

Endoscopic Thyroidectomy Using a New Bilateral Axillo-Breast Approach

Jun-Ho Choe, MD,¹ Seok Won Kim, MD,² Ki-Wook Chung, MD,² Kyoung Sik Park, MD,¹ Wonshik Han, MD,¹ Dong-Young Noh, MD,¹ Seung Keun Oh, MD,¹ Yeo-Kyu Youn, MD¹

¹Department of Surgery, Seoul National University Hospital, Seoul, Republic of Korea

²National Cancer Center, Goyang-si, Gyeonggi-do, Republic of Korea

Abstract

Introduction: Endoscopic techniques have recently been applied in thyroid surgery using cervical, axillary, and breast approaches. We modified the axillo-bilateral breast approach (ABBA) and developed the bilateral axillo-breast approach (BABA) to obtain optimal visualization for total thyroidectomy.

Methods: We used two 12-mm ports through bilateral circumareolar incisions for flexible videoscopy and Harmonic scalpel and two 5-mm ports through both axillae for graspers and dissectors. Thyroidectomy was performed under full visualization of the superior and inferior thyroidal arteries, parathyroid glands, and recurrent laryngeal nerves.

Results: After performing 25 ABBA endoscopic thyroid surgeries, we developed BABA and performed 110 operations using this method. The BABA operations included 52 total thyroidectomies, 2 near-total thyroidectomies, 8 subtotal thyroidectomies, 43 lobectomies, and 3 subtotal lobectomies. Pathology revealed 41 benign lesions and 69 cancers. Mean operation time was 165.3 ± 43.5 minutes. There were 2 cases of conversion to open surgery, 1 due to cancer with capsular invasion and the other due to tracheal injury. Nine postoperative complications developed: transient unilateral vocal cord palsy in 4 cases, transient hypocalcemia in 4 cases, and postoperative infection in 1 case. The 2-month postoperative thyroglobulin level was less than 1 ng/ml in all examined cases of total thyroidectomy. Cosmetic results were excellent.

Conclusions: The BABA technique for endoscopic thyroid surgery is a feasible method of total thyroidectomy with a low rate of postoperative complications and, additionally, excellent cosmetic results. Therefore, in selected cases of thyroid cancer, the BABA endoscopic total thyroidectomy should be considered as a valid surgical option.

Endoscopic techniques have recently been applied to thyroid surgery using cervical, axillary, and breast approaches. One of the advantages of endoscopic thyroid surgery over conventional open surgery is that it can provide better cosmetic results. However, endoscopic thyroid surgery has been regarded as disadvantageous for optimal visualization and complete surgery. In performing thyroid cancer surgery, the surgeon has to consider complete resection and cosmetic results

simultaneously because thyroid cancer has a good prognosis and a significant number of patients are young females. In 2001, we began to use the axillo-bilateral breast approach (ABBA) to endoscopic thyroid surgery developed by Shimazu *et al.*¹ We chose this method because of the excellent cosmetic results, but found total thyroidectomy via ABBA difficult. After performing 25 cases of ABBA endoscopic thyroidectomy, including 1 total thyroidectomy, we developed the bilateral axillo-breast approach (BABA) to obtain optimal visualization for total thyroidectomy by adding a contralateral axillary

Correspondence to: Yeo-Kyu Youn, MD, e-mail: ykyoun@plaza.snu.ac.kr

port. Thus, the aims of this study are to evaluate the feasibility of BABA and the completeness of total thyroidectomy using this approach.

MATERIALS AND METHODS

Patients

From July 2001 to November 2005, 135 patients (133 females, 2 males) underwent endoscopic thyroidectomy at the Seoul National University Hospital. Twenty-five patients underwent endoscopic thyroidectomy using the ABBA according to the original method described by Shimazu *et al.*,¹ and 110 patients underwent endoscopic thyroidectomy using the BABA described in this paper. Thyroid function test results were normal in all patients. Indications for the BABA technique were as follows: benign thyroid mass, T1 thyroid carcinomas not larger than 1 cm with low risk (age < 50 years, no evidence of lymph node metastasis, intrathyroidal location), and follicular neoplasm less than 3 cm. Sixty patients were diagnosed with papillary thyroid carcinoma by preoperative fine-needle aspiration cytology. In all but 2 patients, there were no suspicious breast masses on palpation, mammography and ultrasonography. Two patients had C4a lesions upon preoperative evaluation, and endoscopic thyroidectomies were performed after diagnosing fibroadenomas using intraoperative excisional biopsies. Informed consent was obtained regarding the surgical methods and possible complications including conversion to the conventional method.

In cases of total thyroidectomies, thyroglobulin levels were checked after 2 months in order to evaluate the completeness of surgery.

Surgical Procedure for the BABA to Endoscopic Thyroidectomy

Under general anesthesia, patients were placed in the supine position with neck extension using a shoulder pillow. Both arms were mildly abducted to provide for insertion of 5-mm ports. Diluted (1:200,000) epinephrine solution was injected into the subcutaneous space in both breasts and the subplatysmal space in the neck to reduce bleeding during the dissection. After making 2 incisions on both upper circumareolar areas, subcutaneous and subplatysmal dissections were performed bluntly with the use of a Rochester clamp and vascular tunneler. The working space was extended to the level of the thyroid

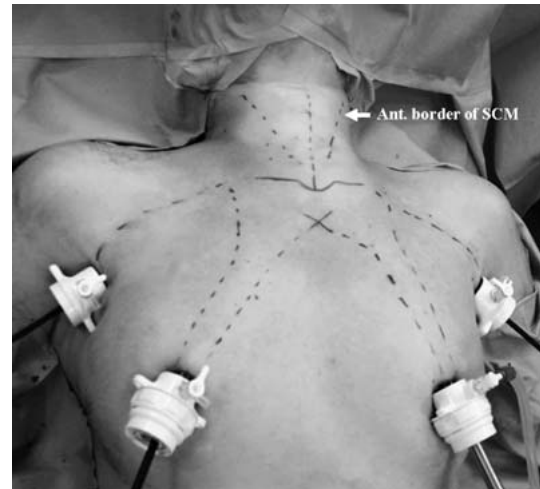


Figure 1. Two 12-mm ports inserted via each circumareolar incision and two 5-mm ports via the bilateral axillary incisions. The parts shown in the *dotted line* represent the anatomical landmarks and extent of dissection.

cartilage superiorly and to the medial border of each sternocleidomastoid muscle laterally. After establishing the required working space, the ports (12 mm) were inserted. Through the 12-mm port ipsilateral to the thyroid mass, the flexible endoscope was introduced. The contralateral 12-mm port was used for the operational instruments including the Harmonic Scalpel. The working space was established with CO₂ insufflation at a pressure up to 5–6 mmHg. The remaining dissection was completed with the visual guidance of the flexible endoscope. Two 5-mm ports were inserted, 1 through the major crease of each axilla (Fig. 1). First, a midline incision was made in the same manner as for conventional thyroidectomy (Fig. 2A). After full visualization of the crico-thyroid membrane, the isthmus portion of the thyroid gland, and the central lymph node group, we dissected the isthmus (Fig. 2B). This procedure resulted in optimal retraction of the thyroid tissue for dissection of its lateral and posterior aspects. Thyroidectomy was performed using Harmonic Scalpel under full visualization of superior and inferior thyroidal arteries, parathyroid glands, and recurrent laryngeal nerves (Fig. 2C, D). The resected specimen was inserted into a plastic bag and retrieved through the 12-mm port (Fig. 2E). A frozen section of the resected specimen was examined intraoperatively for pathologic confirmation. Meticulous hemostasis was attained and the midline was repaired with endosuture (Fig. 2F). A suction drain (Jackson–Pratt) was left in place. The skin was reapproximated cosmetically and a surgical brassiere was applied for proper compression of the skin flap.

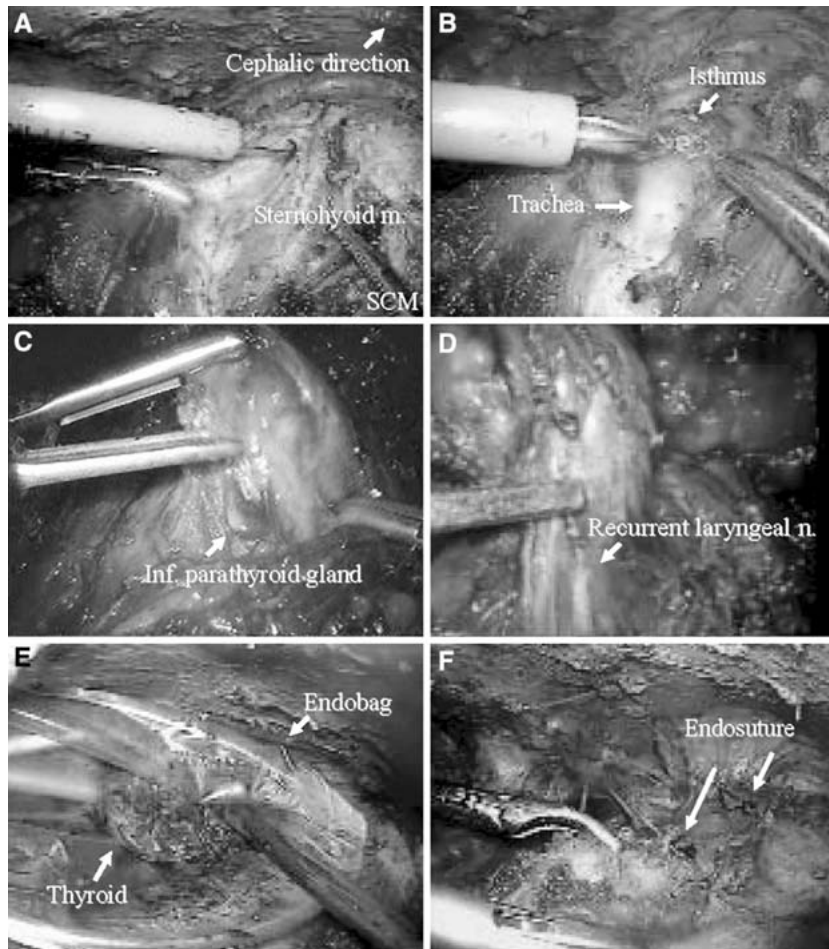


Figure 2. Surgical procedure for the bilateral axillo-breast approach (BABA) to endoscopic thyroidectomy. **A.** Division of the midline. **B.** Division of the isthmus. **C.** Inferior parathyroid gland conservation. **D.** Identification of the recurrent laryngeal nerve. **E.** Removal of the thyroid with plastic bag. **F.** Repair of the midline with endosuture.

RESULTS

A total of 135 patients with clinical data were reviewed. The mean age of the patients was 36.9 years, ranging from 20 to 56 years, and included 133 females and 2 males. The mean operation time of the ABBA and BABA was 184.0 ± 69.4 and 165.3 ± 43.5 minutes respectively. The ABBA operations included 3 subtotal lobectomies, 19 unilateral lobectomies, and 1 total thyroidectomy. The BABA operations included 52 total thyroidectomies, 2 near-total thyroidectomies, 8 subtotal thyroidectomies, 43 lobectomies, and 3 subtotal lobectomies. There were 4 cases of conversion to open surgery (4 out of 135, 2.9%). The causes were uncontrolled bleeding, multicentric cancer, cancer with capsular invasion and tracheal perforation (Table 1). The mean diameter of the tumors was 1.40 ± 1.10 cm ranging from 0.2 to 6.0 cm. Pathologic results are shown in Table 2. There were 58 benign lesions and 77 cancers. Among the benign lesions, there were 46 cases of adenomatous hyperplasia, 9 follicular adenomas, 1 Hürthle cell adenoma, and 2 cases of thyroiditis. Among the malignant cases, there were

58 papillary microcarcinomas, 11 papillary carcinomas, and 8 follicular carcinomas. Ten postoperative complications developed: 4 cases of unilateral vocal cord palsy were identified on postoperative laryngoscopic examination, and there were 4 cases of transient hypocalcemia, 1 of pneumothorax, and 1 of postoperative infection (Table 3). All cases of vocal cord palsy and hypocalcemia were resolved within 6 months. There was no postoperative bleeding in any of the cases. In the 52 total thyroidectomies, we checked thyroglobulin levels after 2 months in order to evaluate the completeness of surgery. The 2-month postoperative thyroglobulin level was less than 1 ng/ml in all examined cases, except for 5 cases lost to follow-up. There were 3 cases of postoperative radioactive iodine ablation, in which the thyroglobulin levels after levo-thyroxine cessation were still less than 1 ng/ml, and stimulated TSH levels were 57, 101, and 147 uIU/ml respectively. The whole body I-131 scan 6 months after single 30 mCi I-131 administration revealed no remnant thyroid activity. Mean hospital stay after endoscopic surgery was 4.0 ± 1.0 days ranging from 2 to 7 days, except for 1 patient with postoperative

Table 1.

Types of operation and causes of conversion to conventional surgery

Approach	ABBA	BABA
Type of operation		
Subtotal lobectomy	3	3
Unilateral lobectomy	19	43
Unilateral lobectomy with contralateral subtotal lobectomy		7
Bilateral subtotal lobectomy		1
Near-total thyroidectomy		2
Total thyroidectomy	1	52
Conversion to conventional surgery	2	2
Total	25	110
Causes of conversion		
Uncontrolled bleeding	1	
Multicentric papillary carcinoma	1	
Cancer with capsular invasion		1
Tracheal perforation		1

ABBA: axillo-bilateral breast approach; BABA: bilateral axillo-breast approach.

Table 2.

The pathologic classification of the tumors

Pathology	Number
Adenomatous hyperplasia	46
Follicular adenoma	9
Hürthle cell adenoma	1
Follicular carcinoma	8
Papillary microcarcinoma	58
Papillary carcinoma	11
Thyroiditis	2
Total	135

Table 3.

Postoperative complications

Complication	Number
Transient vocal cord palsy	4
Transient hypocalcemia	4
Pneumothorax	1
Infection	1
Total	10

infection for whom postoperative hospital stay was 30 days. Cosmetic results were evaluated by a simple questionnaire and physician interview. The operative scars were almost invisible, even if the patients elevated their arms (Fig. 3A, B). The questionnaire, which was obtained from 102 patients, consisted of questions with 4 possible answers: excellent, good, fair, and bad: 76.5% (78 out of 102) of the responses were "Excellent", 20.6%

(21 out of 102) were "Good", 2.9% (3 out of 102) "Fair", and there were no "Bad" responses.

DISCUSSION

In general, thyroid cancer, particularly papillary thyroid cancer, grows slowly and has an excellent prognosis. Furthermore, a large percentage of papillary thyroid cancer patients are young females. Therefore, one of the main concerns of the thyroid surgeon is postoperative quality of life of the patients, including cosmetic results. To date, several techniques for endoscopic neck surgery have been introduced since Gagner² and Hüscher *et al.*³ first successfully performed endoscopic neck surgery.^{4–10} Minimizing cosmetic problems and improving postoperative quality of life are cited as important reasons for using the endoscopic approach. Endoscopic procedures for the thyroid are divided into 2 approaches depending on the position of incisions, i.e., the neck (transcervical) approach and the remote approach. The neck approach results in small operative scars in or near the neck; these are inconspicuous, compared with those of conventional open surgery. However, indications for this approach tend to be limited to a small tumor because the working space is too small to handle a large tumor.^{10,11} Shimizu *et al.*⁶ modified the transcervical approach for application to large tumors, but operative scars measuring up to about 4 cm, just below the clavicle, tended to be hypertrophic. In the remote approach, other investigators developed scarless endoscopic thyroid surgery using the axillary approach⁹ and the breast approach.¹² The axillary approach reported by Ikeda *et al.* utilized 3 ports located in the axillary region. In this technique, the cosmetic results seemed excellent because there were no operative scars in either the neck or anterior chest. However, the 3 ports were located in such a narrow area that the interference of the surgical instruments occurred frequently. The breast approach (BA) reported by Ohgami *et al.*¹² utilized 3 ports passing through 2 circumareolar incisions and 1 parasternal incision. The BA method improved narrow-angled instrumentation, but was problematic due to the resulting hypertrophic scars on the anterior chest. Shimazu *et al.*¹ modified the BA method to develop the axillo-bilateral breast approach (ABBA). They reported that ABBA was feasible for removing huge goiters sized 5–6 cm and described excellent cosmetic results. Furthermore, due to the multiangular nature of this approach, the ABBA procedure seemed easy to perform compared with the axillary approach. However, this method is limited by difficulty visualizing both lobes of the thyroid. We modified

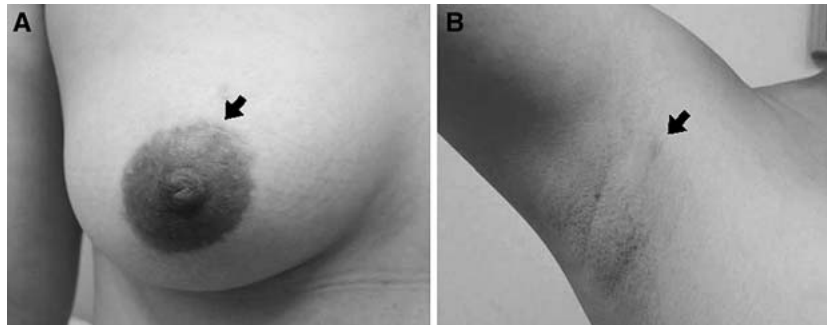


Figure 3. Photographs taken 6 months after operation. **A, B.** *Black arrows* indicate postoperative circumareolar and axillary scars respectively.

the ABBA method and developed a new endoscopic thyroid procedure by using the bilateral axillo-breast approach (BABA) method after performing 25 ABBA operations since July 2001. We were able to obtain optimal visualization of major structures including recurrent laryngeal nerves, superior and inferior thyroid arteries, and parathyroid glands, as well as both lobes of the thyroid. The dissection method we used is not different from the conventional method. We used a midline incision and identified the isthmus and trachea first, and then performed the thyroidectomy. Using BABA, we could perform total thyroidectomy under almost the same view as conventional thyroid surgery. Additionally, a huge goiter measuring 6 cm was successfully removed, even though the mean diameter of the tumors was 1.40 cm. Given our experience of 25 ABBA thyroid surgeries, it is difficult to calculate the learning curve for BABA. The operative length was sharply shortened after performing 15 ABBA endoscopic thyroid surgeries. After establishing competence for ABBA, we found no additional difficulties performing BABA. Thus, we estimate that approximately 15 BABA operations would suffice for experienced thyroid surgeons to develop competence using the BABA technique. After BABA surgery, there were no hypertrophic scars and all the patients were satisfied with the cosmetic results. The remote approach, including our method, tends to be more invasive than the neck approach because the former requires a wide skin flap for creation of the working space. In our experience, some patients complained of slight numbness in the lower neck and anterior chest skin; however, the numbness was resolved within 4 to 6 months after the surgery. It has been reported that severe subcutaneous emphysema and hypercarbia may be experienced when endoscopic surgery is performed using CO₂ insufflation.^{13,14} However, no adverse effects have been noted with the use of lower insufflation pressures.^{13,14} In the 4-port method, the

working space can be maintained with a low pressure level of CO₂ insufflation (5–6 mmHg), and we have experienced no complications induced by CO₂ insufflation. There was no significant difference in mean hospital stay after surgery between endoscopic thyroidectomy (mean of 4 days' hospital stay) and conventional thyroidectomy (mean of 3.7 days' hospital stay in the same period as our BABA study). Among the cases with complications, 1 postoperative infection in a 35-year-old woman and 1 occurrence of pneumothorax in another 35-year-old woman are noteworthy. The former patient visited the emergency room 7 days after endoscopic total thyroidectomy due to neck swelling and fever. A CT scan revealed fluid collection around the operative field. We responded by performing an incision and draining the pus; however, the patient's fever was not resolved. After 2 days of observation, we elected for an exploration of the operative field. Surprisingly, there was an esophageal perforation near the site of the superior thyroid artery ligation. We concluded that there was a possibility of thermal injury to the esophagus at the moment of superior thyroid artery ligation with the Harmonic Scalpel. Gauze packing was maintained for 25 days and eventually her condition improved and she was discharged. The latter patient showed low oxygen saturation during recovery from anesthesia. An immediate chest X-ray was performed and the patient was diagnosed as having pneumothorax. There was no abnormality on preoperative chest X-ray. Chest tube insertion was performed and maintained for 2 days until the pneumothorax was resolved. Since there was no possibility of mechanical injury of the chest wall by surgical instruments, we concluded that high-pressure ventilation during general anesthesia contributed to the pneumothorax. There was 1 case of papillary carcinoma recurrence, which was diagnosed by follow-up neck ultrasonography. The disease-free interval was 20 months and the recurrence site

was the paratracheal lymph node, confirmed by fine-needle aspiration cytology. We performed limited lymph node dissection through a 1.5-cm mini-incision with the help of intraoperative ultrasonography. There was no significant lymph node enlargement on preoperative neck ultrasonography and CT scan. Given the indolent nature of papillary thyroid carcinoma, we concluded that metastatic lymph nodes were overlooked on preoperative imaging work-up and intraoperative investigation. Thus, we emphasize the importance of thorough investigation of central and cervical lymph nodes, especially when planning the method of thyroid surgery. In conclusion, the BABA can provide an optimal endoscopic view and enables a bilateral approach to the thyroid gland, resulting in a feasible method of total thyroidectomy. The complication rate for the procedure is low and its cosmetic outcome is superior to that of other methods. Therefore, in selected cases such as benign nodules or low-risk T1 thyroid carcinomas not larger than 1 cm, the BABA can be the surgical treatment of choice.

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