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Prospective comparative study of endoscopic via unilateral axillobreast approach versus open conventional total thyroidectomy in patients with papillary thyroid carcinoma

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Abstract
Background Total thyroidectomy can be accomplished in one of two ways. The first is an open conventional approach, and the other is an endoscopic unilateral axillobreast approach (UABA). However, the two have not been thoroughly compared. In the study described herein, we compare the technical feasibility, safety, and surgical completeness of open versus endoscopic total thyroidectomy procedures.
Methods A total of 152 patients who underwent open ($n = 102$) or endoscopic ($n = 50$) total thyroidectomy via UABA for papillary microcarcinoma from January to December 2011 were enrolled in this study. Data were collected prospectively after obtaining informed consent. We analyzed the clinical characteristics, pathologic results, postoperative thyroglobulin (Tg) levels, and results of radioactive iodine treatment between the two groups.
Results We conclude that endoscopic thyroidectomy resulted in a younger age, lower body mass index, longer operation time and drain maintenance, and larger drain amount. There were no significant differences with respect to gender, hospital stay, tumor size, time for central compartment neck dissection, number of harvested ipsilateral lymph nodes, or bleeding amount between groups. The proportion of extrathyroidal extension, multifocality, and bilaterality did not differ, and the surgical complication rate was similar. In addition, the postoperative stimulated and non-stimulated Tg levels did not differ significantly, nor did the thyroid bed/brain iodine uptake ratio.
Conclusions Based on our results, endoscopic total thyroidectomy via UABA is technically feasible and has comparable surgical completeness to open total thyroidectomy for papillary microcarcinoma within 1 cm.

Keywords Papillary thyroid microcarcinoma · Thyroidectomy · Endoscopic surgical procedure

The endoscopic unilateral axillobreast approach (UABA) is one of the most commonly used endoscopic methods; however, there is one drawback regarding surgical extension to the contralateral lobe when total thyroidectomy is needed. We hypothesized that endoscopic total thyroidectomy via UABA is technically feasible and comparable to open conventional thyroidectomy. This report describes a prospective study to determine the feasibility and surgical completeness of endoscopic total thyroidectomy compared with open thyroidectomy.

Materials and methods

Patients and study design

This study was conducted on patients who underwent total thyroidectomy via UABA for papillary microcarcinoma from January to December 2011. Following approval from the Institutional Review Board at Soonchunhyang

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University at Bucheon (SCHBC_IRB_10_63), patients chose their approach (open conventional or endoscopic via a UABA) with informed consent. Among the patients, 152 met the following criteria: papillary microcarcinoma less than 1 cm and a greater than a 1-year follow-up period without recurrence. Patients with carcinoma larger than 1 cm, benign disease, and follow-up loss were excluded. Patients with one of the following pathologic results underwent postoperative radioactive iodine treatment (RAIT): microscopic extension, bilateral papillary thyroid carcinoma, or central neck lymph node metastasis. All data were collected prospectively.

Based on the approach, patients were categorized as the open conventional group (OPEN) or endoscopic approach via UABA group (ENDO). The demographics, operative data, hospital stay, time of drain removal (removed less than 20 ml/day), pathologic results, and postoperative complications (e.g., vocal cord palsy and hypoparathyroidism) were compared. We also examined the stimulated/non-stimulated thyroglobulin (Tg) level, as well as the thyroid bed/brain iodide uptake ratio to evaluate the surgical completeness of total thyroidectomy.

Surgical procedure

For the open approach, a no-tie harmonic scalpel (CS-14C handpiece; Johnson & Johnson Medical, Cincinnati, OH, USA) thyroidectomy was performed. All procedures, including vascular control of the thyroid gland, were completed using only a harmonic scalpel without conventional hand-tied ligation [1].

For the endoscopic approach, total thyroidectomy with ipsilateral central neck dissection was performed using a gasless unilateral transaxillary approach [2]. A 5-cm skin incision was made parallel to a skin crease in the axillary fossa. The skin was elevated above the pectoralis major muscle under direct vision using Bovie electrocautery (Conmed, Utica, NY, USA) through the axillary skin incision.

To create a working space, an external retractor (Sejong Medical Corporation, Gyohaeup, Korea) was inserted through the skin incision in the axilla and raised using a lifting device. A second 1-cm skin incision was made along the upper margin of the mammary areola on the tumor side for insertion of a 10-mm trocar. A harmonic scalpel (Harmonic Ace 36P; Johnson & Johnson Medical, Cincinnati, OH, USA) and an endoscopic dissector for vessel sealing and tissue dissection were used throughout the operation. The thyroid gland was dissected in the subcapsular plane with care for preservation of the recurrent laryngeal nerve and superior/inferior parathyroid gland (Fig. 1A). For contralateral hemithyroidectomy, the upper insertion part of the sternothyroid muscle was divided for better visualization. The thyroid gland was retracted laterally, and meticulous dissection was performed through the pretracheal fascia plane to Berry's ligament. The contralateral recurrent laryngeal nerve was secured due to the contralateral retraction of the thyroid gland and subcapsular dissection (Fig. 1B).

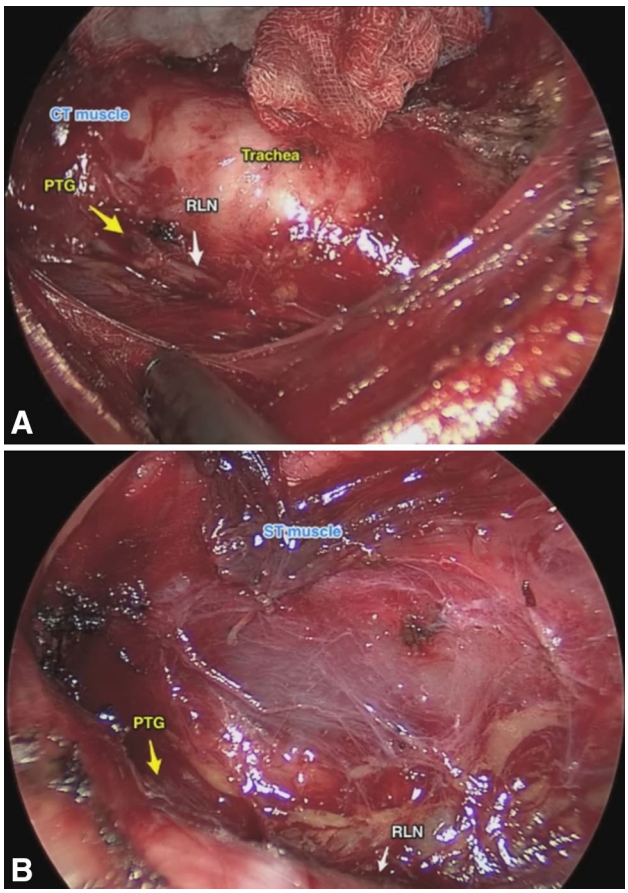

Fig. 1 Total thyroidectomy via the unilateral axillobreast approach. **A** Ipsilateral hemithyroidectomy (*right*); **B** contralateral hemithyroidectomy (*left*). *CT muscle* cricothyroid muscle, *PTG* parathyroid gland, *RLN* recurrent laryngeal nerve, *ST muscle* sternothyroid muscle

For ipsilateral central compartment neck dissection (pretracheal and ipsilateral paratracheal lymph node on the tumor side), dissection was performed superficial to the recurrent laryngeal nerve using an endoscopic dissector without the harmonic scalpel. Central compartment neck dissection was performed separately following the thyroidectomy.

Statistical analysis

Differences between groups were compared using Student's t test for numeric parameters and Chi-squared test for non-numeric parameters. Statistical significance was accepted at a P value less than 0.05. All statistical analyses

were performed using SPSS for Windows version 18.0 (SPSS, Inc., Chicago, IL, USA).

Results

Patient demographics and clinical characteristics are summarized in Table 1. Patients in the ENDO group were younger in age and had a lower body mass index (BMI). The distribution of gender, tumor size, and bleeding amount did not differ significantly between groups, nor did the time of drain removal or hospital stay. The operation time for total thyroidectomy was longer in the ENDO group. Additionally, the drain amount observed in the ENDO group was greater than that in the OPEN group.

Table 2 shows the pathologic results and postoperative-related complications. There was no significant difference in extrathyroidal extension, multifocality, or bilaterality of tumors. In addition, the number of metastatic lymph nodes and harvested paratracheal lymph nodes did not differ significantly between groups, nor did the overall complication rate, which included hematoma, chyle leakage, seroma, and voice pitch problems. In terms of hypoparathyroidism and vocal cord paralysis, there was no difference according to the surgical approach.

Among all patients, 72 from the OPEN group and 26 from the ENDO group underwent radioactive iodine treatment (RAIT). The thyroid bed/brain I^{131} uptake ratio did not differ significantly between groups, nor did the stimulated Tg and non-stimulated Tg levels (Fig. 2).

Discussion

Since Dr. Gagner first introduced endoscopic parathyroidectomy in 1996 [3], endoscopic thyroidectomy has made much progress, and its surgical applications have widened. Currently, there is much focus on the gasless UABA [4] and bilateral axillobreast approach, particularly with CO_2 gas insufflation [5]. Presently, UABA is the most preferred approach for endoscopic thyroidectomy in Korea [6] and has been proven a safe and efficient approach in several reports [4, 7, 8].

However, this unilateral endoscopic approach has major limitations because a contralateral endoscopic view is not sufficient for total thyroidectomy for surgeons without sufficient experience. Open conversion or both unilateral approaches are necessary when the patient requires a total thyroidectomy. Although this limitation has been overcome following the development of robotic systems with the dexterity of robotic instruments and improvement in surgical view [9], the expected cost is approximately double for the robotic procedure than endoscopic thyroidectomy in the Korean national insurance system [10].

Endoscopic hemithyroidectomy via the UABA itself requires a learning curve due to the unfamiliar anatomic orientation. Endoscopic total thyroidectomy can be achieved after acquiring expertise. This study was designed to determine whether endoscopic total thyroidectomy via the UABA could be accomplished and reach comparable results to those of open conventional thyroidectomy.

Recommendations from the authors for a successful contralateral hemithyroidectomy are as follows:

1. Creation of an adequate work space by wide flap elevation for full exposure of the pyramidal lobe and contralateral thyroid gland.
2. Division of the upper insertion part of the sternothyroid muscle for better visualization of the upper pole of the contralateral thyroid gland.
3. Upward (anterior) retraction of the contralateral lobe and identification of the recurrent laryngeal nerve followed by subcapsular dissection and division of Berry's ligament using endoscopic Metzenbaum scissors.

Recently, several studies comparing endoscopic and open conventional thyroidectomy have been reported [4, 11, 12]. To our knowledge, this is the first report in the literature regarding the comparison of endoscopic total thyroidectomy via the UABA.

Table 1 Demographic and clinical data from endoscopic (ENDO) and open (OPEN) patients

Characteristics	ENDO group	OPEN group	*P* value
Age	38.0 ± 9.4	50.8 ± 11.5	<0.001
Gender (male/female)	4:46	14:88	0.305
Body mass index (BMI) (kg/m^2)	22.8 ± 3.0	24.9 ± 3.6	<0.001
Tumor size (mm)	8.0 ± 3.7	7.6 ± 1.9	0.537
Drain removal (days)	7.1 ± 1.8	5.9 ± 1.4	<0.001
Hospital stay (days)	7.7 ± 2.4	6.9 ± 3.6	0.104
Operation time (minutes)	123.9 ± 39.3	70.7 ± 22.3	<0.001
Bleeding amount (ml)	16.4 ± 31.2	8.1 ± 7.2	0.07
Drain amount (ml)	336.9 ± 221.2	164.6 ± 56.9	<0.001

Table 2 Pathologic results and related complications from endoscopic and open patients

Characteristic	ENDO group	OPEN group	*P* value
Extrathyroidal extension (%)	56.0 (28/50)	68.6 (70/102)	0.150
Multifocality (%)	14.0 (7/50)	18.6 (19/102)	0.647
Bilaterality (%)	20.0 (10/50)	17.6 (18/102)	0.824
Metastatic lymph nodes	0.7 ± 1.4	0.6 ± 1.2	0.478
Ipsilateral paratracheal lymph node	2.4 ± 1.8	2.5 ± 2.1	0.488
Overall complication rate (%)[a]	18.0 (9/50)	8.8 (9/102)	0.114
Hypoparathyroidism (%)			
Transient	26.0 (13/50)	22.5 (23/102)	0.687
Permanent	4.0 (2/50)	2.9 (3/102)	0.664
Vocal cord paralysis			
Transient	8.0 (4/50)	6.9 (7/102)	0.440
Permanent	4.0 (2/50)	3.9 (4/102)	0.482

[a] Included hematoma, chyle leakage, seroma, pitch problems, and vocal cord palsy

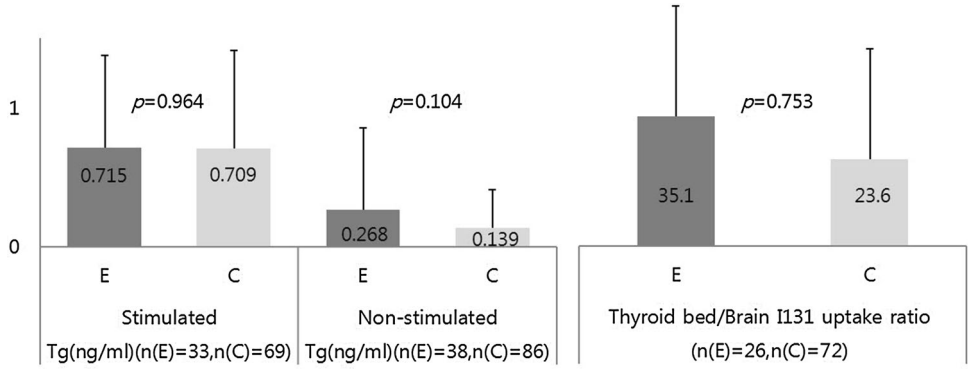

Fig. 2 Postoperative thyroglobulin levels and thyroid/bed/brain I^{131} uptake ratio

Our results indicate that endoscopic total thyroidectomy via the UABA by an expert was technically feasible and comparable to open conventional thyroidectomy with respect to surgical completeness, as evidenced by harvested lymph nodes, postsurgical RAI uptake ratio, and non-stimulated/stimulated Tg levels. Surgical complications were similar to those of the open conventional approach. In both groups, transient hypocalcemia and permanent hypoparathyroidism were comparable to those of previous studies, ranging from 1.6 to 50 % [13] and 1 to 3 % [14], respectively. Transient and permanent vocal cord paralysis did not differ according to the surgical approach and appeared to be higher than the conventionally cited 0.85–3.5 % [15–17], but similar to a recent report on the population-level incidence of vocal cord paralysis [18].

Drawbacks of this procedure included longer operation time and larger drain amount than open conventional thyroidectomy, findings that were acceptable when patients agreed with informed consent.

As described above, endoscopic total thyroidectomy via the UABA by an expert is technically feasible and has similar safety and surgical completeness to open total thyroidectomy for selected patients.

Conclusions

Based on our results, endoscopic total thyroidectomy via the UABA is technically feasible and has comparable surgical completeness to open total thyroidectomy for micropapillary cancer within 1 cm.

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Compliance with ethical standards

Disclosure Ki Nam Park, Chan-Hee Jung, Ji Oh Mok, Jung Ja Kwak, and Seung Won Lee have no conflicts of interest or financial ties to disclose.

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