Surgical completeness of bilateral axillo-breast approach robotic thyroidectomy: Comparison with conventional open thyroidectomy after propensity score matching

Kyu Eun Lee, MD,[a] Do Hoon Koo, MD,[a,b] Hyung Jun Im, MD,[c] Sue K. Park, MD,[d,e,f] June Young Choi, MD,[a] Jin Chul Paeng, MD,[c] June-Key Chung, MD,[c] Seung Keun Oh, MD,[a] *and* **Yeo-Kyu Youn, MD,[a]** *Seoul, Korea*

Background. *Bilateral axillo-breast approach (BABA) robotic thyroidectomy (RoT) has good postoperative and excellent cosmetic outcomes. To assess the surgical completeness of BABA RoT, it was compared to open thyroidectomy (OT) after propensity score matching of the cohorts.*

Methods. *Between 2008 and 2010, 760 patients who underwent total thyroidectomy with central node dissection (CND) caused by papillary thyroid carcinoma (PTC) in Seoul National University Hospital were enrolled; 327 BABA robotic and 423 open method operations were performed. We selected 174 robotic and 237 open thyroidectomy patients who received radioactive iodine (RAI) ablation. Propensity score matching using 3 demographic and 5 pathologic factors was used to generate 2 matched cohorts, each composed of 108 patients.*

Results. *The matched BABA RoT and OT cohorts were not different with regard to the RAI uptake ratio, stimulated thyroglobulin (Tg) levels, or proportion of patients with stimulated Tg levels < 1.0 ng/mL on the first ablation. The number of RAI ablation sessions and RAI doses needed to achieve a complete ablation also did not differ significantly.*

Conclusion. *The surgical completeness of BABA RoT did not differ from OT. BABA RoT may be suitable for patients with PTC who prefer scarless neck surgery. (Surgery 2011;150:1266-74.)*

From the Department of Surgery and Cancer Research Institute,[a] Seoul National University College of Medicine; Department of Surgery,[b] Seoul National University Boramae Medical Center; Department of Nuclear Medicine and Cancer Research Institute,[c] Seoul National University College of Medicine; Department of Preventive Medicine and Cancer Research Institute,[d] Seoul National University College of Medicine; Department of Biomedical Science,[e] Seoul National University Graduate School; and Medical Research Collaborating Center,[f] Seoul National University and Seoul National University Hospital, Seoul, Korea

The incidence of well differentiated thyroid cancer is increasing in Korea and worldwide.[1,2] Thyroid cancer is particularly prevalent in young women, who are often concerned about postoperative neck scars; moreover, the prognosis of thyroid cancer is favorable, which places particular emphasis on quality-of-life issues.[1-3] These issues mean that thyroid cancer management should be based on an oncoplastic concept where both complete surgical resection of the thyroid gland (including the tumor) and the cosmetic outcome are pursued simultaneously.[4] In 2008, we combined the bilateral axillo-breast approach (BABA) technique with the fundamental advantages of the robotic system and examined the feasibility and postoperative outcomes of BABA robotic thyroidectomy (RoT).[5,6]

Since Hüscher et al[7] first reported an endoscopic thyroid resection in 1997, various endoscopic methods in the field of head and neck surgery have been developed.[8-12] However, only a few studies have investigated the surgical completeness of endoscopic or robot-assisted thyroidectomy.[13-15] With regard to determining surgical completeness, it has been reported that thyroglobulin (Tg) levels and radioactive iodine (RAI) uptake are suitable

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Reprint requests: Yeo-Kyu Youn, MD, Department of Surgery, Seoul National University College of Medicine, 101 Daehang-ro, Jongro-gu, Seoul, 110-744, Korea. E-mail: ykyoun@plaza.snu.ac.kr.

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markers for the amount of thyroid tissue that remains after thyroidectomy.[16,17]

To assure the surgical completeness of BABA RoT, we generated matched BABA RoT and open thyroidectomy (OT) cohorts by propensity score matching and then compared them in terms of the thyroid bed–to-background ratio (TBR) of RAI uptake on the first RAI scan, the stimulated Tg levels on the first RAI scan, and the number of sessions and doses needed to ablate the remnant thyroid completely.

PATIENTS AND METHODS

Study population. Between February 2008 and February 2010, a total 760 patients who underwent total thyroidectomy with central node dissection (CND; either prophylactic or therpapeutic) because of papillary thyroid carcinoma (PTC) in Seoul National University Hospital were enrolled. Of them, 327 patients were operated on using the BABA robotic method; 423 underwent operations using the open method. According to RAI ablation, we subdivided RAI-positive and RAI-negative groups. The indications for RAI ablation were as follows: all patients with stage III or IV disease; all patients with stage II disease who were younger than 45 years of age; most patients with stage II disease who were 45 years of age or older; and selected patients with stage I disease, especially those with multifocal disease, nodal metastases, extrathyroidal or vascular invasion, and/or more aggressive histologies.[18] To evaluate the surgical completeness of BABA RoT, RAI ablation–positive groups were chosen from both BABA RoT and OT patients. Of 327 BABA RoT patients, 174 (53.2%) received RAI ablation; of 423 OT patients, 237 (56.0%) received RAI ablation (Fig 1). Finally, 108 patient sets were selected after matching by propensity scores composed of 3 demographic and 5 pathologic factors to avoid selection and information bias.

RAI ablation and measurement of the RAI uptake ratio. The indicated patients received RAI ablation therapy 8 to 12 weeks after the operation. For this, 30 mCi of I-131 was administered orally in most cases, excluding 6 cases of >100 mCi in the RoT group and 7 cases in the OT group. In the BABA RoT group, RAI was administered after human recombinant thyroid-stimulating hormone (TSH) injection in 12 (6.9%) of 174 cases. In the OT group, 4 (1.7%) of 237 cases used human recombinant TSH. In the other patients, T4 was withdrawn for 4 weeks. The serum-stimulated Tg and TSH levels were measured on the day of RAI administration and by radioimmunoassay using commercial assay kits (Brahms, Henningsdorf, Germany). A whole body scan for RAI was performed 3 days after its administration.

The remaining thyroid was measured by determining the uptake of RAI on the first ablation scan. For this, a rectangular region of interest (ROI) that encircled all remnant activity as the thyroid bed was drawn on the neck. Thereafter, another ROI of the same size and shape was drawn on the brain area as a reference region (Fig 2). The counts of both ROIs were measured and the count ratio of the 2 ROIs was calculated. This TBR value represents the amount of thyroid that remains.

Ablation of the remnant thyroid was repeated until the ablation scans no longer detected remnant thyroid tissue. The number of RAI ablation sessions and the dose needed to achieve complete ablation were also included as measures of the surgical completeness of the 2 operative methods.

Statistical analysis. The basic characteristics between the BABA RoT and OT groups were compared using the Student t test for continuous variables and the Pearson χ^2 test for categorical variables. To reduce treatment selection bias and potential confounding effects in this study, we conducted propensity score matching. Propensity score measures the likelihood that a person would have been treated using covariates score. Therefore propensity score matching balance the covariates and increase the comparability between the BABA RoT and OT groups.[19] We selected 8 factors with significant differences between the 2 groups as follows: gender, age, body mass index (BMI), tumor size, multifocality/bilaterality, extrathyroid extension, lymph node (LN) metastatsis, and thyroiditis. After propensity score matching, the 2 groups were compared in terms of the baseline characteristics and the main clinical parameters that represent surgical completeness. Categorical variables were analyzed using the McNemar test, while continuous variables were analyzed with a paired t test or the Wilcoxon signed-rank test. All P values are 2-sided.

RESULTS

Characteristics of the study population before matching. The baseline characteristics of the BABA RoT and OT patients are shown in Table I. The BABA RoT group had significantly more females than the OT group (88.5 vs 78.9%; $P = .012$) and was also younger on average (39.9 ± 8.8 years [range, 18–63] vs 51.1 ± 11.1 years [range, 21–78]; $P < .001$) and had a lower average BMI (22.9 ± 3.0 kg/m^2

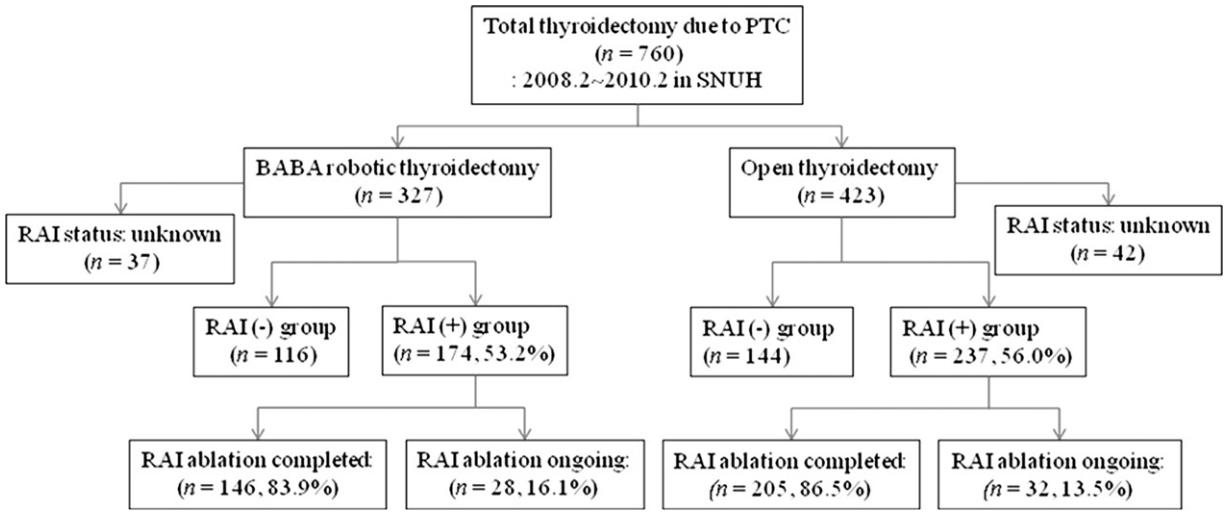

Fig 1. Schematic depiction of the 327 patients who received bilateral axillo-breast approach robotic total thyroidectomy and the 423 patients who received open total thyroidectomy and were then stratified according to whether radioactive iodine ablation was given. *BABA*, Bilateral axillo-breast approach; *PTC*, papillary thyroid carcinoma; *RAI*, radioactive iodine.

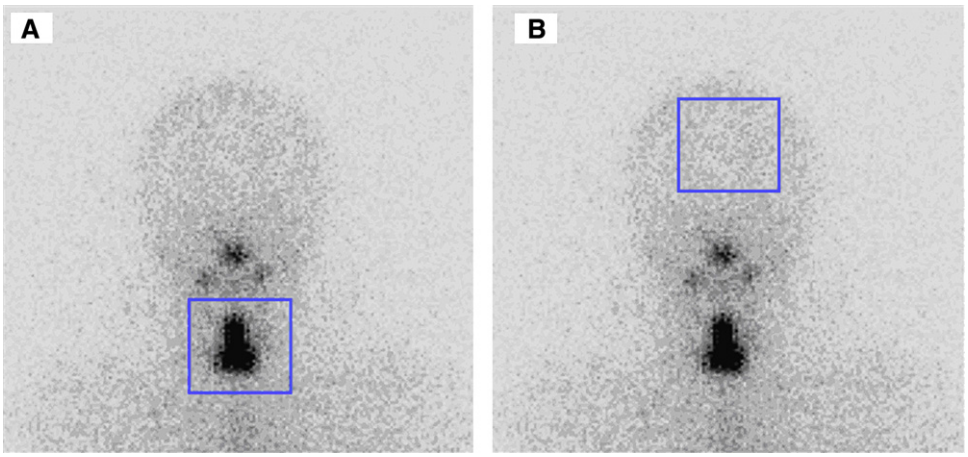

Fig 2. Assessment of remnant thyroid on the first ablative scan by measuring the thyroid bed–to-background ratio of radioactive iodine uptake on the basis of region of interest counts. (*A*) Region of interest count of the thyroid bed (target region). (*B*) Region of interest count of the brain area (reference region).

[range, 17.0–31.8] vs 23.9 ± 3.1 kg/m^2 [range, 17.1–38.2]; $P < .001$).

In terms of mean tumor size, as determined by the histologic examination, the BABA RoT group (0.80 ± 0.36 cm [range, 0.2–2.7]) did not differ significantly from the OT group (0.90 ± 0.49 cm [range, 0.1–3.6]; $P = .054$). They also did not differ significantly in terms of prevalence of multifocality (45.1% vs 37.1%)/bilaterality (24.3% vs 18.1%; $P = .218$), extrathyroid extension (76.2% vs 75.4%; $P = .862$), or LN metastasis (48.4% vs 40.9%; $P = .228$). However, the BABA RoT patients had a higher prevalence of thyroiditis (40.5% vs 25.3%; $P = .001$). Based on tumor, node, metastasis staging according to the American Joint Committee on Cancer's *Cancer Staging Manual, 7th edition*, the 2 groups did not differ in terms of T stage ($P = .647$), but the BABA RoT patients were more likely to have stage I disease while the OT patients were more likely to have stage III disease ($P < .001$).

With regard to the clinical parameters that represent surgical completeness (Table II), the TBRs of RAI uptake on the first ablation in the BABA RoT and OT groups were 12.2 ± 13.1 (range, 1.0–86.7) and 13.8 ± 13.4 (range, 1.4–76.6), respectively ($P = .078$), the TSH levels were 109 ± 64 μIU/mL (range, 0.3–445) and 101 ± 62 μIU/mL (range, <0.05–268), respectively ($P = .144$), and the mean

Table I. Baseline characteristics of 411 patients who received radioactive iodine ablation after bilateral axillo-breast approach robotic thyroidectomy or open thyroidectomy

Variables	*BABA RoT* (n = *174*)	*OT* (n = *237*)	P *value*
Clinical demographics			
No. of females	154 (88.5%)	187 (78.9%)	.012
Mean age in years (range)	39.9 ± 8.8 (18–63)	51.1 ± 11.1 (21–78)	<.001
Mean BMI, kg/m^2 (range)	22.9 ± 3.0 (17.0–31.8)	23.9 ± 3.1 (17.1–38.2)	<.001
Pathologic parameters			
Mean tumor size on histology, cm (range)	0.80 ± 0.36 (0.2–2.7)	0.90 ± 0.49 (0.1–3.6)	.054
Multifocality/bilaterality	78* (45.1%)/42* (24.3%)	88 (37.1%)/43 (18.1%)	.218
Extrathyroid extension	131† (76.2%)	178* (75.4%)	.862
Lymph node metastasis	82 (48.4%)	97 (40.9%)	.228
Thyroiditis (Hashimoto or lymphocytic)	70* (40.5%)	60 (25.3%)	.001
T stage (T1a/T1b/T2/T3/TX‡)	37 (21.3%)/8 (4.6%)/0/128 (73.6%)/1 (0.6%)	51 (21.6%)/8 (3.4%)/1 (0.4%)/176 (74.6%)/1 (0.4%)	.647
Stage I/II/III (%)	123 (70.7%)/0/51 (29.3%)	78 (32.9%)/1 (0.4%)/158 (66.7%)	<.001

*One case unknown.
†Two cases unknown.
‡Primary tumor cannot be assessed.
BABA, Bilateral axillo-breast approach; *BMI*, body mass index; *OT*, open thyroidectomy; *RAI*, radioactive iodine; *RoT*, robotic thyroidectomy.

stimulated Tg levels were 1.4 ± 3.9 ng/mL (range, <0.1–37.4) and 1.2 ± 3.1 ng/mL (range, <0.1–38.7), respectively (P = .998). Excluding 7 cases for distant metastasis or abnormal RAI uptakes, the BABA RoT and OT groups also did not differ in terms of proportion of patients whose Tg levels were <1.0 ng/mL on the first ablation (69.1% vs 68.6%; P = .924). While the OT group required more RAI ablation sessions to ablate the remnant thyroid completely (2.05 ± 0.51 [range, 1–4] vs 1.95 ± 0.49 [range, 1–3]; P = .050), the BABA RoT and OT groups did not differ with regard to the total RAI dose needed to achieve complete ablation (62.2 ± 19.1 mCi [range, 30–150] vs 66.8 ± 27.3 mCi [range, 30–300]; P = .113).

Outcomes of the matched cohorts. Propensity score matching of the 174 BABA RoT and 237 OT patients yielded 108 matched pairs of patients. The matched cohorts did not differ in terms of the 8 covariates that were used, as determined by using statistical methods that are appropriate for matched data (Table III). Therefore, the significant differences in gender, age, BMI, and thyroiditis between the 2 groups seen on the initial analysis were no longer present.

The matched cohorts also did not differ in terms of the clinical parameters that reflect surgical completeness. On the first ablation, the TBRs of RAI uptake for the BABA RoT and OT groups were 12.8 ± 13.3 (range, 1.0–83.6) and 13.5 ± 13.3 (range, 1.4–76.6), respectively (P = .319), the mean TSH levels were 106.8 ± 69.2 μIU/mL (range, 0.58–445) and 110.1 ± 62.1 μIU/mL (range, <0.05–265), respectively (P = .385). Excluding 4 cases for distant metastasis or abnormal RAI uptakes, the mean stimulated Tg levels were 1.4 ± 3.8 ng/mL (range, <0.1–36.4) and 1.4 ± 3.9 ng/mL (range, <0.1–38.7), respectively (P = .564), and 65.0% and 68.5% of the 2 groups had stimulated Tg levels <1.0 ng/mL, respectively (P = .593). The matched cohorts also did not differ in terms of the total number of RAI ablation sessions (1.97 ± 0.46 [range 1–3] vs 1.98 ± 0.52 [range 1–3]; P = .774) and the dose needed to achieve complete ablation (65.8 ± 35.4 mCi [range, 30–150] vs 68.3 ± 34.6 mCi [range, 30–300]; P = .468).

DISCUSSION

The present study was performed to investigate whether the BABA RoT can achieve as much surgical completeness as OT. For this purpose, matched BABA RoT and OT cohorts were obtained by propensity score matching, which served to minimize baseline differences between the original patient cohorts. The clinical parameters that reflect surgical completeness were then compared—namely, TBR of RAI uptake and Tg levels on the first RAI scan and the total number of sessions and doses needed to ablate the remnant thyroid completely. The 2 matched groups did not differ in terms of any of these clinical parameters of surgical completeness.

In the last decade, various endoscopic methods, including the cervical,[8,12] chest wall/axillary,[10] and breast[9,11] approaches, were introduced in the field of head and neck surgery. We developed the BABA technique in 2004 and have used it to treat

Table II. Clinical parameters for surgical completeness of 411 patients who received radioactive iodine ablation after bilateral axillo-breast approach robotic thyroidectomy or open thyroidectomy

Clinical parameters for surgical completeness	*BABA RoT* (n = *174*)	*OT* (n = *237*)	P *value*
Mean TBR of RAI uptake on first ablation (range)	12.2 ± 13.1 (1.0–86.7)	13.8 ± 13.4 (1.4–76.6)	.078
Mean TSH in μIU/mL on first ablation (range)	109 ± 64* (0.3–445)	101 ± 62 (<0.05~268)	.144
Mean stimulated Tg in ng/mL on first ablation (range)‡	1.4 ± 3.9* (<0.1–36.4)	1.2 ± 3.1† (<0.1~38.7)	.998
Proportion of stimulated Tg <1.0 ng/mL on first ablation‡	114* (69.1%)	162† (68.6%)	.924
Mean total no. of RAI ablation sessions‡	1.95 ± 0.49 (1–3)	2.05 ± 0.51 (1–4)	.050
Mean total RAI ablation dose (mCi)‡	62.2 ± 19.1 (30–150)	66.8 ± 27.3 (30–300)	.113

*Two cases unknown.
†One case unknown.
‡Seven cases excluded from distant metastasis or abnormal radioactive iodine uptake.
BABA, Bilateral axillo-breast approach; *OT*, open thyroidectomy; *RAI*, radioactive iodine; *RoT*, robotic thyroidectomy; *TBR*, thyroid bed–to-background ratio; *Tg*, thyroglobulin; *TSH*, thyroid-stimulating hormone.

both benign and malignant thyroid diseases.[20] The BABA method provides an operative view that is similar to that obtained by the open midline approach, which is familiar to most endocrine surgeons. It allows for good visualization of bilateral structures, such as the recurrent laryngeal nerves and parathyroid glands. Its postoperative complication rates are comparable to those of the open approach, while its cosmetic outcomes are excellent. In 2008, we combined our unique BABA technique with the vital advantages of the da Vinci surgical robot system, which include high definition 3-dimensional imaging, the EndoWrist function, easy operative manipulation, and a short learning curve. The technical feasibility and surgical outcomes of this combination were then reported.[6,21]

However, it remains important to ensure that endoscopic or robotic thyroid surgery achieves the same surgical completeness as OT. Two reports have shown that endoscopic approaches for selected cases of PTC that require total thyroidectomy are as suitable as the open procedure, as indicated by the RAI uptake, postoperative Tg levels, and successful ablation rates.[15,22] Our previous study on 109 cases of BABA RoT found similar results.[21] However, although these studies involved relatively large numbers of patients and long durations of follow-up, the assignment of the patients into the endoscopic and open groups was not randomized. Therefore, it remains possible that patient selection factors may have influenced the results, which limits the usefulness of these studies. Indeed, such studies could be defined as observational studies, which are defined as etiologic or effectiveness studies that use an existing database. Such studies are known to be subject to selection bias and confounding in terms of the inclusion of the study population and the assessment of the associated causes and the resulting outcomes.[23] To minimize these biases and confounding factors, we performed propensity score matching, thereby adjusting the baseline differences between the groups in terms of patient characteristics.[19,24] Therefore, although the design of the present study did not involve randomization, this study can be seen as an upgraded type of case-matched control study in which 8 covariates were matched.

To determine the surgical completeness of BABA RoT, several clinical parameters were measured. First, on the first ablation, the RAI uptake ratio between the thyroid bed as the target region and the brain area as the reference region was measured together with the proportion of patients whose stimulated Tg levels were <1.0 ng/mL. These RAI uptake ratios were calculated as the ratio of thyroid bed counts divided by brain area count on the same image and could show relative rather than absolute completeness, which is amenable to comparing 2 surgical methods. The number of sessions and doses needed to completely ablate the remnant thyroid were recorded. Those cases of distant metastasis or abnormal RAI uptakes are excluded from the analysis of stimulated Tg level and times and dose for complete RAI ablation, which could reflect a systemic burden of remnant thyroid. Salvatori et al[14] have reported that video-assisted endoscopic thyroidectomy was similar to conventional OT in terms of postoperative RAI uptake, stimulated Tg levels, and successful ablation rates. RAI uptake (defined as the TBR) and stimulated Tg levels are considered to be reliable surrogate markers that reflect the amount of remnant thyroid tissue.[16,17] Total session numbers and doses needed for complete

Table III. Baseline characteristics and clinical parameters for surgical completeness of the bilateral axillo-breast approach robotic and open total thyroidectomy groups (n = 108 for both) after propensity score matching using 8 covariates

Characteristics	*BABA robotic* (n = *108*)	*Open* (n = *108*)	P *value*
Matched 8 covariates from clinicopathologic parameters			
No. of females (%)	91 (84.3%)	91 (84.3%)	1.000
Mean age, yrs (range)	43.7 ± 7.4 (23–62)	43.8 ± 8.8 (21–66)	.939
Mean body mass index in kg/m2 (range)	23.4 ± 3.0 (17.2–31.8)	23.1 ± 2.7 (17.1–30.6)	.869
Mean tumor size on histology, cm (range)	0.82 ± 0.38 (0.2–2.3)	0.83 ± 0.40 (0.1–2.7)	.827
Multifocality/bilaterality	47 (43.5%)/27 (25.0%)	37 (34.2%)/17 (15.7%)	.220
Extrathyroid extension	83 (77.9%)	82* (76.8%)	.974
Lymph node metastasis	52 (49.5%)	44 (40.7%)	.338
Thyroiditis (Hashimoto or lymphocytic)	37 (34.3%)	40 (37.0%)	.776
Clinical parameters for surgical completeness			
Mean TBR of RAI uptake (range)	12.8 ± 13.3 (1.0–83.6)	13.5 ± 13.3 (1.4–65.7)	.319
Mean TSH, μIU/mL (range)	107 ± 69* (0.6–445)	110 ± 62 (<0.05~265)	.385
Mean stimulated Tg, ng/mL (range)†	1.4 ± 3.8* (<0.1–36.4)	1.4 ± 3.9 (<0.1~38.7)	.564
Proportion of stimulated Tg <1.0 ng/mL†	70* (64.2%)	78 (69.0%)	.593
Mean total no. of RAI ablation sessions (range)†	1.97 ± 0.46 (1–3)	1.98 ± 0.52 (1–3)	.774
Mean RAI ablation dose, mCi (range)†	65.8 ± 35.4† (30–380)	68.3 ± 34.6† (30–300)	.468

*One case unknown.

†Four cases excluded from distant metastasis or abnormal radioactive iodine uptake.

BABA, Bilateral axillo-breast approach; *RAI*, radioactive iodine; *TBR*, thyroid bed-to-background ratio; *Tg*, thyroglobulin; *TSH*, thyroid-stimulating hormone.

ablation also indirectly reflect successful ablation rates. In the present study, the 2 matched cohorts did not differ significantly in terms of any of these surgical completeness parameters. Notably, the proportion of patients whose stimulated Tg levels on the first ablation were <1.0 ng/mL (65.0% and 68.5% for the BABA RoT and OT groups, respectively) were similar to the proportion reported for BABA RoT in our previous study (41/54; 76%).[21] In other words, numerical Tg value itself is not considered as absolute criterion of the surgical completeness but could be used as a relative marker to compare the 2 approaches.

In conclusion, when BABA RoT and OT were compared after adjusting the patient cohorts by propensity score matching, they did not differ with regard to any of the surgical completeness parameters, including the TBR of RAI uptake and stimulated Tg levels on the first RAI scan, and the total number of sessions and doses needed to ablate the remnant thyroid. Therefore, we can say that the surgical completeness (which can be regarded as oncologic safety) of BABA RoT is not inferior to that of OT. This oncologic safety of BABA RoT, together with its surgical safety and its excellent cosmetic outcome, suggests that it may be suitable for patients with PTC who would prefer scarless neck surgery to treat their thyroid malignancy.

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DISCUSSION

Dr Steven Libutti (Bronx, NY): I have now been convinced by your group and others that a robotic thyroidectomy can be performed safely. It can be performed adequately in terms of a cancer operation. And that, certainly, the imaging and magnification that you see and the cosmetic benefits are appropriate, both for the surgeon to get a better look at what you are operating on and for the patient to get a better cosmetic outcome.

But in the United States, we are going through now a re-evaluation of our healthcare system. And yesterday, accountable care organization metrics were published for the first time. And I know at my institution, we are spending a lot of time now looking at how reimbursement is going to work in the future.

And what I have not seen yet by any of the groups that have performed this application of robotic surgery is what the costs are going to be. Because the metrics we're going to be scored by here, I don't know if cosmetic outcome is going to carry that much weight as one group competes against another for contracts with the government and other payers.

So, my question to you is—and this may not have direct translation to costs in the United States—but I guess my question and my challenge to the groups that are doing this in large numbers is to show what are the cost differences between robotic thyroidectomy and standard thyroidectomy? And what benefits in terms of length of stay, morbidity, and other outcomes metrics that we're all going to be tracked by can be improved with this approach? Because equivalence, I don't think, necessarily, is going to hold the day when one must invest the cost in robots, et cetera, to do this procedure. But if you can address a little bit on the cost of using this approach, that would be great.

Dr Kyu Eun Lee (Seoul, Korea): This is a very important question and, actually, we are working on the cost-effectiveness analysis. In the near future, I hope I can provide evidence of the financial safety of this approach. But the main question would be: what is the cost to alter the scarred neck? And I think we should have some perspective of that question. And I'm sure there is a cultural difference between the countries or races, but I'm sure your question is very important and we should deal with it in the future.

Dr Jeffrey F. Moley (St. Louis, MO): I've followed your work and the work from Japan on minimally invasive techniques with a lot of interest over the last few years. My question is, you're trading off 1 small scar in the neck for 4 scars: 1 under each axilla, 1 under each breast. I personally would prefer a small scar in the neck. Because patients come in and they ask about this approach, and there are people in the United States who are doing it. And I'm happy to refer them if that's what they want. But most of the time, American patients are not particularly interested in having a complicated approach that requires 4 incisions just in order to preserve their neck. Our scars are quite small. And most

of the patients are satisfied with them, and they are happy with the cosmetic appearance.

Are you having that problem at all in your country? Are there some patients who are saying, "Look, I don't really care about the scar. You know, I don't want to have 4 incisions." So, I was wondering if you could comment on that, and how prevalent is this attitude that 4 scars in more remote locations are better than 1 scar in the neck?

Dr Kyu Eun Lee (Seoul, Korea): This is a psychological safety issue. In Korea, most patients regard a 1-or 2-cm incision on the neck as equivalent to a 5-cm incision on the neck. It is the same. So, a smaller incision does not mean much. I just know the Korean image. To them, they are the same. So, if they want to do something more cosmetically secure, they want their scars in remote areas. There could be some difference between the cultures or something like that. In the Caucasian cultural area, scars, which are experienced on the outside is considered something to mock, that someone has some disease. And it is a different situation between the 2 cultures. And we are actually working on these issues, also, for future meetings.

Dr Cord Sturgeon (Chicago, IL): Just a comment. I think this is fascinating. I enjoyed the presentation. And the questions from Dr Libutti and Dr Moley raise an important issue that I think needs to be studied. We really don't know what the impact is on quality of life in the long term from these new procedures. You're looking at something very important here: how effective is the resection of cancerous tissue by this methodology?

But we are still viewing this, saying, "Oh, well, this is cosmetically superior." And I think that we need to acquire data from people who have had this procedure, this robotic procedure, and find out what the differences really are. What is the magnitude in their perceived differences in cosmesis and quality of life?

Once the patients have spoken—and I don't mean 2 weeks after the procedure; I mean 2 years after the procedure—and we find out what all is going on, because there are issues with potential changes in the way that the body perceives things at the nipple area. There could be changes in the axilla. And those may outweigh the differences in their neck appearance. So, we don't really know that. Once we know that, I think we'll have a better idea of what the benefit of this procedure is.

Dr Kyu Eun Lee (Seoul, Korea): What I want to say is that we all know that the thyroid cancer is different from other cancers. We have relatively young women patients. As we all know, survival is very excellent. And the patients will live 30, 40 years, their whole lives, with thyroid cancer. And I have the message that I am working on, the his or hers lifelong psychological, and also the quality-of-life, issues in the long term. As you know, and I hope, in the near future, I also can answer the question better.

Dr Ashok R. Shaha (New York, NY): I think this has generated a lot of discussion in the United States, and considerable interest in US cities from Korea is really, really large, that we revisit this issue every now and then. I have two questions.

Number 1, what happens to the people who recur? And I think now, with the ultrasound and thyroglobulin, we are finding more and more nodal recurrences. So, when these people recur, and now you probably have to do the neck surgery, the whole idea of not having a neck incision just goes away. And the second question, which is more philosophical: I hear all the time the major indication for robotic surgery in Korea is the Korean culture, and the Korean women don't want an incision in the neck. My question is, 10 years back, they did have the neck incision. Has there been a change in the culture, that they don't want the incision in the neck?

Dr Kyu Eun Lee (Seoul, Korea): I'll answer your second question first. Yes, we did not have such an approach 10 years ago. But in a different aspect of medical sessions, 10 years ago, we didn't have any good technology, like putting in new teeth. Ten years ago, the technology developed to put new teeth in our mouths.

So, after that, everyone loved the technology and we are getting used to it. And the culture is not like a 10-year change sort of thing. It's like a 1,000-year interval. And as I showed in the last slide about my patient who was going to marry had a cancer diagnosis 5 months before her wedding day. And I'm not sure it's just Korean women, but I just know Korean women. I do not know the women in America.

But she was not worried about whether she would die of cancer or she will recur with thyroid cancer. But her concern was that she would have the neck scar. So, that will have some impact, I believe with not only in Korean women, but women will have some impact. They will understand the consequences or the cultural things more than men.

And the cancer being a recurring thing, that's why we are trying to have the indications specifically for those who have low risk of recurrence. Once it has recurred, we need to make a big incision. I totally agree. Yes.

Dr Julie Ann Sosa (New Haven, CT): My question is about breast surveillance and what are the implications of this operation for mammography and ultrasound for these women going forward with regard to the risk for breast cancer? And also the implications in the axilla should these patients ultimately require surgery for breast disease?

Dr Kyu Eun Lee (Seoul, Korea): There are 3 aspects to deal with the breast: one is the breast cancer surveillance, second is the sensory changes in the breast area, and the third is breastfeeding.

And we actually do not deal with the breast parenchyma. We just use the breast area by subcutaneous tunnel, so we do not do anything with the breastfeeding. My patients have married, and they have had children, and my mother fed her children very well with her own breasts. With regard to the sensory issues, we have performed several retrospective and prospective studies, and within 3 months, it's like the neck area. After thyroid surgery, they have the sensory changes in the neck area. But it eventually gets to normal. And the same with this. Within 3 months, breast area sensation is getting to normal, the same as before the surgery.

And your question about the breast cancer surveillance: we did not perform a cancer surveillance study, but we usually do the breast cancer screening before our approach or during our approach. And afterwards, as we have the same section as the breast endocrine section. We have correlated and asked breast colleagues if they have any difficulty with our patients, but they did not even know that our patients had cancer surgery. So, I think it would not make a big problem for the cancer surveillance in the breast area. We do not have comprehensive data, but we do have some data to support that.

Dr Michael Yeh (Los Angeles, CA): In Los Angeles, there is a very large Korean community, possibly one of the largest outside of the Seoul metropolitan area. The typical Korean patient I see, one who has gone back to Korea, gotten a total body scan for a reasonable price, found a 4-mm papillary cancer, and returned for surgery. So, my question to you is, how many cancers in this group were <1 cm? And what is the role that total body scanning is doing in Korea for the overall volume of thyroid surgery and in driving these types of procedures?

Dr Kyu Eun Lee (Seoul, Korea): Number 1, the average diameter of the cancers in each group was 0.7 cm or 0.8 cm. They were detected by screening.

Are you asking me if there is some screening program in Korea?

Dr Michael Yeh (Los Angeles, CA): That seems to be something that's available in Korea, the idea of a total body computed tomographic scan or these sort of large-volume imaging performed electively on patients.

Dr Kyu Eun Lee (Seoul, Korea): I think the Korean women are more likely to undergo the thyroid cancer screening, but we do not have any government-driven screening program.

Dr Quan-Yang Duh (San Francisco, CA): I just want to comment that I want to congratulate you and your group in Korea for actually studying this. Whether or not we agree whether this operation is worthwhile or not, whether a small or large incision, I think there is probably some cultural difference, because I know there are thousands of transaxillary cases being done in Southeast Asia without the robot.

I've met Thai surgeons, I have met Vietnamese surgeons that have done thousands of these. And in China, that's also occurring. You can say that's bad, that's whatever. There are differences in perception about these types of operations; but I think the most important thing is if you do these operations, you should follow up with questions.