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Original Article

Comparison of Outcomes and Cosmetic Satisfaction of Bilateral Trans-Axillary Endoscopic Total Thyroidectomy versus Conventional Open Total Thyroidectomy

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Abstract

Objective: The purpose of the present study was to compare the outcomes and cosmetic satisfaction achieved by bilateral trans-axillary endoscopic total thyroidectomy to those of conventional open total thyroidectomy at Rajavithi Hospital.

Methods: A retrospective study was conducted on 11 patients who underwent bilateral trans-axillary endoscopic thyroidectomy and 20 patients who had conventional total thyroidectomy between April 2013 and April 2018. Bilateral trans-axillary endoscopic thyroidectomy was performed using a four-port technique, and ultrasonic devices were used for dissection. Demographic data, weight of thyroid gland, mean operative time, blood loss, hospital stay, complications and scar satisfaction in the two groups were compared.

Results: Bilateral trans-axillary endoscopic total thyroidectomy was successfully performed in all cases without conversion to the open technique. Operative time for the endoscopic group was longer than for that for open total thyroidectomy (293 ± 58 vs 165 ± 52 minutes, $p < 0.001$); however, operative blood loss (124 ± 18 vs. 231 ± 19 mL, $p = 0.134$) and duration of hospital stay (6.5 ± 1.7 vs. 6.9 ± 1.9 days, $p = 0.582$) were lower for the endoscopic technique, even though these findings were not statistically significant. Scar satisfaction in all parameters, such as wound color, size and overall satisfaction were better in the endoscopic group, $p = 0.001$. With the open technique, transient recurrent laryngeal nerve injury was found in 1 patient (5%) and transient hypocalcemia occurred in 4 cases (25%). There were no serious complications in the bilateral trans-axillary endoscopic total thyroidectomy group.

Conclusion: Bilateral trans-axillary endoscopic thyroidectomy is an appropriate option for total thyroidectomy; however, the surgeon should be familiar with laparoscopic operations, and suitable cases should be selected for this procedure.

Keywords: Bilateral trans-axillary endoscopic thyroidectomy, Total thyroidectomy, Outcome, Cosmetic satisfaction

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Introduction

Thyroid nodules are more common in women [1,2], many of whom worry about the cosmetic outcome of surgery, specifically the neck scar. Even though conventional open total thyroidectomy (COT) can remove the entire thyroid gland, this procedure may leave a permanent surgical neck scar that can become hypertrophic. Currently there are various remote-access[3,4] thyroidectomy procedures that bring the surgical wound to another area away from the neck, and trans-axillary endoscopic thyroidectomy is one of these options. This procedure has an advantage over COT in that it does not involve neck incisions and enables easy identification of recurrent laryngeal nerves and parathyroid tissue because the operative field is magnified by a laparoscope. However, surgeons who perform this procedure need to be familiar with laparoscopic techniques and have experience with open thyroidectomy. We hypothesized that bilateral trans-axillary endoscopic total thyroidectomy would have comparable surgical outcomes to those of COT but is superior cosmetically. Only a few studies have compared bilateral trans-axillary endoscopic total thyroidectomy with COT; most studies have focused on comparing these two techniques in thyroid lobectomy[5,6].

Materials and Methods

The present study was approved by the Institutional Review Board of Rajavithi Hospital, Bangkok, Thailand (143/2558). A retrospective and cross-sectional medical record review was conducted on 31 patients who underwent total thyroidectomy between April 2013 and April 2018 at the Department of Surgery, Rajavithi Hospital. Patients found to have thyroid nodules underwent fine needle aspiration (FNA) in accordance with the American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer[7]. FNA results were then classified in accordance with the Bethesda System[8]. The indications for total thyroidectomy included compressive symptom, hyperthyroidism uncontrolled by medication, and thyroid cancer without lymph node metastasis. For bilateral trans-axillary endoscopic thyroidectomy, the maximum thyroid nodule size was 6 cm. Exclusion criteria included previous neck surgery or thyroid cancer with lymph nodes metastasis, and follow-up time of less than 2 years after surgery. Patients' age, BMI, gender, thyroid volume and definite pathologic results after surgery were recorded.

Eleven patients underwent bilateral trans-axillary endoscopic thyroidectomy and 20 underwent COT. Operative time, blood loss and hospital stay were recorded. Serum calcium levels were measured on postoperative days 1 and 2, and postoperative hypoparathyroidism was diagnosed when corrected total calcium was less than 8 mg/dL. Patients who had hypocalcemia were given supplementary calcium carbonate, 2 to 3 g/day. Permanent hypocalcemia was defined as low serum calcium persisting for more than 6 months. Post-operative vocal cord assessment was performed in patients with suspected recurrent laryngeal nerve injury, such as those with hoarseness or stridor. Recurrent laryngeal nerve injury was defined as permanent when there was persistent impairment for more than 1 year; otherwise, it was considered transient.

All patients were followed at 2 weeks, 1 month, 3 months, 6 months and 1 year after thyroidectomy. Physical examination of the wound and voice assessment were performed. In cases of suspected recurrent laryngeal nerve injury, vocal cords were assessed by an ENT specialist. Laboratory tests for thyroid function and calcium level were also evaluated.

At 1-year follow-up, surgical scar satisfaction was assessed using 4 parameters: overall satisfaction, satisfaction with color, satisfaction with size and satisfaction with symmetry of the scar. These satisfaction parameters were graded on a 5-point Likert scale (5 points for extremely satisfied and 1 point for extremely dissatisfied).

Numerical results were summarized as counts (percentage), median (range), or mean (standard deviation), as appropriate. Statistical comparison of data between two groups was performed by Student's t-test in the case of Normal-distributed data. For data that did not have a Normal distribution, Mann-Whitney U-test was used. Categorical data were compared using the chi-square test. A p-value of 0.05 or less was considered statistically significant. The IBM SPSS Statistics software version 22 was used for all analyses.

Operative Technique

Bilateral trans-axillary endoscopic thyroidectomy was performed with the patient set in the supine position with neck extension. Both arms were raised over the patient's head and fixed until the operation was finished. At Rajavithi Hospital, we have constructed a custom-made, special metallic instrument that can fix both arms of the patient in the appropriate position, and we used

this instrument in all cases.

We employed a 4-port technique inserted through the axillary area. A 3-cm incision was made at the axillary skin crease to create a subcutaneous tunnel above the pectoralis major muscle across the clavicle to the sternocleidomastoid. A 10 mm flexible or rigid laparoscope was inserted through this port, after which any residual skin gap was sutured to ensure air-tightness. Two 5-mm incisions were created at the right and left sides of the laparoscopic port to insert an ultrasonic dissecting device and a grasper. The final 5-mm incision was made at the lateral part of the laparoscope port to insert a suction device, which was used not only for clearing the operative field also for retracting the sternocleidomastoid muscle laterally in order to easily identify the thyroid gland.

CO2 insufflation pressure was set at 6 mmHg. The operation was begun when the anterior border of the sternocleidomastoid muscle on one side was dissected laterally to identify the strap muscle, which was then split at the lateral part to reach the thyroid gland. The superior and inferior poles of the thyroid gland on that side were dissected free using an ultrasonic device without suturing or ligation, and the gland was mobilized medially to identify and preserve the recurrent laryngeal nerve and parathyroid glands. After completion of the same procedure on the contralateral side, the entire thyroid gland was removed via the 10 mm laparoscope incision. Neither the split strap muscles nor the sternocleidomastoid muscle required suturing, and no drains were employed in any case.

Conventional open total thyroidectomy (COT) was performed in a familiar fashion. A 5 to 8cm transverse collar incision was made, a subplatysmal plane was created up to the thyroid cartilage, and the strap muscles were separated at the midline to identify the thyroid gland. The superior thyroid vessels were ligated and divided within 1cm of the superior pole to preserve the external branch of the superior laryngeal nerve. The recurrent laryngeal nerves and parathyroid glands were identified and preserved before the inferior thyroid artery on either side was divided. Finally, the inferior poles were ligated and divided, and a vacuum drain was placed and later removed when the drainage volume was less than 30 mL per day.

Results

Over the 5-year period from April 2013 to April 2018, 11 patients, including 9 women and 2 men with a mean age of 35.5 ± 11.2 years, underwent bilateral trans-axillary endoscopic total thyroidectomy**.** Pathologic results revealed 5 cases of adenomatous goiter, 3 of diffuse follicular hyperplasia, 2 of papillary thyroid carcinoma, and 1 of Hashimoto's thyroiditis. The mean weight of the thyroid gland was 59 ± 19 gm, the mean operative time was 293 ± 58 min, and the mean blood loss was 125 ± 18 mL. The mean length of hospital stay was 6.5 ± 1.7 days, and no serious complications were encountered with this technique.

All 20 patients who underwent COT were women, and their mean age was 51.0 ± 10.7 years. Pathologic results revealed 18 cases of adenomatous goiter, 1 of papillary thyroid carcinoma, and 1 of Hashimoto's thyroiditis. The mean weight of the thyroid gland was 245 ± 21 gm, the mean operative time was 165 ± 52 min, and mean blood loss was 231 ± 19 mL. the mean length of hospital stay was 6.9 ± 1.9 days.

Table 1 Baseline characteristics of patients (n = 31)

Variables	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)	*p*-value
Age, year: mean ± SD	35.5 ± 11.2	51.0 ± 10.7	0.001
BMI: mean ± SD	25.0 ± 15.1	25.5 ± 5.0	0.891
Gender Female: Male	9:2	20:0	
Pathology			
Adenomatous goiter	5 (45.5)	18 (90.0)	0.032
Follicular hyperplasia/Graves' disease	3 (27.3)	0 (0.0)	
Hashimoto's thyroiditis	1 (9.2)	1 (5.0)	
Papillary carcinoma	2 (18.18)	1 (5.0)	
Weight of thyroid, gm: mean ± SD	59.0 ± 19.1	244.9 ± 21.2	< 0.001

Table 2 Perioperative and postoperative data (n = 31)

Variables	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)	*p*-value
Operative time, min: mean ± SD	293 ± 58	165 ± 52	< 0.001
Blood loss, mL: mean ± SD	125 ± 18	231 ± 19	0.134
Length of hospital stay, days: mean ± SD	6.5 ± 1.7	6.9 ± 1.9	0.582

Table 3 Operative complications (n = 31)

Operative complications	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)
Transient hypocalcemia: number (%)	0	4 (20)
Transient RLN injury: number (%)	0	1 (5)
Permanent RLN injury: number (%)	0	0
Hematoma: number (%)	0	0
Wound infection: number (%)	0	0

Table 4 Scar satisfaction (n = 31)

Satisfaction Score	Bilateral endoscopic thyroidectomy (n=11)	Open thyroidectomy (n=20)	*p*-value
Overall satisfaction: median (range)	5.0 (4 - 5)	3.5 (3 – 5)	0.001
Satisfaction–color: median (range)	5.0 (3 – 5)	4.0 (3 – 5)	0.027
Satisfaction–size: median (range)	5.0 (3 – 5)	4.0 (3 – 4)	0.001
Satisfaction–symmetry: median (range)	5.0 (4 – 5)	4.0 (3 – 4)	< 0.001

Four patients had transient hypocalcemia, and 1 had transient recurrent laryngeal nerve injury. Although there were more varied thyroid diseases in the bilateral trans-axillary endoscopic thyroidectomy group, this might not affect surgical and cosmetic outcomes.

Patients were significantly younger in the bilateral trans-axillary endoscopic thyroidectomy group ($p = 0.001$), and the weight of the thyroid gland in this group was also significantly lighter ($p < 0.001$). The mean operative time in this group was significantly longer ($p < 0.001$); however, blood loss and length of hospital stay were not significantly different.

Finally, we assessed scar satisfaction in the two groups at one year after surgery. In all parameters, including overall satisfaction ($p = 0.001$), color ($p =$

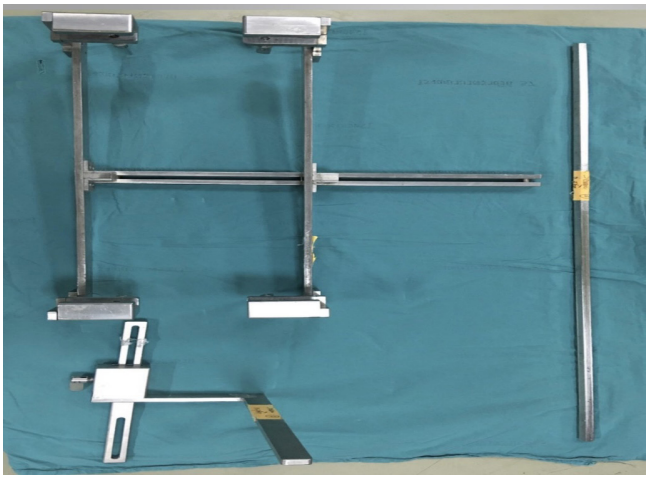

Figure 1 Custom-made, metallic instrument for patient's positioning

0.027), size ($p = 0.001$) and symmetry ($p < 0.001$) of the scar, bilateral trans-axillary endoscopic thyroidectomy yielded superior results.

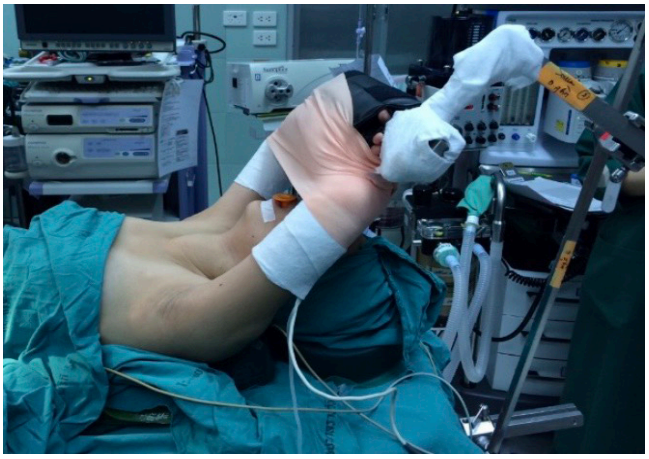

Figure 2 Patient's positioning for bilateral trans-axillary endoscopic thyroidectomy

Figure 3 Surgical scar of bilateral trans-axillary endoscopic thyroidectomy

Discussion

Currently, there are many remote-access thyroidectomy techniques that bring the surgical scar to another area away from the neck to avoid conventional neck incisions[3,4]. Trans-axillary thyroidectomy is one of these techniques[9]. At present, there is little data on the results of comparing bilateral trans-axillary endoscopic total thyroidectomy to conventional transcervical total thyroidectomy[5,6] because the former involves a longer operative time and a steep learning curve. Furthermore, positioning of the patient for the former technique can be problematic. At Rajavithi Hospital, to counter the latter difficulty, we have constructed a custom-made, metallic instrument that can fix both arms of the patient in the appropriate position in order to facilitate the performance of the trans-axillary technique. Further, we also split the strap muscle at the lateral part, so that the strap muscles do not require re-suturing in the midline. Finally, as we approach the thyroid gland from the lateral, and as the operative field is magnified by the laparoscope, the recurrent laryngeal nerves and parathyroid glands are easily identified and saved.

Bilateral trans-axillary endoscopic thyroidectomy required longer operative time than COT because a subcutaneous tunnel has to be created, together with a working space, to reach the thyroid gland bilaterally. However, operative blood loss seemed to be lower in the trans-axillary technique, possibly because of the smaller thyroid size and the use of ultrasonic devices in all cases to arrest bleeding. This finding is in keeping with those of other studies[11,12]. The rates of complications were low in both groups, but bilateral trans-axillary endoscopic thyroidectomy seemed to have fewer complications than COT. Studies with larger sample sizes are required to corroborate this.

The most important reason for developing remote-access thyroidectomy is to improve cosmetic outcomes. In our study, we evaluated scar satisfaction in terms of 4 parameters: overall satisfaction, and satisfaction with color, size and symmetry of the scar. The results were as expected: bilateral trans-axillary endoscopic thyroidectomy was significantly better than COT in all cosmetic outcomes.

Conclusion

Bilateral trans-axillary endoscopic thyroidectomy is an attractive and safe procedure for total thyroidectomy, with good outcomes and superior cosmesis. However, surgeons who perform this procedure need to be familiar with laparoscopic techniques and also have some experience performing open thyroidectomy. Appropriate patient selection is also very important in order to achieve excellent results.

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What this Study Adds

1. Bilateral trans-axillary endoscopic thyroidectomy is a feasible procedure for treatment of surgical thyroid disease that requires total thyroidectomy, and it achieves excellent outcomes with very few complications.

2. In carrying out this procedure, the surgeon can set the operative position easily using our innovative instrument.

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บทคัดย่อ **ศึกษาเปรียบเทียบผลการผ่าตัดและความพึงพอใจของบาดแผลระหว่างการผ่าตัดไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างกับการผ่าตัดไทรอยด์ออกทั้งต่อมบริเวณลำคอแบบดั้งเดิม**

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ความเป็นมา: ถึงแม้การผ่าตัดไทรอยด์ทั้งสองข้างบริเวณลำคอจะเป็นการผ่าตัดมาตรฐาน แต่การผ่าตัดดังกล่าวทำให้เกิดบาดแผลบริเวณลำคอ ซึ่งไม่อาจคาดเดาได้ว่าจะเกิดแผลเป็นนูนหรือคีรอยด์หรือไม่ การผ่าตัดไทรอยด์ผ่านกล้องทางรักแร้จึงเป็นทางเลือกสำหรับผู้ป่วยเพื่อหลีกเลี่ยงบาดแผลบริเวณลำคอ

วัตถุประสงค์: เพื่อศึกษาเปรียบเทียบผลการผ่าตัดและความพึงพอใจของบาดแผลระหว่างการผ่าตัดไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างกับการผ่าตัดไทรอยด์ออกทั้งต่อมบริเวณลำคอแบบดั้งเดิม

วิธีการศึกษา: เป็นการเก็บข้อมูลผู้ป่วยทั้งหมดที่ได้รับการผ่าตัดต่อมไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างจำนวน 11 รายและการผ่าตัดต่อมไทรอยด์ออกทั้งต่อมบริเวณคอแบบดั้งเดิมจำนวน 20 ราย ตั้งแต่เดือนเมษายน 2013 ถึงเดือนเมษายน 2018 โดยการผ่าตัดไทรอยด์ผ่านกล้องนั้นใช้การลงแผลเฉพาะบริเวณรักแร้เท่านั้น (จำนวน 4 ports) และใช้อุปกรณ์ผ่าตัดด้วยเครื่องผ่าตัดความถี่สูง (ultrasonic device) ข้อมูลทั่วไปของผู้ป่วย ผลชิ้นเนื้อ ขนาดของต่อมไทรอยด์ ระยะเวลาในการผ่าตัด ปริมาณการเสียเลือด ระยะเวลาการนอนโรงพยาบาลและภาวะแทรกซ้อนจะได้รับการบันทึกเพื่อเปรียบเทียบ ส่วนความพึงพอใจของแผลผ่าตัดจะได้รับการสัมภาษณ์เปรียบเทียบหลังการผ่าตัด 1 ปี

ผลการศึกษา: แม้ว่าการผ่าตัดไทรอยด์ทางกล้องผ่านทางรักแร้ทั้งสองข้างจะใช้เวลามากกว่าการผ่าตัดไทรอยด์ออกทั้งต่อมแบบดั้งเดิมก็ตาม (293 ± 58 vs 165 ± 52 นาที, $p < 0.001$) แต่ไม่ว่าจะเป็นปริมาณการเสียเลือด (125 ± 18 vs 231 ± 19, $p = 0.134$) หรือระยะเวลาการนอนโรงพยาบาล (6.5 ± 1.7 vs 6.85 ± 1.9, $p = 0.582$) ไม่แตกต่างกัน ซึ่งผลดีของการผ่าตัดแบบนี้พบว่าความพึงพอใจของบาดแผลผ่าตัดในผู้ป่วยที่ได้รับการผ่าตัดผ่านกล้องดีกว่าอย่างมีนัยสำคัญทางสถิติ $p = 0.001$ นอกจากนั้นภาวะแทรกซ้อนของการผ่าตัดก็ค่อนข้างน้อย

สรุปผลการศึกษา: การผ่าตัดต่อมไทรอยด์ผ่านกล้องทางรักแร้ทั้งสองข้างในผู้ป่วยที่จำเป็นต้องตัดต่อมไทรอยด์ออกทั้งต่อมเป็นการผ่าตัดที่ปลอดภัยและสามารถใช้เป็นทางเลือกในผู้ป่วยที่มีความกังวลเรื่องแผลผ่าตัดบริเวณลำคอ แต่ควรเลือกผู้ป่วยให้เหมาะสม และศัลยแพทย์ควรมีทักษะการผ่าตัดทางกล้องเป็นอย่างดี