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Bilateral Axillo-Breast Approach Robotic Thyroidectomy for Graves' Disease: An Initial Experience in a Single Institute

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Abstract

Background Bilateral axillo-breast approach (BABA) robotic thyroidectomy has shown excellent cosmetic and surgical outcomes. The aim of the present study was to evaluate the safety, feasibility, and initial outcome of this procedure in patients with Graves' disease.

Methods From June 2008 to July 2001, a total of 30 patients with Graves' disease were reviewed retrospectively. Patient demographics, operative indications, and surgical variables, including operative time, blood loss, excised thyroid weight, and complications, were collected and investigated.

Results The thyroidectomies were classified as total ($n = 21$), near-total ($n = 6$), or subtotal ($n = 3$). There were five indications for surgery: concomitant thyroid carcinoma or suspicious nodule ($n = 22$), recurrence after antithyroid medication ($n = 2$), local compressive symptoms ($n = 1$), patient's preference ($n = 4$), and side effects of antithyroid medication ($n = 1$). The mean operative time, console time, blood loss, and excised thyroid weight were 190 min (range: 105–298 min), 113 min (range: 60–227 min), 229 mL (range: 50–550 mL), and 36.6 g (range: 7.8–123.0 g), respectively. There were no cases of postoperative bleeding or conversions to open surgery. Postoperative transient hypoparathyroidism and vocal cord palsy occurred in 13 (43.3 %) and 4 (13.3 %) cases. Permanent hypoparathyroidism occurred in 1 (3.3 %) case. All patients were satisfied with the cosmetic outcomes.

Conclusions BABA robotic thyroidectomy is a feasible and safe treatment for Graves' disease. It is recommended as an alternative for patients who are concerned by the cosmetic effects of traditional thyroidectomy.

Introduction

Surgical resection is usually performed on patients with Graves' disease with concomitant thyroid nodule or malignancy, or on patients who fail to respond to antithyroid drugs [1]. Thyroidectomy has advantages over more conservative treatments, including prompt and definitive control of hyperthyroidism, the avoidance of radiation exposure, and the avoidance of side effects due to antithyroid medication [2]. Thyroidectomy is traditionally performed through a cervical collar incision; however, the cosmetic appearance is a concern for many patients, particularly younger patients [3]. While endoscopic or robotic thyroidectomy can now be performed without a neck scar, there is little data on the use of these procedures in patients with Graves' diseases [1, 3–6], possibly because of the high vascularity and large size of the thyroid gland in these patients [6].

Adequate bleeding control during endoscopic thyroidectomy can be hampered by the two-dimensional visual

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representation and straight, nonflexible endoscopic instruments, which make it difficult to visualize the surgical field and manipulate the surgical instruments [7]. The use of a surgical robot (da Vinci Robot System, Intuitive, Inc., Sunnyvale, CA) has helped to overcome this problem through the use of magnified stereoscopic visualization and flexible instruments, which improve dexterity and enable more meticulous bleeding control, resulting in a safer surgical procedure [7].

A bilateral axillo-breast approach (BABA) for endoscopic thyroidectomy has previously been used to treat various benign and malignant thyroid diseases [8]. We previously reported our experience in 512 cases of BABA endoscopic thyroidectomy and 109 cases of BABA robotic thyroidectomy, and showed oncologic and surgical outcomes comparable to those with conventional open surgery [9, 10]. This successful experience with BABA robotic thyroidectomy led us to extend the indications for this procedure to include patients with Graves' disease. The aim of the present study was to investigate the safety, feasibility, and initial surgical outcome of BABA robotic thyroidectomy in patients with Graves' disease.

Methods

The institutional review board approved this study. Thirty patients (27 women and 3 men) with Graves' disease underwent BABA robotic thyroidectomy at Seoul National University Hospital between June 2008 and July 2011. The mean age of the patients was 32.9 years (range: 19–52 years). There were five indications for BABA robotic thyroidectomy for Graves' disease in this study: concomitant thyroid carcinoma or suspicious nodule, recurrence after antithyroid medication, local compressive symptoms, preference for surgery as the initial treatment, and side effects of antithyroid medication. All patients chose this robotic procedure for cosmetic reasons. Informed consent was obtained from each patient.

Lugol's solution was administered to 24 patients for 10 days before surgery, and all patients were euthyroid at the time of surgery. Vocal cords were examined using video-assisted or direct laryngoscopy 1 day before and 2 weeks after surgery. Recurrent laryngeal nerve (RLN) injury was defined as a postoperative laryngoscopic impairment of the motility of one or both vocal cords. Permanent RLN injury was defined as persistent impairment of vocal cord motility at 6 months after surgery; otherwise, it was considered transient.

Serum levels of calcium, phosphorus, ionized calcium, and parathyroid hormone were measured on postoperative day 1. In cases of postoperative hypoparathyroidism, defined as a total serum calcium level lower than 8.0 mg/dL (normal range: 8.5–10.2 mg/dL), patients were supplemented with 1000–2000 mg of oral calcium and 0.5 μg of a vitamin D analog. Hypoparathyroidism was considered permanent in patients who required calcium and vitamin D supplementation for longer than 6 months after surgery. All patients were followed up at 2 weeks, 3 months, 6 months, and annually. Follow-up tests included clinical examinations for hypoparathyroidism, vocal cord evaluation, and a thyroid function test. In cases where vocal cord injury was noted in the previous follow-up, the vocal cord was re-examined with video-assisted or direct laryngoscopy. In cases where hypoparathyroidism was noted in the previous examination, serum levels of calcium, phosphorus, and parathyroid hormone were also measured.

Surgical Procedure

The BABA robotic thyroidectomy surgical technique used in this study has been previously described [11]. In brief, the patient was placed in a supine position with a pillow under the shoulders to enable neck extension. After marking the skin flaps, diluted epinephrine (1:200000) was injected in the flap area (Fig. 1). After the flaps were raised, bilateral axillary and circumareolar ports (8–12 mm) were inserted with a tunneler. The flap extended to the thyroid cartilage superiorly, 3 cm below the clavicle inferiorly, and laterally from just beyond the lateral border of one sternocleidomastoid muscle to the other. The robot was then docked, and the midline was divided with a hook until the thyroid was identified. After visualization of the cricothyroid membrane, the isthmus, and the central group of lymph nodes, the isthmus was divided with a harmonic scalpel, facilitating the dissection of the gland laterally and posteriorly, as well as allowing for optimal visualization of the superior thyroid pedicle. The middle thyroid pedicle was then ligated and divided with Harmonic Shears. The remainder of the thyroidectomy was then performed with a full view of the middle and inferior thyroid pedicles, the RLN, and the superior and inferior parathyroid glands. Where bleeding occurred, Harmonic Shears, Hem-o-lock clips, and Endo-Clips were used to control the source of bleeding. After unilateral thyroidectomy, the excised lobe was delivered in an endopouch (Fig. 2). The contralateral lobe was dissected in a similar manner. Central node dissection was performed in patients with concomitant malignancy or a suspicious nodule. A suction drain was inserted unilaterally, and a surgical brassiere was used to provide compression of the flaps.

Results

Bilateral axillo-breast approach robotic thyroidectomy was successful in all patients, and none required conversion to

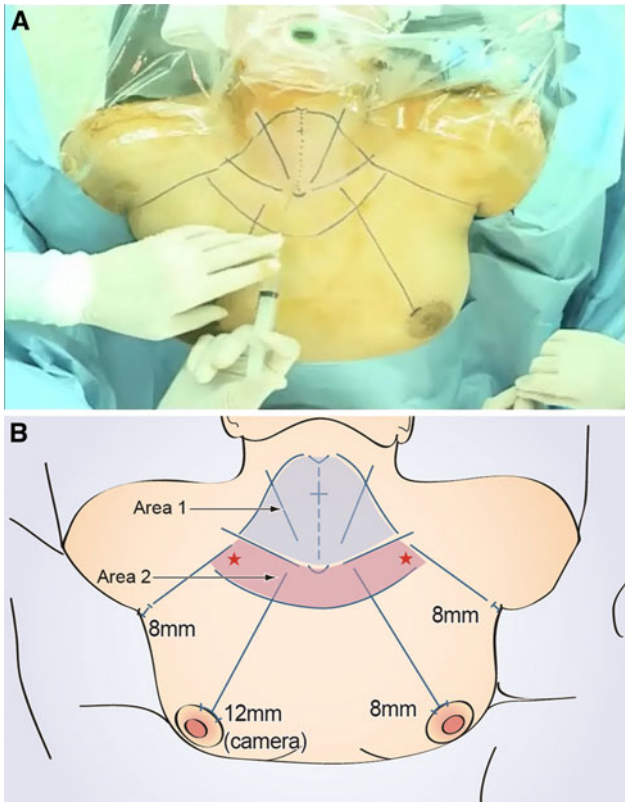

Fig. 1 **a.** Guidelines of bilateral axillo-breast approach (BABA) robotic thyroidectdomy. **b.** Illustration of guidelines

open surgery. As shown in Table 1, there were five indications for surgery: concomitant thyroid carcinoma or a suspicious nodule ($n = 22$; 73.3 %), an initial preference for surgical treatment ($n = 5$; 16.7 %), failure of antithyroid medication ($n = 2$; 6.7 %), and side effects from antithyroid medication ($n = 1$; 3.3 %). The choice of total thyroidectomy, near-total thyroidectomy, or bilateral subtotal thyroidectomy depended on the indications for surgery and the results of previous treatments. Near-total thyroidectomy or total thyroidectomy with central lymph node dissection was recommended if concomitant thyroid carcinoma or a suspicious nodule was present. Total thyroidectomy was performed in 21 patients, near-total thyroidectomy in 6 patients, and bilateral subtotal thyroidectomy in 3 patients.

The mean operating time, defined as the time from skin incision to skin closure, was 190 min (range: 105–298 min), and the mean console time, defined as the time from the robot docking to completion of the thyroidectomy, was 113 min (range: 60–227 min) (Table 2). The mean blood loss and mean resected thyroid weight were 229 mL (range: 50–550 mL) and 38.5 g (range: 15.5–123.0 g), respectively. Fractional resection was performed in one patient whose resected thyroid weight was 123.0 g. Postoperative transient hypoparathyroidism occurred in 13 patients (43.3 %), but permanent hypoparathyroidism occurred in only 1 patient (3.3 %). Laryngoscopic examination revealed that 4 patients had unilateral vocal cord palsy, including one case of voice complaint (hoarseness). After 3 months, the hoarseness improved, and no patient showed vocal cord palsy upon laryngoscopic examination. The mean hospital stay was 3.5 days (range: 3–6 days), and the mean follow-up period was 19.8 months (range: 0.5–46.5 months). There was no recurrence of hyperthyroidism in any of the 3 patients who underwent bilateral subtotal thyroidectomy.

Discussion

This study showed that BABA robotic thyroidectomy can be safely performed in patients with Graves' disease. Various techniques have been introduced since endoscopic thyroidectomy was first reported in 1997 [12–15]; however, there are very few data on endoscopic or robotic surgery for Graves' disease, with most reported patients undergoing endoscopic subtotal thyroidectomy [1, 6, 16]. The use of endoscopic thyroidectomy for Graves' disease is controversial because of the high vascularity and large size of the thyroid gland. Sasaki et al. [1] proposed that a cervical approach is safer than an endoscopic approach in patients with a thyroid weight >60 g. Yamamoto et al. [3] have reported that endoscopic thyroidectomy should only be indicated for patients with a comparatively small goiter (<100 g). To our knowledge, there is only one report of robot-assisted subtotal thyroidectomy, in five patients in whom a gasless transaxillary approach was used; the authors considered that these patients underwent subtotal thyroidectomy because of the risk of contralateral RLN injury [17]. We postulated that robotic surgery would overcome the shortcomings of endoscopic surgery, and that BABA robotic thyroidectomy would be an effective and feasible option for treating Graves' disease.

Despite the high vascularity of the thyroid gland, bleeding could be controlled using the robot system. This is so because the operative view afforded by BABA robotic thyroidectomy is symmetrical and similar to that of conventional open surgery. Also, the endo-wrist function of the robot system allows bleeding to be controlled in a manner similar to open surgery. The Harmonic Scalpel and bipolar coagulation forceps were also effective for dissection and hemostasis. Furthermore, for large vessels (>5 mm), Hemo-locks and Endo-clips are an effective alternative. We found that by using these devices, meticulous bleeding control could be achieved during BABA robotic thyroidectomy for Graves' disease.

There was no case of postoperative bleeding or conversion to open surgery. The incidence of transient and permanent hypoparathyroidism was 43.3 and 3.3 %, respectively. The patient with permanent hypoparathyroidism was a 29-year-old

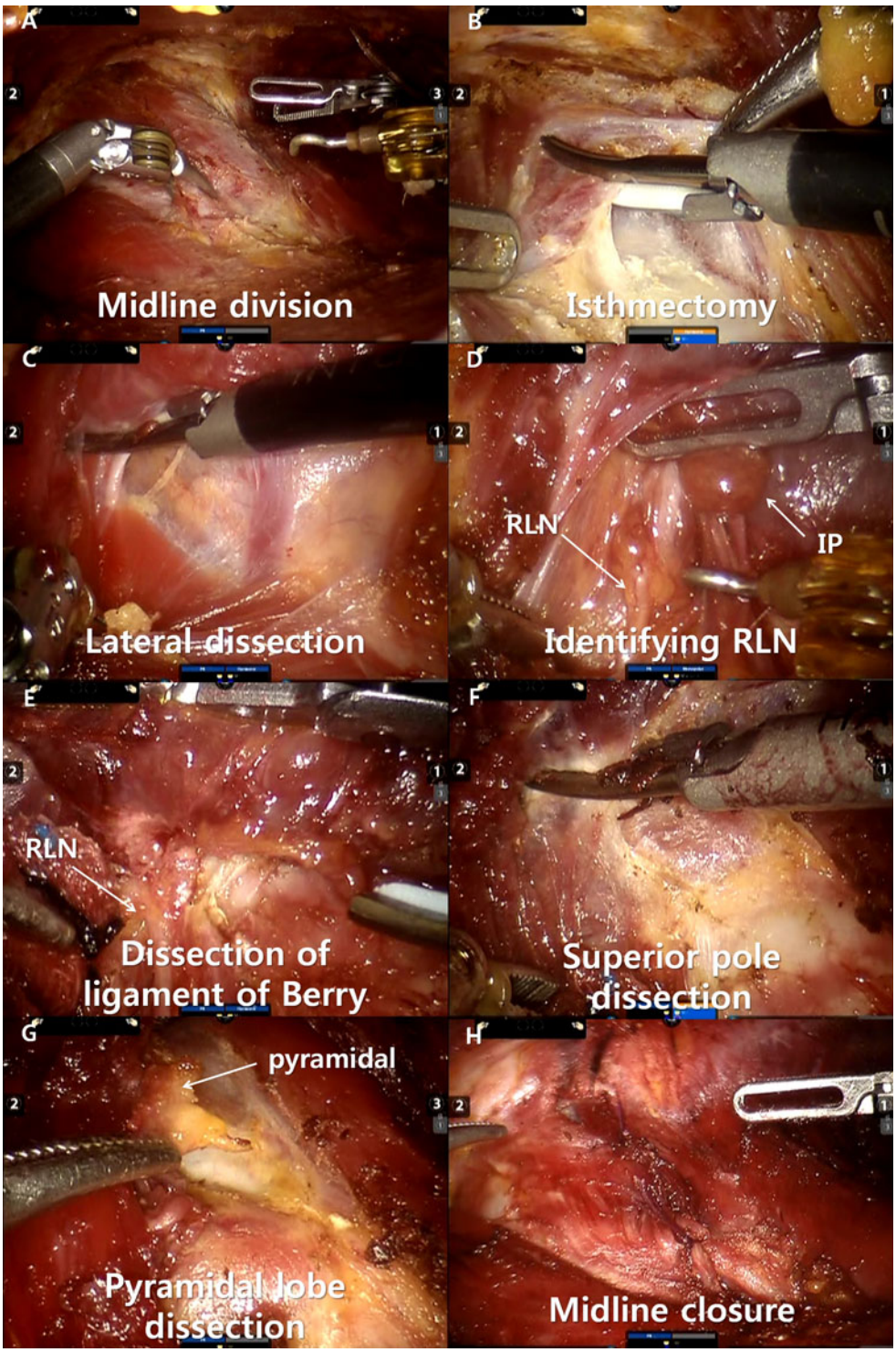

Fig. 2 **a–h** Surgical procedures for BABA robotic thyroidectomy. *RLN* recurrent laryngeal nerve, *IP* inferior parathyroid

woman with a 1.1-cm-sized papillary thyroid carcinoma; she underwent total thyroidectomy with bilateral central lymph node dissection. This patient had T3N1a papillary cancer, and pathologic examination revealed that two parathyroid glands were resected along with metastatic lymph nodes. Transient and permanent vocal cord palsy occurred in 13.3 and 0 % of patients, respectively. These results were comparable with those reported for open thyroidectomy for Graves' disease: permanent vocal cord palsy and hypoparathyroidism occurred in 0–3.4 and 0–2.8 % of patients, respectively [18].

Surgical treatment for Graves' disease includes total thyroidectomy, near-total thyroidectomy, and subtotal thyroidectomy. Subtotal thyroidectomy was traditionally preferred, because transient postoperative hypoparathyroidism

Table 1 Patient demographics

Characteristics	
Gender (male:female)	3:27
Age, years	32.9 ± 9.4 (range: 19–52)
Surgical indication	
Concomitant thyroid carcinoma or suspicious nodule	22 (73.3 %)
Recurrence after medication	2 (6.7 %)
Local compressive symptoms	1 (3.3 %)
Patient preference	4 (13.2 %)
Side effects of antithyroid drugs	1 (3.3 %)
Extent of operation	
Total thyroidectomy ± central LN dissection	21 (70 %)
Near-total thyroidectomy ± central LN dissection	6 (20 %)
Bilateral subtotal thyroidectomy	3 (10 %)
Preoperative TSH-R antibody level, %	40.3 (range: 11.9–91.8)

LN lymph node, *TSH-R* thyroid stimulating hormone receptor

Table 2 Surgical outcomes after bilateral axillo-breast approach robotic thyroidectomy

Characteristics	
Operative time, min	190 (range: 105–298)
Console time, min	113 (range: 60–227)
Blood loss, mL	229 (range: 50–550)
Excised thyroid weight, g	36.6 (range: 7.8–123)
Fractional resection	1 (3.3 %)
Hospital stay, days	3.5 (range: 3–6)
Median follow-up, months	19.8 (range: 0.5–46.5)
Complications	
Transient RLN palsy	4 (13.3 %)
Transient hypoparathyroidism	13 (43.3 %)
Permanent RLN palsy	0 (0 %)
Permanent hypoparathyroidism	1 (3.3 %)
Bleeding	0 (0 %)

RLN recurrent laryngeal nerve

occurred more frequently in patients after total thyroidectomy [19]. However, recent reports recommend total thyroidectomy because the rate of permanent complications after total thyroidectomy is not higher than after subtotal thyroidectomy [20, 21]. Furthermore, the recurrence rate of Graves' disease is ~0 % for total thyroidectomy compared with 8 % for subtotal thyroidectomy [21]. The management guidelines of both the American Thyroid Association and the American Association of Clinical Endocrinologists now recommend near-total or total thyroidectomy for hyperthyroidism due to Graves' disease [2]. Total thyroidectomy for Graves' disease can be easily performed using the BABA approach, without significant complications.

In conclusion, we have shown that BABA robotic thyroidectomy is a feasible and safe procedure for the surgical treatment of Graves' disease, with excellent clinical and cosmetic outcomes. It is recommended as an alternative option for patients with Graves' disease who require surgical resection.

Conflict of interest Drs. Kwon, Koo, Choi, Kim, Lee, and Youn have no conflicts of interest or financial ties to disclose.

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