematoma, and wound infections. The thyroid gland, an endocrine organ with a rich blood supply, is a surgical area where surgeons often struggle to achieve intraoperative hemostasis.<sup>[11-13]</sup>

A bloodless surgical field significantly reduces the operative duration, which, in turn, reduces the time the patient is under the effects of anesthetic agents. This shorter surgery duration plays a significant role in post-operative morbidity. Proper control of intraoperative hemorrhage helps the surgeon identify vital structures in relation to the gland, thus reducing the incidence of damage to these structures.<sup>[14-16]</sup>

The foundations of classical thyroidectomy laid by Kocher and Halsted have significantly changed over the last two decades with the introduction of modern techniques for achieving hemostasis. The various vascular sealing equipment currently available can be categorized into three groups: using ultrasonic waves as an energy source, using electro thermal systems, and hybrid or combination devices. These systems have almost entirely replaced traditional blood vessel ligation and paved the way for minimally invasive thyroid surgeries.<sup>[17]</sup>

Harmonic Focus and Harmonic Scalpel are two examples of ultrasonic systems that operate at a low temperature range within 1500°C. Bipolar electrocautery is a widely available tool where electrical energy passes between two closely spaced electrodes, similar to surgical forceps. The advantage of this tool is that the energy flow is confined between the electrodes, resulting in higher energy distribution to the target tissue and less energy dissipation to surrounding normal tissues. Both devices can effectively coagulate vessels of up to 5 millimeters in diameter.

The most common causes for RLN neuropraxia following thyroid surgery are prolonged traction while applying retractors and thermal damage. With a clean surgical field and shorter procedure duration, nerve conduction damages can be reduced. Thermal injury to the RLN can be minimized by using heat-producing devices for a short time continuously near the course of the nerve and saline irrigation over the nerve while using such devices.

Our study results indicate that the use of bipolar devices is associated with fewer post-operative complications. These findings align with various literature works available in research databases. In a comparative study by Hegab et al., the incidence of hypocalcemia in the bipolar device group was 3.3%, compared to 13.3% in the standard knot-tying group. Wound seroma and RLN injury frequencies were also similar to our study. However, the operative time was significantly longer (103.9 minutes) for total thyroidectomy compared to 54.3 minutes in our study.

Balghari et al. conducted a study evaluating the relation between bipolar devices and RLN injury. Among the 52 patients they evaluated, none developed postoperative RLN-related injury. Several other studies have shown that the use of bipolar devices is associated with shorter surgical durations, fewer post-operative complications, and early hospital discharge.<sup>[11]</sup>

## CONCLUSION

Energy devices have been beneficial in surgical procedures, allowing surgeons to perform procedures more precisely. Bipolar devices can be considered an alternative method to the standard ligature technique and other costly energy devices for achieving hemostasis in thyroid surgeries, including sealing thyroid pedicle vessels. Further studies with larger sample sizes are necessary to establish the superiority of bipolar devices in comparison to other hemostasis methods.

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