Original Article

Safety and feasibility of robotic reoperation via a bilateral axillo-breast approach for patients with locally recurrent thyroid cancer: a single-center retrospective study

Sijuan Chen[1,2], Xianjiao Cao[2], Gaoyuan Xu[1,2], Dan Wang[2], Dayong Zhuang[2], Peng Zhou[2], Tao Yue[2], Qingqing He[2], Xiaolei Li[2]

[1]Department of Thyroid and Breast Surgery, The Postgraduate Training Base of Jinzhou Medical University (the 960th Hospital of People's Liberation Army), Jinan, China; [2]Department of Thyroid and Breast Surgery, the 960th Hospital of People's Liberation Army, Jinan, China

Contributions: (I) Conception and design: Q He, X Li, S Chen; (II) Administrative support: X Cao, G Xu, D Zhuang; (III) Provision of study materials or patients: P Zhou, T Yue; (IV) Collection and assembly of data: D Wang; (V) Data analysis and interpretation: X Li; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Qingqing He, MD, PhD; Xiaolei Li, MD, PhD. Department of Thyroid and Breast Surgery, the 960th Hospital of People's Liberation Army, No. 25 Shifan Road, Tianqiao District, Jinan 250031, China. Email: heqingqing@yeah.net; lixiaoleijinan@sina.com.

Background: For patients with recurrent thyroid cancer, traditional open re-operative surgeries often leave conspicuous cervical scars, significantly impacting patients' long-term quality of life. The potential for robotic surgery to enhance the aesthetic outcomes of re-operative surgery and improve the quality of life for these patients has rarely been studied. This study aimed to assess the feasibility and effectiveness of robotic reoperation for recurrent thyroid cancer following initial surgery, offering a viable surgical alternative tailored to patients with heightened aesthetic concerns.

Methods: We conducted a retrospective analysis of patients with recurrent thyroid cancer who underwent robotic reoperation via the bilateral axillo-breast approach (BABA) at the 960th Hospital of People's Liberation Army between September 2018 and March 2024. The study design involved a comprehensive review of clinical data, including patient demographics, surgical outcomes, and postoperative complications.

Results: A cohort of 24 patients (18 females, 6 males) with a mean age of 34.13±10.06 years successfully underwent robotic BABA reoperation without conversion to open surgery. Two patients underwent completion total thyroidectomy (CTT) with central neck node dissection (CND), four underwent CTT with lateral neck dissection (LND), and the remaining 18 patients received LND alone. Histopathological examination revealed papillary thyroid carcinoma (PTC) in 23 patients and medullary thyroid carcinoma (MTC) in one patient. The mean number of lymph nodes retrieved from LND was 14.21±12.30, with 2.74±2.64 nodes harboring metastases. Postoperative complications were transient, including hypoparathyroidism in four patients and temporary vocal cord palsy in one patient, with no permanent complications reported. During an average follow-up period of 29.71±19.29 months, no recurrences were detected. Cosmetic satisfaction was assessed and yielded a median satisfaction score of 9.2.

Conclusions: Robotic BABA reoperation emerges as a feasible and safe surgical modality for managing recurrent thyroid cancer, offering effective treatment while catering to patients' high aesthetic demands.

Keywords: Thyroid neoplasms; recurrence; robotic surgery; reoperation; bilateral axillo-breast approach (BABA)

Submitted Nov 02, 2024. Accepted for publication Feb 08, 2025. Published online Feb 25, 2025.
doi: 10.21037/gs-24-477
View this article at: https://dx.doi.org/10.21037/gs-24-477

Introduction

In recent decades, the incidence of thyroid cancer has rapidly increased worldwide, ranking as one of the fastest-growing malignancies and currently the fifth most prevalent among women (1). Despite the generally favorable prognosis following initial thyroid cancer surgery, a substantial proportion of patients, estimated to be between 3.87% and 28% (2-5), experience local lymph node metastasis and recurrence, necessitating reoperation (6). Traditional open re-operative surgeries often leave conspicuous cervical scars, significantly impacting patients' long-term quality of life.

Robotic thyroidectomy has emerged as a viable therapeutic option for early-stage thyroid cancer, demonstrating oncologic outcomes comparable to open surgery while offering superior cosmetic outcomes postoperatively (7-9). This approach has garnered widespread acceptance among patients and surgeons worldwide due to its advantages (10,11). With advancing surgical techniques and accumulating experience, the indications for robotic surgery are steadily expanding to encompass more complex surgical scenarios. However, the history of neck surgery has traditionally been viewed a contraindication for robotic thyroid surgery.

Highlight box

Key findings

- Robotic bilateral axillo-breast approach (BABA) reoperation emerges as a feasible and safe surgical modality for managing recurrent thyroid cancer, offering effective treatment while catering to patients' high aesthetic demands.

What is known and what is new?

- Despite the generally favorable prognosis following initial thyroid cancer surgery, a substantial proportion of patients, estimated to be between 3.87% and 28%, experience local lymph node metastasis and recurrence, necessitating reoperation.
- The potential for robotic surgery to enhance the aesthetic outcomes of re-operative surgery and improve the quality of life for these patients is an area that has rarely been studied.

What is the implication, and what should change now?

- Robotic reoperation via the BABA is proven to be safe and feasible, achieving comparable surgical outcomes to open surgery, while offering superior postoperative cosmetic effects, making it particularly suitable for thyroid cancer patients with local recurrence or metastasis who have strong aesthetic needs, offering them a viable and attractive alternative to traditional open surgery.

Young patients who experience recurrent thyroid cancer after initial surgery, particularly those who underwent procedures such as endoscopic or robotic surgery, place a high value on the cosmetic appearance of surgical scars. The potential for robotic surgery to enhance the aesthetic outcomes of re-operative surgery and improve the quality of life for these patients is an area that has rarely been understudied (12). Therefore, in this study, we conducted a retrospective analysis of clinical data from patients who underwent robotic re-operative thyroidectomy at our center, aiming to explore the feasibility and safety of applying robotic surgery in the context of thyroid reoperation. We present this article in accordance with the STROBE reporting checklist (available at https://gs.amegroups.com/article/view/10.21037/gs-24-477/rc).

Methods

Patients

A retrospective analysis was undertaken of the case data pertaining to 24 patients who underwent reoperation with the aid of the Da Vinci robotic system at the 960th Hospital of the People's Liberation Army, owing to residual thyroid cancer or recurrence of local lymph node metastasis, spanning from September 2018 to March 2024. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Prior to their inclusion in the study, all patients provided their written informed consent. Furthermore, the research was granted approval by the Institutional Review Board of the 960th Hospital of the People's Liberation Army, ensuring adherence to ethical principles and standards (No. 20190606) and registered with ClinicalTrials.gov (No. NCT02768753).

Preoperative assessment and preparation

Before surgery, a neck ultrasound (US) examination accompanied by fine-needle aspiration (FNA) guided by US was conducted to evaluate thyroid nodules. For patients with suspicious cervical lymph nodes, an US-guided FNA combined with thyroglobulin (Tg) washout fluid analysis was conducted to confirm the presence of metastatic disease. In cases where lymph nodes were located in unusual positions or were sporadic, preoperative US-guided nano-carbon staining and localization techniques were employed to facilitate accurate identification and resection during surgery. To assess the location, size, and

anatomical relationship of lymph nodes with adjacent tissues, a contrast-enhanced computed tomography (CT) scan of the neck was performed. Where necessary, three-dimensional imaging was also utilized for enhanced visualization. Pulmonary CT scans were carried out to detect any metastases in the lungs or mediastinal lymph nodes. Additionally, an electronic laryngoscopy examination was done to evaluate the functionality of the recurrent laryngeal nerve (RLN).

All patients were thoroughly informed of the merits and drawbacks associated with both robotic and open surgical procedures, enabling them to make an informed decision based on their individual preferences. For inclusion in robotic re-operative surgery, patients must have a history of prior thyroidectomy (lobectomy or total thyroidectomy), exhibit radiographic or cytological evidence of recurrent thyroid nodules or lymph nodes, and undergo preoperative evaluation confirming that the lesion does not compromise the RLN, trachea, esophagus, common carotid artery, or internal jugular vein.

Surgical techniques

Following successful endotracheal intubation and the induction of general anesthesia, the patient was positioned supine with the head tilted backwards to fully expose the neck. For patients undergoing open surgery as the first procedure, four minimal incisions were strategically placed within the bilateral axillary creases and areolar margins. For those with a history of prior bilateral axillary areolar approach, the existing incisions were reused to minimize scarring. Alternatively, for individuals who had previously undergone endoscopic areola surgery, two additional incisions were made in the axillary creases. Upon cannula insertion, the robotic surgical system was connected, with intraoperative CO_2 gas pressure maintained at 5 mmHg (1 mmHg =0.133 kPa) and a flow rate set to 15 L/min to ensure optimal surgical conditions.

The surgical techniques employed for reoperations, such as thyroid lobectomy, central compartment dissection, or lateral neck lymph node dissection—which were not addressed during the initial surgery—closely adhered to our previously established protocols (13). The extent of LND includes dissection of levels II, III, IV, and Vb lymph nodes. Notably, in the context of re-operative central lymph node dissection, the traditional midline approach was eschewed. Instead, an innovative route was taken along the interval separating the sternocleidomastoid and strap muscles, allowing for lateral retraction of the thyrohyoid and sternothyroid muscles towards the trachea, thereby exposing the tracheoesophageal groove. With the aid of a nerve monitoring system, the RLN was meticulously identified and dissected, while utmost care was taken to preserve the parathyroid glands. Subsequently, preoperatively localized lymph nodes and their surrounding lymphatic fatty tissue were *en bloc* excised. In scenarios where recurrences or tumor remnants were encountered within the initial surgical site, marked by extensive scar adhesions, preoperative dye localization was utilized to guide access to the tumor area, with caution exercised to avoid regions dissected during the primary surgery. To gain access to the tumor, the surrounding muscular fibers were delicately dissected. Here, regional lymph node resection was performed *en bloc*, as opposed to individual node excision, to ensure comprehensive removal. Finally, all specimens were extracted via the right axillary route, followed by thorough irrigation of the surgical field with distilled water, and subsequent closure of the incision.

Data collection and outcomes

A retrospective analysis was undertaken, encompassing clinical baseline parameters (age, gender), initial surgical approach, surgical extent, pathological features, postoperative complications, and treatment outcomes. Routinely, postoperative day 1 measurements of parathyroid hormone (PTH) and blood calcium levels were performed. Transient hypoparathyroidism was diagnosed when serum PTH fell <15 pg/mL or blood calcium <2.25 mmol/L, with spontaneous normalization within 6 months. Postoperative hoarseness or vocal cord paralysis indicated transient RLN injury. Persistence of these symptoms beyond 6 months without improvement led to a diagnosis of permanent RLN injury. Patients underwent follow-up via telephone or outpatient clinic visits, with regular assessments of thyroid function, Tg levels, and thyroid US. To assess postoperative cosmetic satisfaction, a patient satisfaction score was employed, ranging from 0 (unsatisfactory) to 10 (most satisfactory) 3 months after surgery.

Statistical analysis

Statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables that fit the normal distribution were expressed as the mean ± standard deviation (SD), otherwise as the

Table 1 Clinical baseline characteristics of re-do robotic operation (n=24)

Characteristics	Values
Age (years)	34.13±10.06
Male: female	6:18
Initial surgical method (COT: RT: ET)	10 (41.67): 12 (50.00): 2 (8.33)
Initial operation hospital (the 960th Hospital of People's Liberation Army: others)	20 (83.33): 4 (16.67)
Extent of initial surgical procedure	
UT + CND	1 (4.17)
NTT + CND	5 (20.83)
NTT + LND	1 (4.17)
TT + CND	5 (20.83)
TT + LND	12 (50.00)
Time to recurrence (months)	
UT + CND†	79
NTT + CND	46 [37, 125]
NTT + LND†	11
TT + CND	20 [7.5, 62]
TT + LND	10 [4.25, 25.75]
Extent of 2nd surgery	
CTT + CND	2 (8.33)
CTT + LND	4 (16.67)
Only LND	18 (75.00)
Operative time (min)	
CTT + CND	160±91.92
CTT + LND	243.75±83.07
Only LND	175.44±47.02
Postoperative hospital stays (days)	
CTT + CND	8.5 [8, 9]
CTT + LND	7.5 [7, 9]
Only LND	10 [9, 12]

Values are presented as mean ± SD, number, number (%), or median [IQR]. †, means the sample size of 1, only a single value is provided. CND, central neck node dissection; COT, conventional open thyroidectomy; CTT, completion total thyroidectomy; ET, endoscopic thyroidectomy; IQR, interquartile range; LND, lateral neck node dissection; NTT, near-total thyroidectomy; RT, robotic thyroidectomy; SD, standard deviation; TT, total thyroidectomy; UT, unilateral thyroidectomy.

median [interquartile range (IQR)]. Meanwhile, categorical variables were reported as counts with percentages.

Results

Clinical characteristics

The clinical baseline characteristics of the 24 patients who underwent robotic reoperations are detailed in *Table 1*. With an average age of 34.13±10.06 years (ranging from 22 to 51), the cohort comprised 6 males and 18 females. Regarding their initial surgical procedures, 41.67% underwent conventional open thyroidectomy, 50% underwent robotic bilateral axillo-breast approach (BABA) thyroidectomy, and 8.33% opted for endoscopic thyroidectomy via the areola approach. Notably, 20 patients had their initial surgeries performed at the 960th Hospital of People's Liberation Army, while the remaining four underwent surgery at other hospitals.

Regarding the extent of initial operation, one patient underwent unilateral thyroidectomy (UT) with central neck node dissection (CND), five received near-total thyroidectomy (NTT) with CND, and one underwent NTT with lateral neck dissection (LND). Additionally, 17 patients underwent total thyroidectomy, with five of them receiving CND and the remainder undergoing LND. The median disease-free duration among these patients was 17.5 months.

Surgical extent and outcomes

All 24 patients underwent robotic re-operative surgery successfully, without any conversions to open surgery. Specifically, two patients underwent completion total thyroidectomy (CTT) with CND, requiring 95 minutes and 225 minutes, respectively. Another four patients underwent CTT with LND, with an average operative time of 243.75±83.07 minutes. The remaining 18 patients underwent LND, with an average operative time of 175.44±47.02 minutes. Regarding postoperative stays, the patient who underwent CTT and CND stayed for 8.5 days, while those who underwent CTT and LND stayed for median 7.5 days. Patients who underwent only LND had a median stay of 10 days.

Table 2 summarizes the postoperative complications of the robotic reoperation. Four patients experienced transient hypoparathyroidism, and one case had transient RLN injury. Notably, no cases of permanent hypoparathyroidism

Table 2 Postoperative complications of re-do robotic operation (n=24)

Characteristics	Values
Transient hypoparathyroidism	4
Permanent hypoparathyroidism	0
Chyle leakage	0
RLN injury	1

Values are presented as number. RLN, recurrent laryngeal nerve.

Table 3 Baseline pathological characteristics of re-do robotic operation (n=24)

Characteristics	Values
Pathology	
Papillary carcinoma	23
Medullary carcinoma	1
Tumor size (cm)	0.85±0.34
N classification	
N0	4
N1a	3
N1b	17
Retrieved LNs	
CND	6.5 [4, 9]
LND	14.21±12.30
Metastatic LNs	
CND	0 [0, 0]
LND	2.74±2.64

Values are presented as number, mean ± SD, or median [IQR]. CND, central neck node dissection; IQR, interquartile range; LND, lateral neck node dissection; LNs, lymph nodes; SD, standard deviation.

or RLN injury, chyle leakage, wound infection, or Horner's syndrome were reported.

Pathological characteristics

Table 3 summarizes the baseline pathological characteristics of the robotic reoperations. Among the 24 patients, 23 were diagnosed with papillary thyroid carcinoma (PTC), and one with medullary thyroid carcinoma (MTC). The mean tumor size was 0.85±0.34 cm. Regarding lymph node status, four patients were classified as N0, three as N1a, and 17 as N1b. Notably, two patients underwent CND, resulting in the retrieval of 4 and 9 lymph nodes, respectively, none of which were metastatic. Furthermore, an average of 14.21±12.30 lymph nodes were retrieved from the lateral neck, with 2.74±2.64 LNs being metastatic.

Table 4 Treatment outcomes of re-do robotic operation (n=24)

Characteristics	Values
I^{131} therapy	22 (91.67)
Tg <1.0 ng/mL under stimulated conditions	15 (62.50)
Follow-up time (months)	29.71±19.29
Aesthetic score	9.2 [8.9, 9.3]

Values are presented as number (%), mean ± SD, or median [IQR]. IQR, interquartile range; SD, standard deviation; Tg, thyroglobulin.

Follow-up results

A total of 22 patients underwent radioactive iodine (RAI) treatment, and none of them demonstrated any abnormal uptake on the diagnostic whole-body scan (*Table 4*). Prior to RAI therapy, 15 patients (62.5%) had Tg levels below 1 ng/mL under stimulated conditions. Over an average follow-up period of 29.71±19.29 months, no recurrence was detected in any of the patients. All the patients were satisfied with the esthetic score 3 months post-surgery, with a median satisfaction score of 9.2.

Discussion

To the best of our knowledge, this represents the first case series to document the use of robotic reoperation via a BABA for locoregional recurrent thyroid cancer. Our findings suggest that robotic reoperation utilizing the BABA offers excellent cosmetic outcomes and oncologic results that are comparable to those of open surgery. Consequently, we propose that this approach can serve as a viable alternative to conventional open procedures for carefully selected patients with locally recurrent thyroid cancer, regardless of the initial surgical method employed.

Surgery remains the cornerstone of thyroid cancer management, with a majority of patients experiencing favorable outcomes post-operatively (6). However, research indicates that recurrence or metastasis may occur

in 3.87% to 28% of patients, necessitating a secondary surgical intervention (14-16). Traditional open surgery, while effective, often leaves conspicuous scars on the neck, which can adversely affect patients' psychological well-being and social functioning (17,18). Notably, thyroid cancer disproportionately affects young females, many of whom have had their initial surgeries conducted using endoscopic or robotic methods, thereby fostering heightened expectations for postoperative cosmetic outcomes. Consequently, there is an urgent need for extra-cervical approaches that prioritize cosmetic results for this patient cohort, with profound societal implications. By minimizing surgical trauma and catering to patients' aesthetic aspirations, this surgical technique not only improves physical outcomes but also enhances their overall quality of life.

The challenges posed by scar adhesion and anatomical alterations following initial thyroid surgery often render subsequent surgeries exceedingly complex, frequently disqualifying them from consideration for minimally invasive thyroid surgery. Consequently, there has been a scarcity of research investigating the viability of robotic or endoscopic reoperations for thyroid cancer. Notably, a study by Kim *et al.* in 2022 reported on 65 robotic thyroid reoperations via the axillary approach, underscoring its safety and feasibility (12). Nevertheless, a significant portion of these patients had undergone their initial surgery through the axillary approach. For patients who underwent their first surgery through BABA or anterior chest approach, reoperation via the axillary approach necessitates an additional 6–7 cm incision in the axilla, which may not be the optimal choice. In such cases, adopting the BABA for the second surgery could be a more suitable solution. To date, there have been no published reports on robotic thyroid reoperations performed exclusively via the BABA. Our team, with a rich history of conducting robotic thyroid surgeries via the BABA since February 2014, has gradually ventured into exploring robotic reoperations (13,19,20). Our current study marks the first to demonstrate the safety and feasibility of robotic thyroid reoperations via the BABA, particularly for patients with a history of endoscopic or robotic thyroid surgeries through the anterior chest approach or BABA. This discovery presents an innovative surgical approach for such patients, aiming to minimize additional scarring and optimize cosmetic outcomes.

The adoption of robot-assisted thyroid reoperation via the BABA introduces several compelling benefits. Firstly, the BABA has emerged as a widely accepted approach for robotic thyroidectomy, with a robust body of research demonstrating its comparable oncologic outcomes to traditional open surgery in managing benign or early-stage thyroid cancer across various patient populations, including children and adults (8,20-22). This approach not only offers exceptional postoperative cosmetic results but also aligns with the preferences of both patients and surgeons alike. Its advantages stem from the high-definition, magnified surgical field, coupled with the flexibility and precision of the robotic instrumentation, which enable surgeons to perform delicate manipulations with minimal trauma, while effectively preserving RLN and parathyroid functions. Secondly, the BABA provides a surgical field similar to open surgery, enabling surgeons to replicate their open surgery experience and techniques, thereby shortening the learning curve, facilitating a smoother transition to robotic thyroidectomy. Thirdly, the BABA facilitates comprehensive surgical procedures, including total thyroidectomy and bilateral central and LND. In contrast, the transaxillary approach can be limiting in its ability to perform contralateral thyroidectomy or LND, often necessitating an additional incision in the contralateral axilla, which can increase surgical trauma. Lastly, the BABA offers a significant improvement over open surgery in terms of cosmetic outcomes. By completely eliminating postoperative neck scars, this approach enhances patients' physical appearance and long-term quality of life, providing a psychological benefit.

Regardless of the initial surgical method—open, endoscopic, or robotic—robotic reoperation utilizing the BABA can be successfully executed. This study encompassed a cohort comprising 10 patients who underwent open surgery, two who underwent endoscopic surgery via an anterior chest approach, and 12 who underwent robotic surgery via the BABA. For those patients who initially underwent open surgery and subsequently required LND during a subsequent surgical intervention, traditional open surgery would typically have entailed extending the initial incision by 12–15 cm to ensure optimal exposure and manipulation. However, these patients opted for the BABA approach, aiming to minimize the length of the surgical incision and attain more favorable cosmetic results.

The challenges posed by reoperation largely stem from scar adhesion within the surgical field, arising from the initial surgery. This obscures anatomical planes and boundaries, complicates dissection, heightens bleeding risks, and escalates the danger of vital organ damage. As such, robotic thyroidectomy for secondary surgeries

necessitates the expertise of skilled surgeons and adherence to the following critical procedural steps: (I) conduct a comprehensive preoperative evaluation, encompassing FNA biopsy of suspicious thyroid nodules and cervical lymph nodes to validate tumor recurrence or metastasis, thereby ensuring surgical justification. (II) Utilize US, CT, and other imaging modalities to comprehensively assess tumor location, size, and its anatomical relationships with adjacent vessels and organs. Preoperative US-guided dye marking of metastatic lymph nodes can curtail unnecessary intraoperative exploration and dissection. (III) Obtain detailed information on the first surgery, focusing on the surgical approach, extent, and especially the status of RLN and parathyroid gland protection, as well as any parathyroid auto-transplantation performed. This is paramount for devising an appropriate surgical strategy. (IV) Allow at least three months between surgeries to mitigate scar adhesion, facilitating easier intraoperative dissection and separation (23,24). (V) Commence dissection from less adhered areas, gradually progressing to more adhered regions. Adhere strictly to standard lymph node dissection protocols, aiming for *en bloc* tumor resection to avoid non-standard techniques. (VI) Employ intraoperative nerve monitoring to safeguard the RLN, minimizing the risk of injury. (VII) In cases where severe adhesion hinders adequate dissection or complete tumor resection, promptly convert to open surgery to ensure surgical safety and complete tumor eradication. All 24 cases of robotic re-operative thyroidectomy were successfully concluded and followed by RAI treatment. With an average follow-up of about 30 months, no instances of tumor recurrence or metastasis were observed. Furthermore, 62.5% of patients achieved a postoperative Tg level of <1 ng/mL, underscoring the oncological safety of our robotic re-operative thyroidectomy approach.

In our study, the occurrence of major complications associated with robotic reoperations was found to be commensurate with those reported in open surgery. Specifically, we documented a single case of temporary RLN injuries and four cases of temporary hypoparathyroidism, mirroring the 4.55–21.21% incidence range documented in the literature for such complications during open redo procedures (25-27). Notably, we did not encounter any instances of permanent complications, lymphatic leakage, nor postoperative infections. Furthermore, the duration of hospital stays was comparable to those reported for open surgical interventions (28,29), reinforcing the safety and feasibility of robotic re-operative thyroidectomy. It is crucial to emphasize that robotic reoperations are inherently intricate procedures, underscoring the importance of surgeons possessing extensive operative expertise to guarantee both the safety and efficacy of these procedures.

There are some shortcomings in this study. First, the sample size remains relatively modest, and further expansion of the cohort is needed. Second, there is no control study with open surgery, mainly due to the inherent variability in the scope of re-operative surgeries, which poses significant challenges for designing controlled trials. We will conduct large-scale, prospective controlled studies in future research, and extend the follow-up period to fully demonstrate the feasibility and effectiveness of robotic reoperation.

Conclusions

In summary, robotic reoperation via the BABA is proven to be safe and feasible, achieving comparable surgical outcomes to open surgery, while offering superior postoperative cosmetic effects, making it particularly suitable for thyroid cancer patients with local recurrence or metastasis who have strong aesthetic needs, offering them a viable and attractive alternative to traditional open surgery. Our study underscores the efficacy of this approach, providing a valuable option for this specific patient population.

Acknowledgments

The authors thank all the patients included in this study. We gratefully acknowledge the statistical analysis assistance from Dr. Jing Yuan, the chief of Department of Medical Information, for the 960th Hospital of PLA, Jinan, China.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://gs.amegroups.com/article/view/10.21037/gs-24-477/rc

Data Sharing Statement: Available at https://gs.amegroups.com/article/view/10.21037/gs-24-477/dss

Peer Review File: Available at https://gs.amegroups.com/article/view/10.21037/gs-24-477/prf

Funding: This work was supported by the grant of Clinical Medical Science and Technology Innovation Plan of Jinan City (No. 202328089).

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://gs.amegroups.com/article/view/10.21037/gs-24-477/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Institutional Review Board of the 960th Hospital of the People's Liberation Army (No. 20190606), and informed consent was obtained from all individual participants.

References

1. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2024;74:229-63.
2. Rubinstein JC, Herrick-Reynolds K, Dinauer C, et al. Recurrence and Complications in Pediatric and Adolescent Papillary Thyroid Cancer in a High-Volume Practice. J Surg Res 2020;249:58-66.
3. Li Y, Tian J, Jiang K, et al. Risk factors and predictive model for recurrence in papillary thyroid carcinoma: a single-center retrospective cohort study based on 955 cases. Front Endocrinol (Lausanne) 2023;14:1268282.
4. Grogan RH, Kaplan SP, Cao H, et al. A study of recurrence and death from papillary thyroid cancer with 27 years of median follow-up. Surgery 2013;154:1436-46; discussion 1446-7.
5. Ywata de Carvalho A, Kohler HF, Gomes CC, et al. Predictive factors for recurrence of papillary thyroid carcinoma: analysis of 4,085 patients. Acta Otorhinolaryngol Ital 2021;41:236-42.
6. Haugen BR, Alexander EK, Bible KC, et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid 2016;26:1-133.
7. Paek SH, Kwon H, Kang KH. A Comparison of the Bilateral Axillo-breast Approach (BABA) Robotic and Open Thyroidectomy for Papillary Thyroid Cancer After Propensity Score Matching. Surg Laparosc Endosc Percutan Tech 2022;32:537-41.
8. He QQ, Ma YH, Zhu J, et al. Comparison of transoral vestibular robotic thyroidectomy with traditional low-collar incision thyroidectomy. J Robot Surg 2024;18:88.
9. Kim JK, Lee CR, Kang SW, et al. Robotic transaxillary lateral neck dissection for thyroid cancer: learning experience from 500 cases. Surg Endosc 2022;36:2436-44.
10. Yuan Y, Pan B, Tang E, et al. Surgical methods of total thyroidectomy for differentiated thyroid cancer: a systematic review and Bayesian network meta-analysis. Int J Surg 2024;110:529-40.
11. An S, Park J, Kim K, et al. Safety and surgical outcomes of single-port trans-axillary robot-assisted thyroidectomy: Experience from a consecutive series of 300 patients. J Robot Surg 2024;18:13.
12. Kim DG, Kim K, Lee JE, et al. Re-do Operation Using a Robotic System due to Locoregional Recurrence after Initial Thyroidectomy for Thyroid Cancer. Sci Rep 2022;12:11531.
13. He Q, Zhu J, Zhuang D, et al. Robotic lateral cervical lymph node dissection via bilateral axillo-breast approach for papillary thyroid carcinoma: a single-center experience of 260 cases. J Robot Surg 2020;14:317-23.
14. Patel KR, Wang B, Abdelhamid Ahmed AH, et al. Surgical and Biochemical Outcomes in Nerve Monitored Reoperation Surgery for Recurrent Papillary Thyroid Carcinoma. Otolaryngol Head Neck Surg 2023;169:1234-40.
15. Otsuki N, Shimoda H, Morita N, et al. Salvage surgery for structural local recurrence of papillary thyroid cancer: recurrence patterns and surgical outcome. Endocr J 2020;67:949-56.
16. Sun W, Di L, Chen L, et al. The outcomes and prognostic factors of patients who underwent reoperation for persistent/recurrent papillary thyroid carcinoma. BMC Surg 2022;22:374.
17. Chen S, Hu X, Yang P, et al. Status of mental and social activities of young and middle-aged patients after papillary thyroid cancer surgery. Front Oncol 2024;14:1338216.

18. Liu L, Xiang Y, Xiong L, et al. Assessment of preoperative health-related quality of life in patients undergoing thyroidectomy based on patient-reported outcomes. Front Psychol 2024;15:1329175.
19. Chen S, Li Y, Cao X, et al. Bilateral axillo-breast approach robotic thyroglossal duct cyst resection in an adolescent: a case report and literature review. Gland Surg 2024;13:775-80.
20. Li C, Gao Y, Zhou P, et al. Comparison of the Robotic Bilateral Axillo-Breast Approach and Conventional Open Thyroidectomy in Pediatric Patients: A Retrospective Cohort Study. Thyroid 2022;32:1211-9.
21. Zhang R, Chen Y, Deng X, et al. Comparison of bilateral axillo-breast approach robotic thyroidectomy and open thyroidectomy for papillary thyroid carcinoma. J Robot Surg 2023;17:1933-42.
22. Lee JK, Choi JH, Kim W, et al. Bilateral axillo-breast approach robotic thyroidectomy in pediatric patients with thyroid disease and cancer. Endocrine 2023;81:532-9.
23. Dueñas JP, Duque CS, Cristancho L, et al. Completion thyroidectomy: is timing important for transcervical and remote access approaches? World J Otorhinolaryngol Head Neck Surg 2020;6:165-70.
24. Erbil Y, Bozbora A, Ademoglu E, et al. Is timing important in thyroid reoperation? J Otolaryngol Head Neck Surg 2008;37:56-64.
25. Canu GL, Medas F, Cappellacci F, et al. Risk of Complications in Patients Undergoing Completion Thyroidectomy after Hemithyroidectomy for Thyroid Nodule with Indeterminate Cytology: An Italian Multicentre Retrospective Study. Cancers (Basel) 2022;14:2472.
26. Sena G, Gallo G, Innaro N, et al. Total thyroidectomy vs completion thyroidectomy for thyroid nodules with indeterminate cytology/follicular proliferation: a single-centre experience. BMC Surg 2019;19:87.
27. Giordano D, Botti C, Piana S, et al. Postoperative hypoparathyroidism after completion thyroidectomy for well-differentiated thyroid cancer. Eur J Endocrinol 2021;185:413-9.
28. Qin X, Luo J, Ma J, et al. Prospective cohort study of parathyroid function and quality of life after total thyroidectomy for thyroid cancer: robotic surgery vs. open surgery. Int J Surg 2023;109:3974-82.
29. Xing Z, Qiu Y, Abuduwaili M, et al. Surgical outcomes of different approaches in robotic assisted thyroidectomy for thyroid cancer: A systematic review and Bayesian network meta-analysis. Int J Surg 2021;89:105941.

Cite this article as: Chen S, Cao X, Xu G, Wang D, Zhuang D, Zhou P, Yue T, He Q, Li X. Safety and feasibility of robotic reoperation via a bilateral axillo-breast approach for patients with locally recurrent thyroid cancer: a single-center retrospective study. Gland Surg 2025;14(2):163-171. doi: 10.21037/gs-24-477