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Robotic-Assisted Modified Radical Neck Dissection: Transaxillary, Bilateral Axill-Breast Approach (BABA), Facelift

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Abstract

Purpose of Review N1b thyroid carcinoma has been surgically treated with open-conventional bilateral total thyroidectomy and modified radical neck dissection (mRND). Recently, the use of robotic method has been increasing for the cosmetic demand of patients. Robotic mRND methods can be divided into transaxillary, bilateral axillo-breast approach (BABA), and facelift depending on how the instruments are inserted.

Recent Findings About 10 years of experience have been accumulated for transaxillary and BABA, and their oncologic outcomes have also been proven. However, the facelift method requires more experience and oncologic outcome needs to be proven.

Summary Robotic surgery not only reduces the fatigue of the surgeon but also improves the precision of the surgery all the while providing a cosmetic benefit. The advantages and disadvantages of each methods are obvious. The patients will be able to determine the method according to the advantages and disadvantages.

Keywords Robot-modified neck dissection · Transaxillary · Bilateral axillo-breast approach · Facelift

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Introduction

The incidence of thyroid carcinoma has increased worldwide over the last few decades [1–4]. Although thyroid carcinoma usually has a good prognosis, metastasis to the lateral neck lymph nodes has been reported up to 30% in patients [5–7]. According to the ATA guidelines, patients with N1b thyroid carcinoma should undergo bilateral total thyroidectomy with central compartment neck dissection (CCND) and modified radical neck dissection (mRND), a procedure including all compartment from level II to level V [8].

The most common method for mRND to date is the open-conventional mRND. However, this method leaves a long cervical scar of about 10–15 cm in front of the neck, which can cosmetically concern patients.

Endocrine surgeons have been trying to resolve the patients' burden of long cervical scar and recently have been conducting minimally invasive surgeries, such as endoscopic and robotic procedures. However, endoscopic surgery has technical difficulties due to the two-dimensional camera and nonflexible instruments [9, 10]. Robotic surgery, on the other hand, has several advantages compared to endoscopic surgery; the camera is three-dimensional, visualization is more natural, robotic instruments are flexible and accessible to difficult locations. Above all, it has the advantage of using three arms freely [11].

To date, robotic mRND has been performed in three methods, depending on how the instruments are inserted; transaxillary [12••], bilateral axillo-breast approach (BABA) [13], and facelift [14••]. Transaxillay method was the first robotic method to be developed and has the most cases performed. BABA method is capable of bilateral mRND through the same flaps, and facelift method is the most newly developed method.

Several studies have reported on the technical feasibility of robotic mRND. We would like to report on the three surgical methods, advantages and disadvantages and surgical outcomes.

Surgical Technique

Transaxillary

The patient is placed in the supine position on the operating table with a soft bar below the shoulders under general anesthesia. The lesion-side arm is abducted to expose the axilla and lateral neck. A 7–10 cm skin incision is made in the axilla along the anterior axillary fold and the lateral border of the pectoralis major muscle. The flap is dissected medially over the sternocleidomastoid (SCM) toward the midline of the anterior neck under the platysma muscle. Laterally, the trapezius muscle is identified and dissected upward along its anterior border. At this time, spinal accessary nerve is identified for the convenience of surgery. The clavicular head of the SCM muscle is slightly divided at the level of its attachment to the clavicle. The dissection proceeds upward along the posterior surface of the SCM until the submandibular gland and the posterior belly of the digastric muscle are exposed. A Jung's retractor blade is inserted through the axillary incision under the SCM and strap muscles. The docking procedure for the robot is similar to that described previously for robotic thyroidectomy. Actually, the mRND procedure is similar to that of the open-conventional procedure. After finishing the level III, IV and V node dissections, redocking is required to provide a better view for level II lymph node dissection. The external retractor is removed and reinserted through the axillary incision toward the submandibular gland superiorly. After delivering the specimen, a drainage tube is inserted under the incision line. Finally, the wound is closed cosmetically.

BABA

The patient is placed in a supine position with neck extension using a soft bar below the shoulders under general anesthesia. After aseptic draping, a diluted epinephrine solution (1:200,000) is injected into the subcutaneous layer of the anterior chest to lift the skin and the subcutaneous layer, a procedure called hydrodissection. Four incisions are made in both circumareolar and axilla, and dissection of the subcutaneous area is performed with a vascular tunneler. The robot is docked through inserted trocars. BABA bilateral total thyroidectomy with CCND is performed before robot mRND.

After total thyroidectomy, the robotic instruments are redocked at the location of lateral neck metastasis. PK dissection forceps are docked in the ipsilateral axillary trocar, and Prograsp forceps are docked in the contralateral axillary trocar. The SCM muscle is separated from the strap muscles using a permanent cautery hook. The strap muscles are retracted in the medial direction using Prograsp forceps, and the SCM muscle is retracted laterally using PK dissecting forceps. The medial border of the lateral LN (level III) is dissected from the internal jugular vein and the lateral border of level III is dissected from the SCM muscle using a harmonic scalpel. Prograsp forceps are carefully passed through the SCM muscle from level IV to level V. The entire lateral border of the SCM muscle is dissected while lifting the SCM muscle with Prograsp forceps.

Level V is dissected with medial traction of Prograsp forceps, while preserving the brachial plexus and spinal accessary nerve. After finishing level V to level II dissection, specimen is removed with laparoscopic retrieval bag, and removed through the areolar trocar. Midline closure is performed with Vicryl sutures, and a drainage tube is inserted through the axillary incision.

Facelift

Under general anesthesia, the patient is placed in the supine position on the operating table. A soft bar is inserted below the shoulders, and the head is slightly rotated toward the contralateral side of the lesion. An 8–10 cm skin incision is made anterior to the tragus and carried inferiorly under the lobule and continued post-auricularly, then 4 cm inferiorly, in the hairline. The skin flap is elevated along the subplatysmal plane to the midline anteriorly, to the inferior border of the mandible superiorly, and to the clavicle inferiorly.

Level II is dissected with standard surgical instruments under direct visualization. The dissection is performed along the inferior border of the submandibular gland, and the posterior belly of the digastric muscle and the internal jugular vein are identified. The spinal accessary nerve is identified near the internal jugular vein. The whole posterior border of the SCM is dissected after level II dissection, and the fibrofatty tissue is dissected from the medial side of the SCM by elevating it upward. A self-retained retractor is then inserted through the skin incision.

Level III and level V are dissected, superior to inferior. The transverse cervical artery is preserved, and level IV dissection is performed. During the dissection of level IV, the lymphatic or thoracic duct is ligated using a harmonic scalpel or clips. After neck dissection is complete, the specimen is removed through the facelift incision. One

drainage tube is inserted behind the incision line. Finally, the wound is closed cosmetically.

Advantages and Disadvantages

Table 1 provides the summary for the advantages and disadvantages of the three methods.

Advantages of transaxillary method is that it can be possible with a view similar to open-conventional mRND, and it can be performed in a relatively short time due to the most experience among the three method, and it is convenient to use a camera because of not using gas. However, it has some disadvantages that it cannot avoid relatively long wound, although the wound is covered by armpit, and the contralateral mRND is impossible.

BABA method has some advantages of allowing bilateral mRND through the same flap and leaving the smallest scar among the three methods. However, it has some disadvantages that it is slightly inconvenient to use a camera due to gas-using method, and it has some limitations for level IV dissection compared to other methods.

Advantages of facelift method is that the wound is hidden by the hairline, and level II dissection is easier than other methods. However, there are some disadvantages that the operation should be performed with a less familiar view due to the opposite direction of open-conventional mRND, and the contralateral mRND is not possible.

Technical Safety

Transaxillary

To show the technical safety of the method, it is essential to compare it with the open-conventional mRND. Several studies have demonstrated the technical safety of transaxillary method. Kim et al. reported that perioperative complications were comparable to open method [15•]. At least one perioperative complication occurred in 58.5% patients in the robotic and 62.7% in the open method, but there was no significant difference between the two groups. Kang et al. also reported that no significant intergroup differences were observed in perioperative complications [12••].

BABA

Kim et al. described the technical safety of BABA method in their study [16••]. According to the study, there was no open conversion and no significant differences in number of retrieved lymph nodes or metastatic lymph nodes and the postoperative hospital stay. According to another study by Yu el al., the rates of transient and permanent hypocalcemia were 46.7% and 0%, respectively, and the rate of transient and permanent vocal cord palsy were 6.7% and 0%, respectively [13]. These results were not significantly different from open-conventional mRND.

Facelift

Park et al. reported perioperative complications of facelift method [17]. According to this study, there was no nerve injury, but 3 of 7 patients experienced postoperative numbness of the ear lobe, which was resolved within several months. Byeon et al. reported that there were no significant intraoperative complications or conversion to open method [14••]. There was no postoperative vocal cord palsy, but two of four patients developed transient hypocalcemia, which resolved the end without the need for calcium or vitamin D replacement. They concluded that facelift method was technically feasible and safe.

Table 1 Advantages and disadvantages of the three methods

	Advantages	Disadvantages
Transaxillary	1. View similar to open-conventional mRND	1. The scar can be hidden, but a relatively long wound remains
	2. Relatively short operation time	2. Limitation for the contralateral mRND
	3. Convenient to use a camera thanks to the gasless method	
BABA	1. Contralateral mRND possible through the same flap	1. Slightly inconvenient to use the camera due to gas-using method
	2. The smallest scar among the three methods	2. Limitation for level IV dissection compared to other methods
Facelift	1. The wound is hidden by the hair	1. Unfamiliar view due to the opposite direction of open-conventional mRND
	2. Level II dissection is easier compared to other methods	2. Limitation for the contralateral mRND

mRND modified radical neck dissection, *BABA* bilateral axillo-breast approach

Conclusion

With the development of diagnostic technology, the discovery of thyroid carcinoma has been increasing over the last few decades. In addition, lateral neck metastasis has also been increasing. Traditionally, N1b thyroid carcinoma has been surgically treated with open-conventional bilateral total thyroidectomy with CCND and mRND. However, minimally invasive surgery, especially the robotic method, has been increasing with higher cosmetic demand of patients. Robotic surgery not only reduces the fatigue of the surgeon but also improves the precision of the surgery all the while providing a cosmetic benefit. Robotic mRND methods are divided into transaxillary, BABA, and facelift depending on how the instruments are inserted. About 10 years of experience have been accumulated for transaxillary and BABA, and their oncologic outcomes have also been proven. However, the facelift method requires more experience and oncologic outcome needs to be proven.

The advantages and disadvantages of each method are obvious. The patients will be able to determine the method according to the advantages and disadvantages.

Compliance with Ethics Guidelines

Conflict of interest Kwangsoon Kim, Sang-Wook Kang, and Woong Youn Chung each declare no potential conflicts of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- • Of importance
- •• Of major importance

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