

# Evaluation of Endoscopic Trans-oral Approach in Thyroidectomy

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## Abstract

**Background:** Although young women are more likely to suffer from thyroid dysfunction, the number of cases among men is on the rise as well. Endoscopic thyroidectomy procedures have evolved over the years to circumvent the scarring that is commonly associated with traditional thyroidectomy.

**Aim and objectives:** To assess the effectiveness of endoscopic thyroidectomy (ET) in treating benign thyroid tumors by sorting patients' surgical outcomes by feasibility and safety as measured by the vestibular method.

**Patients and methods:** This prospective randomized study was conducted on 10-patients with benign thyroid tumours recruited from Surgical Oncology Clinic and Department at Said Galal University Hospital, Al-Azhar University from May 2023 to September 2024 prior to surgery, following approval by the relevant ethical and review boards, and with the patient's signed informed permission.

**Results:** Regarding the complications, 1(10%) patient converted to an open surgical procedure, 4(40%) patients experienced skin bruising, 3(30%) patients developed edema, and 1(10%) patient experienced surgical emphysema. No patients experienced recurrent laryngeal nerve injury, surgical site infection, hypocalcemia, mental nerve injury, CO2 embolism, bleeding, skin burn, or skin perforations.

**Conclusion:** The study indicates a predominantly female population with a mean age of 38.9 years presenting with thyroid-related symptoms. Most patients exhibited benign thyroid function test results and minimal complications following surgery. The operative time and hospital stay were within reasonable limits, suggesting a safe surgical approach. High rates of cosmetic satisfaction, with 80% of patients reporting good outcomes.

**Keywords:** Endoscopy; Trans-oral Approach; Thyroidectomy

## 1. Introduction

Although young women are more likely to suffer from thyroid dysfunction, the number of cases among men is on the rise as well. Endoscopic thyroidectomy procedures have evolved over the years to circumvent the scarring that is commonly associated with traditional thyroidectomy.<sup>1</sup>

The most recent advancement in this field, the endoscopic trans-oral vestibular technique, guarantees a scar-free result after surgery.<sup>2</sup>

The gold standard for surgical treatment of thyroid tumors for the last several decades has been conventional thyroidectomy (ConT), which involves making a small incision in the front of

the neck at a skin crease.<sup>3</sup>

An unattractive scar is left behind by the cervical collar incision that is necessary for ConT. The esthetic impact of the scar is a common concern for the many young women who undergo surgery to remove thyroid tumors.<sup>4</sup>

Reducing surgical discomfort, improving cosmesis, limiting external scarring, and maximizing postoperative recovery are all aims of endoscopic thyroidectomy (ET), which aims to do all of this without sacrificing treatment efficacy.<sup>5</sup>

Until recently, open or conventional surgery was the method of choice for thyroidectomy. The use of minimally invasive surgical techniques in thyroid procedures has recently gained more attention.<sup>6</sup>

Applying the principles of natural orifice transluminal endoscopic surgery (NOTES) to the neck, the transoral endoscopic approach offers a scar-free treatment that improves aesthetics without sacrificing the benefits of minimally invasive surgery.<sup>7</sup>

This study's overarching goal is to assess the efficiency and safety of endoscopic thyroidectomy (ET) in treating benign thyroid tumors by analyzing the surgical outcomes of individuals who received the procedure via the vestibular route.

## 2. Patients and methods

This prospective randomized study was conducted on 10-patients with benign thyroid tumours recruited from Surgical Oncology Clinic and Department at Said Galal University Hospital, Al-Azhar University from May 2023 to September 2024 prior to surgery, following approval by the relevant ethical and review boards, and with the patient's signed informed permission.

### Inclusion Criteria:

Participants in the study had to be at least eighteen years old, have a thyroid goiter or nodules less than five centimeters in diameter, a thyroid gland volume less than twenty-five milliliters, be free of any suspicion of malignancy, have never had thyroiditis or hyperthyroidism, have never had neck surgery, and have never had neck radiation.

### Exclusion Criteria:

Younger than 18 years old, suspicious of cancer, having had prior neck surgery, managed toxic goiter patients, hypoparathyroidism patients in the past, and individuals with calcium metabolism abnormalities (such as sarcoidosis or chronic renal illness).

### Methods:

#### Pre-operative assessment:

The pre-operative assessment was represented by:

Personal history, including age, profession, and any unique behaviors that may be harmful to one's health, like smoking. Examining the complaint, its duration, its onset, and its impact on other bodily systems are all included in the history of the current illness. History of drug allergies, medical conditions, past surgeries, blood transfusions, radiation exposures, and family history of thyroid cancer and other cancers

A thorough general examination is required, with particular attention to the following: vital signs, complexion (pallor, jaundice), cardiovascular and respiratory fitness, gland size, afflicted lobe or entire gland, presence or absence of cervical lymphadenopathy, and retrosternal

extension.

#### Routine pre-operative blood tests:

Complete blood count (CBC), serum electrolytes, coagulation profile, liver and kidney function tests, random blood sugar, and thyroid function tests (T.S.H., free T3 & free T4).

#### Surgical Technique

With naso-tracheal intubation, TOETVA is carried out while heavily sedated. Positioned in a 15° Trendelenburg bed position, the patients are supine with a minor neck extension produced by a pillow beneath their shoulders. In a laparoscopic surgery, the bed is lowered to the first operator's height.

Surgeon in the operating room with first assistant on left, nurse on right, HD monitor at patient's foot, and surgeon standing close to patient's head. The lower end, at the level of the sternal notch, the higher end, at the level of the upper lip, and the lateral aspects of the neck were prepped and draped to reveal the neck and downturned face. Use 0.05% Hibitane in water for five minutes to disinfect the oral cavity.

Prior to hydro dissection, the oral vestibular area of the lower lip, down to the anterior neck and central working space, is sub-played with a 30-mL solution of 1 mg adrenaline diluted with 500mL normal saline. This hydro dissection facilitates lifting the subplatysmal plane off the strap muscles.

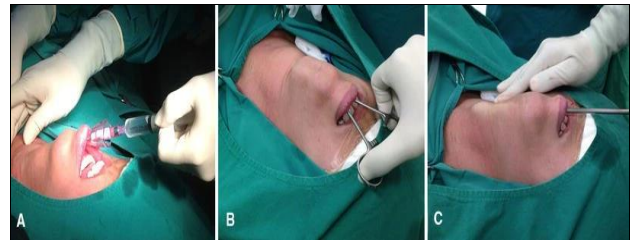


Figure 1. (A)Preparing the work area for hydro dissection with a Veress needle; (B)creating a flap with a rod-shaped dissector; and (C)using a Kelly clamp to pass over the chin.

The operation begins with a 10-mm incision made with a scalpel in the center of the oral vestibule, slightly above the inferior labial frenulum. Monopolar electrocautery is then utilized to dissect from this central incision, passing through the mentalis muscle and ending at the tip of the chin. Through this incision, a medium-sized Kelly clamp is inserted to the level of the thyroid cartilage and then spread gently to create a working area.

Hydrodissection and Kelly clamp dilation are used to get closer to the proper platysma-strap muscle plane. Next, a 10-mm trocar is introduced after a blunt-tip tissue dissector is advanced in a fan-shaped pattern in the subplatysmal plane above the strap muscles to increase the working

space. Following this, the CO<sub>2</sub> insufflation is kept at 6-mmHg while a flow rate of 15L/min is administered through the 10mm central trocar. The lateral ports are inserted by making incisions with a scalpel on the lower lip and lateral to the canine teeth. This is done to prevent damage to the mental nerve. The next step is to enter the operating room through the lateral incisions using two 5-mm trocars. Parallel to the 10-mm trocar, the lateral trocars are kept in place.



Figure 2. Cuts and slits in the oral vestibule.

A working space is completed after port insertion using an L-hook with a monopolar coagulator and an ultrasound instrument. The subplatysmal working space is characterized by the following boundaries: 1. The sternal notch serves as the inferior border. 2. The sternocleidomastoid muscles form the lateral border. 3. The thyroid cartilage serves as the superior border. The central port is used to pass a 30-degree, 10-mm laparoscope. The lateral trocars on the right and left are alternated with an L-hook cautery, an ultrasonic device, and suction irrigation. In order to access the isthmus, thyroid, and trachea, the strap muscles' median raphe is opened. After removing the relevant thyroid lobe, the strap and sternothyroid muscles are separated. To elevate the strap muscles laterally, a 2/0 silk is introduced transcutaneously into the working space, wrapped around them with laparoscopic equipment, and then pulled out through the skin. This silk is employed as an external hanging suture. In order to enhance the visibility of the superior pole, it is occasionally necessary to separate the sternothyroid muscle at its insertion on the cricoid.

Using an ultrasonic device, the thyroid lobes are dissected, starting from the pyramidal lobe and moving inferiorly to divide the isthmus near the contralateral thyroid lobe. Afterward, the superior thyroid arteries are exposed by opening and elevating Joll's space, an avascular plane that lies between the superior pole and thyroid cartilage. Occasionally, this area can be used to locate the cricothyroid muscle, where the external branch of the superior thyroid nerve (EBSLN) inserts. Next, the ultrasonic instrument is used to sever the superior thyroid veins near the thyroid,

preserving the EBSLN and the upper parathyroid gland.

A grasper is used to retract the thyroid lobe to the opposite side after the superior pole dissection. To better view the tracheoesophageal groove, use this medial-rotation technique. Locate the insertion of the recurrent laryngeal nerve (RLN), then cut it in half perpendicular to the inferior thyroid artery and downhill, close to the lower parathyroid gland. This will bring you to a point where the RLN meets the trachea. Next, the thyroid gland is sliced near the thyroid capsule so the RLN and lower parathyroid gland can be preserved. Next, the remaining Berry ligament is cut in half. Careful execution of the procedure is ensured by maintaining a safe distance between the RLN and the active blade of the ultrasonic device.

Removing the camera before inserting an endo bag with a purse string suture and long tail into a 10-mm trocar follows the completion of the lobectomy. In order to transfer the free thyroid lobe into the endo bag, the surgeon advances the bag into the operating room, unrolls it, and positions it such that the suture may be pulled to shut the purse string. After that, the lateral laparoscopic equipment, along with the camera and 10-mm trocar, are taken out. The bag is subsequently brought into the vestibule after being retracted through the central incision. A "push and pull technique" could be used to withdraw the specimen en bloc through this incision for tumors less than 4 cm in diameter. The patient's thyroid lobe is carefully held inside a bag before the sponge forceps are placed into the 10mm incision. Afterward, the surgeon will use their right hand to extract the thyroid sample using the sponge forceps, and their left hand will be used to push the sample from the outside. By using this technique, the thyroid lobe could be removed in one piece. Carefully separating smaller specimens from larger tumors required cutting the thyroid capsule 2-3 times using endo-scissors in the endobag under endoscopic view. It was important not to damage the nodule during this process. To keep the work area free of seeds, cut and remove all materials using the end bag. In cases where a complete thyroidectomy is required, the operation is carried out again on the other side.

Following the thyroidectomy, the surgical site is carefully rinsed with saline to ensure proper bleeding control. There is no requirement for a surgical drain during a lobectomy. To introduce a No. 10 Redivac surgical drain during a complete thyroidectomy, an additional 5-mm incision is made above the collarbone and a 5-mm trocar is inserted. The next step is to re-approximate the strap muscles with 3/0 absorbable sutures. Absorbable sutures (4/0) are used to close the incisions in the oral cavity.



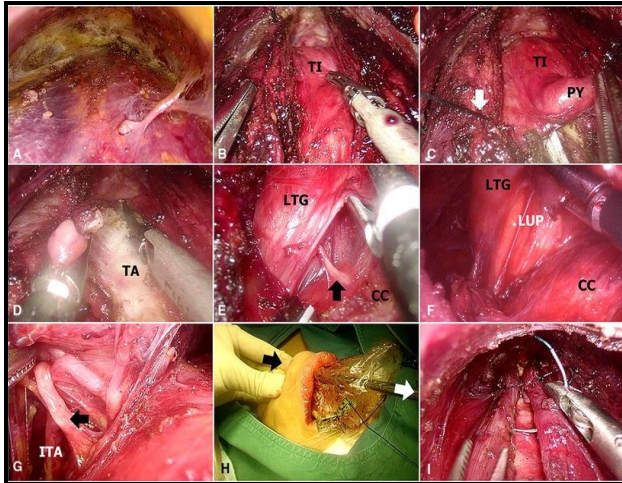


Figure 3. surgical technique: (A) delineating the working space; (B) dissecting the midline to reveal the thyroid and trachea; (C) suturing the outside (white arrow); (D) isthmectomy; (E) upper parathyroid gland; (F) Jolly's space and superior poll dissection, an external branch of the superior laryngeal nerve (black arrow); (G) rotates medially to reveal the RLN (black arrow); (H) extraction of specimens utilizing an endo bag and the "push and pull technique," with the specimen extraction directed by an arrow; closure of (I) strap muscles; ITA inferior thyroid artery, TI thyroid isthmus, PY pyramidal lobe, TA trachea, LTG left thyroid gland, CC cricoid cartilage, and LUP left-upper parathyroid gland



Figure 4. Cuts in the oral vestibule following suturing.

#### Postoperative care:

For a full day, a gauze pressure dressing is wrapped around the chin. Following surgery, drinking water is permitted right away. On day zero of surgery, patients are given a liquid diet, and one day after surgery, they are given a soft diet. One week following surgery, patients are permitted to brush their teeth and rinse their mouths with mouthwash. After surgery, oral antibiotics are administered for seven days after the 48-hour intravenous course of treatment. After surgery, tinidazole gargles are administered for seven days. On the second postoperative day, a surgical drain is removed if one is judged essential.

#### Statistical analysis

IBM Inc., Armonk, NY, USA, used SPSS v26 for statistical analysis. To assess if the data distribution was normally distributed, the

Shapiro-Wilks test and histograms were employed. In quantitative data, the standard deviation (SD) and mean were displayed. Frequency and percentage(%) were the formats used to report qualitative data.

### 3. Results

Table 1. Patient demographics for the research.

N=10		
AGE (YEARS)	Mean $\pm$ SD	38.9 $\pm$ 11.92
	Range	22-53
SEX	Male	0(0%)
	Female	10(100%)

The age of the studied patients ranged between 22-53 years with a mean $\pm$ SD of 38.9 $\pm$ 11.92 years. All 10(100%) patients were females, (Table 1).

Table 2. Complaint of the studied patients.

N=10	
NECK LUMPS	6(60%)
COMPRESSION SYMPTOMS	4(40%)

Six(60%) patients complained about neck lumps and 4(40%) patients complained about compression symptoms (Table 2, Figure 5).

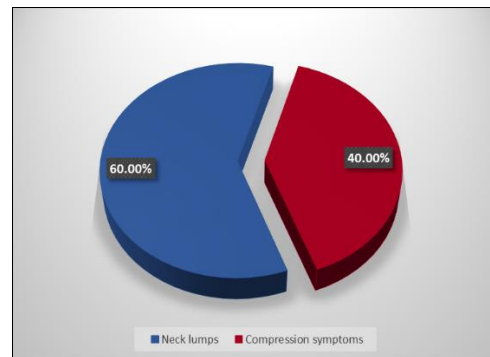


Figure 5. Complaint of the studied patients.

Table 3. Laboratory data of the studied patients.

N=10		
FREE T3(NG/L)	Mean $\pm$ SD	3.25 $\pm$ 0.63
	Range	2.4-4
FREE T4(NG/L)	Mean $\pm$ SD	1.21 $\pm$ 0.23
	Range	0.9-1.7
TSH(MU/L)	Mean $\pm$ SD	2.01 $\pm$ 1.11
	Range	0.5-3.4
CA(MG/DL)	Mean $\pm$ SD	8.39 $\pm$ 0.59
	Range	7.8-9.4

TSH: thyroid-stimulating hormone.

Free T3 ranged between 2.4-4ng/L with a mean $\pm$ SD of 3.25 $\pm$ 0.63ng/L. Free T4 ranged between 0.9-1.7ng/L with a mean $\pm$ SD of 1.21 $\pm$ 0.23ng/L. TSH ranged between 0.5-3.4mU/L with a mean $\pm$ SD of 2.01 $\pm$ 1.11mU/L. Ca ranged between 7.8-9.4mg/dL with a mean $\pm$ SD of 8.39 $\pm$ 0.59 mg/dL (Table 3).

Table 4. Operative time of the studied patients.

N=10		
OPERATIVE TIME(H)	Mean $\pm$ SD	3.15 $\pm$ 0.82
	Range	2-4.5

The operative time ranged between 2-4.5 h with a mean $\pm$ SD of 3.15 $\pm$ 0.82h, (Table 4).

Table 5. Complications of the studied patients.

	N=10
CONVERSION TO AN OPEN SURGICAL PROCEDURE	1(10%)
SKIN BRUISING	4(40%)
EDEMA	3(30%)
SURGICAL EMPHYSEMA	1(10%)

Regarding the complications, 1(10%) patient converted to an open surgical procedure, 4(40%) patients experienced skin bruising, 3(30%) patients developed edema, and 1(10%) patient experienced surgical emphysema(

Table 5, Figure).

No patients experienced recurrent laryngeal nerve injury, surgical site infection, hypocalcemia, mental nerve injury, CO2 embolism, bleeding, skin burn, or skin perforations.

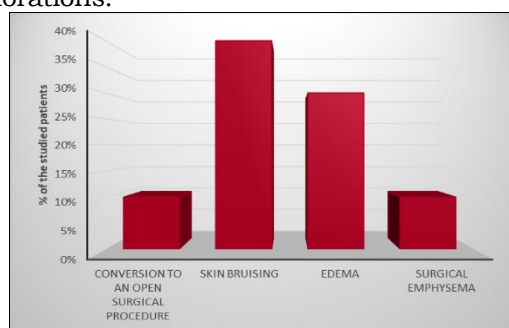


Figure 6. Complications of the studied patients.

Table 6. Length of hospital stay of the studied patients.

	N=10
LENGTH OF HOSPITAL STAY (DAYS)	Mean $\pm$ SD 3.3 $\pm$ 0.82
	Range 2 - 4

The length of hospital stay ranged between 2-4 days with a mean $\pm$ SD of 3.3 $\pm$ 0.82 days(Table 6).

#### 4. Discussion

Surgery to surgically remove all or a portion of the thyroid gland from the neck has become well-known during the past few centuries. Thanks to the courageous efforts of surgeons like Emil Theodor Kocher, what Samuel D. Gross deemed "horrid butchery" in the 19th century is now one of the most popular and secure surgical procedures. Open surgery, often known as conventional surgery, has been the accepted method for thyroidectomy. Lately, there has been a spike in interest in utilizing minimally invasive surgery concepts for thyroid surgery.<sup>8</sup>

In the present study, it was found that about 6(60%) patients complained about neck lumps, and 4(40%) patients complained about compression symptoms.

Anuwong et al.,<sup>9</sup> found that 118 patients (or 27.9% of the total) had multinodular goiter, 245 patients (or 58.1% of the total) had a single thyroid nodule or cyst and had a hemithyroidectomy performed. A complete thyroidectomy was performed on 33 individuals

(7.8%) who were diagnosed with Graves' illness. Out of the sixty-six patients who underwent complete thyroidectomy with central lymph node dissection, twenty-six (6.2%) had papillary microcarcinoma.

The average  $\pm$  standard deviation of the operating time in this study was 3.15 $\pm$ 0.82 hours, and it varied between 2 and 4.5 hours. Patients stayed in the hospital for an average of 3.3 $\pm$ 0.82 days, with the duration varying from 2 to 4 days.

Nakajo et al.,<sup>10</sup> showed that the time it took to do a partial thyroidectomy with central node dissection varied from 310 to 414 minutes (average 361) and that the time it took to perform a simple hemithyroidectomy varied from 158 to 238 minutes (average 208 minutes). On the fourth or fifth day following the operation, they were allowed to leave the hospital. After the procedure, the lower lip swelled for a few days, but it eventually healed on its own.

Regarding the complications, it was found that 1(10%) patients converted to an open surgical procedure, 4(40%) patients experienced skin bruising, 3(30%) patients developed edema, and 1(10%) patient experienced surgical emphysema. No patients experienced recurrent laryngeal nerve injury, surgical site infection, hypocalcemia, mental nerve injury, CO2 embolism, bleeding, skin burn, or skin perforations.

Nakajo et al.,<sup>10</sup> found that one patient had recurrent laryngeal nerve palsy. The three-day course of preventative antibacterial medicines did not result in any infections, and no one experienced mental nerve palsy.

Several technical considerations are required for the LC analysis of these techniques. To start, compared to traditional open thyroidectomy, the midline approach is less complicated because it uses a similar operating view.<sup>11</sup>

On the other hand, when it comes to total thyroidectomy, the surgeon may need more time and procedures to become familiar with the anatomy and technique when using lateral approaches like retro auricular or transaxillary. This is particularly true during contralateral side dissection.<sup>12</sup>

Since the degree of difficulty in performing hemi- and complete thyroidectomies using minimally invasive techniques with a lateral approach varies greatly, it is reasonable to differentiate between the two procedures.

The learning curve for endoscopic and robotic thyroidectomy is longer, and there are more unusual complications compared to traditional thyroidectomy. These include, but are not limited to, numbness of the chest wall, perforation of the neck, chyle leakage, Horner's syndrome, burns and traumas to the skin flap, numbness of the lower lip as a result of mental nerve injury,

dissection of the chin area in the transoral approach, and CO2 embolism. The traditional method of evaluation is superseded by aesthetic outcomes as a new quality metric.<sup>13</sup>

The thyroidectomy LC in many trials is dependent on the expertise of a single surgeon. It is possible that surgeons with varied educational backgrounds learn in various ways. It is clear that among minimally invasive procedures, experience and expertise with the procedure in question are other essential characteristics that overlap with this. Surgeons typically pursue endoscopic or robotic thyroidectomy after they have mastered the technical and anatomical aspects of other operations.

On the flip side, many young trainees begin learning how to perform open thyroidectomy throughout their training, which is the initial stage in surgical education. Recently graduated surgeons or residents were only included in a small number of trials that evaluated the LC. They were seasoned surgeons in the majority of instances. Due to the absence of tactile feedback and three-dimensional vision, endoscopic surgery necessitates the development of new anatomical viewpoints and hand-eye coordination. Endoscopic thyroidectomy could take more time since surgeons are learning a whole new set of skills when they move from an open to a minimally invasive technique. By the time a surgeon starts using robotics for surgery, they have usually gone through all of these stages and are reaping the benefits of the system, such as a 3D vision for precise anatomical dissection, seven degrees of freedom for wristed instrumentation, no tremors, and a comfortable seated position.<sup>14</sup>

#### 4. Conclusion

The study indicates a predominantly female population with a mean age of 38.9 years presenting with thyroid-related symptoms. Most patients exhibited benign thyroid function test results and minimal complications following surgery. The operative time and hospital stay were within reasonable limits, suggesting a safe surgical approach. High rates of cosmetic satisfaction, with 80% of patients reporting good outcomes.

#### Disclosure

The authors have no financial interest to declare in relation to the content of this article.

#### Authorship

All authors have a substantial contribution to the article

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#### Conflicts of interest

There are no conflicts of interest.

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