

## Comparative Analysis of Conventional and Novel Approaches to Thyroidectomy

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**Abstract:** Background: Endoscopic thyroidectomy became the most common method which prevalent in the treatment of patients with thyroid. Objective: This study aimed to conduct a comparative study between endoscopic thyroidectomy and the traditional method. Patients and methods: We conducted a comparative study of injured patients who underwent thyroid surgery, which included 50 patients whose ages ranged between 30 - 60 years, which was performed in different hospitals in Iraq for a period that lasted from January 5, 2022, to August 13, 2023. The data of the study patients was divided into two groups, where the first group represents patients who underwent endoscopic thyroidectomy, which included 25 patients, and the second group includes patients who underwent thyroidectomy using the traditional open surgery, which included 25 patients. Results: According to endoscopic thyroidectomy, surgical outcomes of our study found Operative time was  $107.73 \pm 22.15$  min, blood loss was  $18.68 \pm 8.76$  ml, blood transfusion included 2 cases, hospital stay time was  $8.85 \pm 1.36$  days, admission to the intensive care unit was 1 case, mortality rate was 0 cases, amount of postoperative drainage was  $100.54 \pm 25.67$ , complications were 3 cases. According to the findings of the questionnaire on general quality of life, more success where Physical health was  $92.13 \pm 0.02$ , Psychological functioning was  $89.92 \pm 4.33$ , energy/fatigue was  $94.44 \pm 3.21$ , and general health was  $90.10 \pm 2.81$ . In contrast, surgical outcomes of traditional open surgery found Operative time was  $45.52 \pm 9.80$  min, blood loss was  $21.45 \pm 10.58$  ml, blood transfusion included 6 cases, hospital stay time was  $7.57 \pm 1.02$  days, admission to the intensive care unit was 4 cases, mortality rate was 2 cases, and complications were 10 cases. According to questionnaire findings of general quality of life, the most successful were physical health ( $75.41 \pm 5.82$ ), psychological functioning ( $77.41 \pm 6.23$ ), energy/fatigue ( $79.24 \pm 4.13$ ), and general health ( $85.34 \pm 4.14$ ). Conclusion: This study showed that laparoscopic thyroidectomy is the optimal, safest and most effective surgical procedure in achieving clinical results and long-term improvements compared to traditional open surgery.

**Keywords:** Thyroid gland; Endoscopic thyroidectomy; Traditional open surgery; Histology; Postoperative complication, and Thyroid nodule.

## INTRODUCTION

The thyroid gland was an endocrine organ whose main function is the manufacture of thyroid hormones that manage the human body's metabolism. The thyroid required iodine, that can only be supplied through dietary sources (Gagner, M. 1996). The thyroid gland is positioned in the lower and anterior region of the neck, just in front of the cervical trachea, immediately in the thyroid and cricoid cartilages, which comprise the larynx (Lang, B. H. H. 2010). The gland has an isthmus of the right and left lobes that are not symmetrical (Lang, B. H. H., & Lo, C. Y. 2010).

Small oval glands on the back are closely related with the thyroid gland and are crucial for regulating calcium and phosphorus metabolism in the body via the hormone parathyroid hormone, also known as PTH (Hüscher, C.S. *et al.*, 1997; Sgourakis, G. *et al.*, 2008). The internal makeup of the thyroid gland was unique and changes depending upon its function. The thyroid's functional components are follicles, which are spherical structures made up of a single layer of cubic epithelial cells surrounded from a basement membrane (Ikeda, Y. *et al.*, 2000).

Epithelial cells are responsible for producing and secreting the iodine-containing thyroid hormones thyroxine (T4) as well as triiodothyronine (T3) (Ohgami, M. *et al.*, 2000). These hormones regulate the pace of basal metabolism and have a considerable impact on development and maturation, particularly in neural tissues. The follicles also contain a glycoprotein complex known as thyroglobulin (thyroid colloid), which stores hormones prior to release (Bae, J. S. *et al.*, 2008; Jeong, J. J. *et al.*, 2009). The condition known as hypothyroidism occurs when the thyroid gland is unable to generate sufficient thyroid hormone. Hyperthyroidism, on the other hand, results from an overabundance (Yoon, J. H. *et al.*, 2006).

The second kind of secretory cells seen in the thyroid is composed of isolated cells that are dispersed amongst the follicular cells inside of the follicle basement membrane. These cells, known as parafollicular cells or C cells, produce calcitonin, a hormone that controls blood calcium levels, in addition to PTH (Chantawibul, S. *et al.*, 2003; Ikeda, Y. *et al.*, 2004). Each cell creates a

distinct sort of cancer, and the severity and therapy of the disease vary depending on which cell it originates in (Charles, T. *et al.*, 2008).

Given the thyroid gland's closeness to the larynx and vocal cords, as well as the potential relationship with speech therapy issues in thyroidectomized patients, it is useful for this study to provide a brief overview of the architecture as well as the functioning of these structures (Charles, T. *et al.*, 2008). The larynx is composed of cartilaginous components that articulate with one another. The thyroid, cricoids, arytenoids, and epiglottis are the four primary laryngeal cartilages (Lang, B. H. H., & Wong, K. P. 2013). The thyroid cartilage comprises the majority of the front and lateral walls in the larynx as well as partially envelops the other cartilage (Lee, J. *et al.*, 2010).

The larynx has a sphincter that controls the flow of air during breathing. Internally, the larynx has a duct coated with mucosa that houses the voice cords (Hyun, K. *et al.*, 2014). The larynx is lined by epithelial folds known as voice cords (Ikeda, Y. *et al.*, 2002). Each fold has a ligament, the vocal ligament, and a tiny muscle, the vocal muscle (Lee, M. C. *et al.*, 2016). The vocal folds must be in touch before to phonation, with the glottal cleft closed so that it does not interfere with exhaled air (Zhou, J. *et al.*, 2020).

As air is released, subglottic and infraglottic pressure gradually increases. When this pressure exceeds the closing tension within the vocal folds, these are forced to separate as well as the air rushes out, causing an abrupt drop in pressure in the glottal cleft. Several nerves are involved in laryngeal innervation, with the vagus nerve providing the two laryngeal nerves, the upper one being sensitive for the cricothyroid muscle with the lower or recurrent nerve for the remainder of the intrinsic laryngeal muscles (Sun, H. *et al.*, 2023).

## PATIENTS AND METHODS

We conducted a comparative study of patients with thyroid diseases, which included 50 patients whose ages ranged between 30 - 60 years for both males and females. Clinical and demographic data were collected for patients' parameters from different hospitals in Iraq for a period extending from January 5, 2022, to August 13, 2023, which included Data included age, gender, body mass index (BMI), which was categorized into

(underweight, normal weight, overweight, and obese), previous surgery, concomitant diseases, thyroid diseases, symptoms, duration of symptoms (years), smoking status, level of education, employment, and income level. Patients who were over 60 years of age and less than 30 years old and children and adolescents were excluded, while patients who had undergone previous surgeries and patients whose ages ranged between 30-60 years were included.

Regarding the data of the patients who were registered in the hospital, the data of the study patients was divided into two groups where the first group represents the patients who underwent endoscopic thyroidectomy, which included 25 patients, and the second group includes the patients who underwent thyroidectomy using the traditional method, which included 25 patients.

Moreover, this study recorded the diagnostic data of the patients, in which all patients underwent examinations and diagnoses using the techniques of ultrasound, CT scan, and MRI, where the diagnostic parameters included both sides of the tumor (one side or two sides) and the tumor focus (unifocal and multifocal). ) and tumor size (> 1.5 cm and < 1.5 cm) and thyroid gland (4 remained in place, two remained in place, and one remained in place).

Regarding surgical data, our results recorded patients' surgical data in terms of operation time, blood loss, blood transfusion, hospital stay time, ICU admission, mortality rate, drainage amount, and postoperative complication rate. Furthermore, our study evaluated postoperative questionnaire outcomes as the specific questionnaire consisted of ten items. The visual analogue scale (VAS) pain score at the surgical site ranged from 0 (no pain at all) to 10 (worst pain ever). Tingling, neck movement, and swallowing disturbance, as well as cosmetic satisfaction, were evaluated according to the patient's subjective judgment on a scale from 0 (worst, they always have this problem) to 10 (great, no problem). Also, we conducted a questionnaire to evaluate patients' quality of life with a range of 0 - 100, where 0 represents poor quality of life, and 100 represents optimal quality of life. The criteria for questionnaire scores consist of physical health, psychological aspects, energy/fatigue, emotional performance, social functioning, and general health.

## RESULTS

**Table 1:** Demographic and preoperative of patients' data.

Characteristics	Number of patients, [50]	Percentage [%]
Age		
30 – 39	12	24%
40 – 49	18	36%
50 – 60	20	40%
Sex		
Male	10	20%
Female	40	80%
BMI, Kg/m2		
Underweight	4	8%
Normal weight	6	12%
Overweight	18	36%
Obesity	22	44%
Prior surgeries		
Yes	15	30%
No	35	70%
Medications used		
Yes	20	40%
No	30	60%
Comorbidities		
Yes	38	76%
No	12	24%
Hypertension	30	60%
Diabetes	12	24%
Obesity	25	50%
Kidney diseases	14	28%
Heart failure	6	12%
Asthma	4	8%
Illnesses		
Graves' disease	5	10%
Nodular goiter	19	38%
Follicular adenomas	6	12%
Thyroid cancer	20	40%
Symptoms		
Difficulty swallowing	40	80%
Hoarseness or voice changes	12	24%
Difficulty breathing	16	32%
Pain in the neck	18	36%
Fatigue	7	14%
Weight changes	23	46%
Changes in mood	14	28%
Duration of symptoms (years)	2.5 ± 0.84	
Smoking status		
Yes	8	16%
No	42	84%
Marital status		
Single	4	8%
Married	38	76%
Divorced	8	16%
Employment status		

Employed	38	76%
Un - employed	12	24%
Income level, \$		
< 700	10	20%
700 – 900	35	70%
> 900	5	10%

**Table 2:** Diagnoses outcomes of patients.

Variables	Endoscopic thyroidectomy [25]	Traditional open surgery [25]	P -value
Imaging			0.352
Ultrasound	20 (80%)	23 (92%)	
CT scan	15 (60%)	14 (56%)	
MRI	8 (32%)	5 (20%)	
Tumor side			0.044
Unilateral	22 (88%)	21 (84%)	
Left	12 (48%)	14 (56%)	
Right	8 (32%)	7 (28%)	
Bilateral	3 (12%)	4 (16%)	
Tumor focality			0.032
Unifocal	16 (64%)	14 (56%)	
Multifocal	9 (36%)	11 (44%)	
Tumor size			0.047
> 1.5 cm	18 (72%)	16 (64%)	
< 1.5 cm	7 (28%)	9 (36%)	
Parathyroid glands			0.015
Four are left in place	14 (56%)	12 (48%)	
Two are left in place	8 (32%)	8 (32%)	
One left in place	3 (12%)	5 (20%)	

**Table 3:** Surgical outcomes.

Variables	Endoscopic thyroidectomy [25]	Traditional open surgery [25]	P - value
Operative time (min), mean±SD	107.73 ± 22.15	45.52 ± 9.80	< 0.001
Blood loss (mL), mean±SD	18.68 ± 8.76	21.45 ± 10.58	0.886
Blood transfusion, n (%)			0.013
Yes	2 (8%)	6 (24%)	
No	23 (92%)	19 (76%)	
Hospital stay time (day), mean±SD	8.85 ± 1.36	7.57 ± 1.02	0.001
Admission to the intensive care unit, N (%)			
Yes	1 (4%)	4 (16%)	
No	24 (96%)	21 (84%)	
Mortality rate, N (%)			0.0382
Yes	0 (0%)	2 (8%)	
No	25 (100%)	23 (92%)	
Amount of postoperative drainage	100.54 ± 25.67	72.42 ± 18.84	< 0.001

**Table 4:** Postoperative complications.

Complications	Endoscopic thyroidectomy [25]	Traditional open surgery [25]
Bleeding	0 (0%)	1 (4%)
Scarring	0 (0%)	2 (8%)
Surgical site infection	2 (8%)	2 (8%)
Vocal cord paresis	1 (4%)	2 (8%)
Difficulty swallowing	0 (0%)	3 (12%)
<b>Total</b>	<b>3 (12%)</b>	<b>10 (40%)</b>

**Table 5:** Questionnaire findings of post-operative.

Items	Endoscopic thyroidectomy [25]	Traditional open surgery [25]
<b>Pain</b>	<b>0 (no pain), 10 (severe pain)</b>	
1 <sup>st</sup> Day	1.04 ± 0.23	1.32 ± 1.34
1 <sup>st</sup> week	0.52 ± 1.75	0.84 ± 1.82
1 <sup>st</sup> month	0.28 ± 0.22	0.65 ± 0.34
3 <sup>rd</sup> month	0.12 ± 0.30	0.55 ± 0.21
<b>Tingling</b>	<b>0 (with problem), 10 (no problem)</b>	
1 <sup>st</sup> Day	8.89 ± 0.12	6.76 ± 0.31
1 <sup>st</sup> week	9.22 ± 0.011	7.72 ± 1.81
1 <sup>st</sup> month	9.66 ± 0.32	8.92 ± 1.23
3 <sup>rd</sup> month	9.82 ± 0.24	9.52 ± 0.012
<b>Vocal changes</b>	<b>0 (with problem), 10 (no problem)</b>	
1 <sup>st</sup> Day	8.89 ± 1.23	7.11 ± 0.51
1 <sup>st</sup> week	8.62 ± 1.13	7.81 ± 0.44
1 <sup>st</sup> month	8.80 ± 1.45	8.20 ± 1.02
3 <sup>rd</sup> month	9.15 ± 0.20	8.65 ± 0.51
<b>Swallowing disturbance</b>	<b>0 (with problem), 10 (no problem)</b>	
1 <sup>st</sup> Day	8.98 ± 0.77	6.54 ± 1.25
1 <sup>st</sup> week	9.01 ± 0.23	7.92 ± 1.53
1 <sup>st</sup> month	9.40 ± 0.32	8.93 ± 0.82
3 <sup>rd</sup> month	10.00 ± 0.00	9.18 ± 0.34
<b>Neck movement impairment</b>	<b>0 (with problem), 10 (no problem)</b>	
1 <sup>st</sup> Day	8.55 ± 1.78	7.56 ± 0.12
1 <sup>st</sup> week	9.20 ± 0.51	8.43 ± 1.02
1 <sup>st</sup> month	9.83 ± 0.42	9.20 ± 0.16
3 <sup>rd</sup> month	10.00 ± 0.00	9.23 ± 0.152

**Table 6:** Assessment of general quality of life after surgery.

Items	Endoscopic thyroidectomy [25]	Traditional open surgery [25]
Physical health	92.13 ± 0.02	75.41 ± 5.82
Psychological functioning	89.92 ± 4.33	77.41 ± 6.23
Energy/fatigue	94.44 ± 3.21	79.24 ± 4.13
Emotional functioning	91.10 ± 5.41	80.10 ± 2.31
Social functioning	88.54 ± 5.10	79.78 ± 2.01
General Health	90.10 ± 2.81	85.34 ± 4.14

## DISCUSSION

Clinical and surgical data were enrolled in patients with ages (50 – 60) years were 20 cases patients (40 – 49) years were 18 cases, and patients with ages (30 - 39) years was 12 cases, males include 10 cases, and females was 40 cases; underweight was 8%, normal weight was 12%, overweight was 36%, and obesity was 44%, rate of comorbidities was 76%, the most prevalence of diseases were graves' disease was 5 cases, nodular goiter was 19 cases, follicular adenomas was 6 cases, and thyroid cancer was 20 cases, most common symptoms were difficulty swallowing included 40 cases, difficulty breathing included 16 cases, hoarseness or voice changes included 12 cases, weight changes included 23 cases.

Furthermore, all patients were undergoing into Imaging tests, which ultrasound included 20 cases, CT scan included 15 cases, and MRI included 8 cases; the tumor side contains unilateral had 22 cases and bilateral had 3 cases, tumor size > 1.5 cm was 18 cases, < 1.5 cm was 7 cases, in the endoscopic thyroidectomy, while ultrasound included 23 cases, CT scan included 14 cases, and MRI included 5 cases in the traditional open surgery, tumor side contains unilateral had 21 cases and bilateral had 4 cases, tumor size > 1.5 cm was 16 cases, < 1.5 cm was 9 cases.

According to endoscopic thyroidectomy, surgical outcomes of our study found Operative time was 107.73 ± 22.15 min, blood loss was 18.68 ± 8.76 ml, blood transfusion included 2 cases, hospital stay time was 8.85 ± 1.36 days, admission to the

intensive care unit was 1 case, mortality rate was 0 cases, amount of postoperative drainage was  $100.54 \pm 25.67$ , complications was 3 cases, which the most factors were surgical site infection. According to questionnaire findings, pain was  $0.12 \pm 0.30$ , tingling was  $9.82 \pm 0.24$ , vocal changes was  $9.15 \pm 0.20$ , swallowing disturbance was  $10.00 \pm 0.00$ , neck movement impairment was  $10.00 \pm 00$ , general quality of life which more success were Physical health was  $92.13 \pm 0.02$ , Psychological functioning was  $89.92 \pm 4.33$ , Energy/fatigue was  $94.44 \pm 3.21$ , General health was  $90.10 \pm 2.81$ .

Also, surgical outcomes of traditional open surgery include Operative time was  $45.52 \pm 9.80$  min, blood loss was  $21.45 \pm 10.58$  ml, blood transfusion included 6 cases, hospital stay time was  $7.57 \pm 1.02$  days, admission to the intensive care unit was 4 cases, mortality rate was 2 cases, amount of postoperative drainage was  $72.42 \pm 18.84$  in the Traditional open surgery group, complications were 10 cases, where most common factors were difficulty swallowing included 3 cases, surgical site infection included 2 cases, scarring included 2 cases. According to questionnaire findings, the pain was  $0.55 \pm 0.21$ ; tingling was  $9.52 \pm 0.012$ ; vocal changes was  $8.65 \pm 0.51$ ; swallowing disturbance was  $9.18 \pm 0.34$ ; neck movement impairment was  $9.23 \pm 0.152$ , general quality of life which more success were Physical health was  $75.41 \pm 5.82$ , Psychological functioning was  $77.41 \pm 6.23$ , Energy/fatigue was  $79.24 \pm 4.13$ , General health was  $85.34 \pm 4.14$ .

Last studies, endoscopic thyroidectomy represents a minimally invasive procedure that has certain advantages over typical open surgery in thyroid removal, where endoscopic thyroidectomy can result in smaller incisions, less surgical discomfort, shorter hospital stays, faster recovery times, and better cosmetic outcomes owing to little scarring (Jiang, W. J. et al., 2020; Park, J. O. et al., 2015; Park, K. N. et al., 2015).

Although some studies indicated that conventional thyroidectomy represents the typical surgical procedure which involves the removal of either all or a portion of the thyroid gland, where an incision is made in the neck, and the diseased thyroid tissue is carefully dissected and removed, which this method has been used over a long time, where it is deemed safe and successful (Sun, H. et al., 2022). However, A French study identified novel methods to thyroidectomy involve minimally invasive procedures that include endoscopic thyroidectomy,

where it has been shown to enhance patient clinical results over time (Guo, T. et al., 2022).

An American study shown endoscopic thyroidectomy, as compared to typical open surgery, may cause less tissue stress, a decreased risk of consequences including hypothyroidism and injury to neighbouring tissues, and higher patient satisfaction, which nevertheless, the choice among endoscopic and open surgery is determined by a number of criteria, including the size of the thyroid nodule, the surgeon's expertise and experience, and the patient's particular requirements and preferences (Pennacchietti, V. et al., 2016).

## CONCLUSION

Our current study indicated that promoting laparoscopic thyroidectomy is the safest surgical option for most patients with thyroid diseases because of its advantages, such as achieving excellent surgical outcome rates, a high satisfaction rate, a decrease in the rate of complications and pain, an ideal improvement in patient's quality of life, a faster recovery rate, and less scarring, lower quality compared to traditional open surgery.

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