

Comparison of the breast and areola approaches for endoscopic thyroidectomy in patients with microcarcinoma

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Abstract. The safety, advantages and disadvantages of thyroidectomy for microcarcinoma through the areola approach and breast approach were compared. Fifty patients diagnosed with thyroid microcarcinoma in our department from January 2014 to June 2015 were selected. The areola approach was carried out for 21 patients whereas the breast approach for 29 patients. Endoscopic thyroid lobectomy, isthmus resection and dissection of central group lymph nodes was performed. The clinical outcomes of the two surgical approaches were compared. Comparing operating time, blood loss during surgery, number of lymph node dissections, postoperative hospitalization time and surgical complications between the surgical approaches, there were no significant differences ($P>0.05$). Comparing patient satisfaction of cosmetic results from the incisions, the difference was statistically significant ($P<0.05$). Endoscopic thyroidectomy via areola approach and breast approach have equal curative effects for the treatment of thyroid microcarcinoma. However, the areola approach can achieve better cosmetic results and is a safe and ideal surgical method, that we recommend be widely used.

Introduction

In recent years, the incidence of thyroid diseases has been on the increase. The rate of diagnosis of thyroid nodules via B ultrasound is over 40%. In addition, thyroid cancer has a low incidence but is rapidly increasing and is ranked fifth among malignant tumors in females (1). The prognosis for thyroid diseases is favorable. Benign nodules do not endanger the lives of patients. However, approximately 95% of thyroid cancers are differentiated thyroid carcinomas. In general, patients with

this form of thyroid carcinoma survive for more than 10 years and even up to 30 years in some cases (2,3).

Previously, thyroid surgeries only served to eliminate the clinical problem. Currently, thyroid surgeries must take into account modern bio-psychosocial principles. This includes eradication of the problem, cosmetic result and privacy. Total endoscopic thyroidectomy (ET), which plays a critical role in transition of operative patterns, is popular with the majority of patients, especially female patients. This is due in large part to favorable cosmetic results (4,5). However, there are a variety of approaches for endoscopic resection of diseased thyroid glands, such as the axillary, breast, oral and the areola approaches.

In the present study, we report the advantages and disadvantages of ET via the areola approach by comparing its clinical effects with the breast approach.

Materials and methods

Patients. A retrospective analysis was carried out using the clinical data of 50 female patients who had thyroid nodules, admitted to our hospital from January 2014 to June 2015, and were confirmed to have papillary microcarcinoma via preoperative pathological analysis. Additionally, no unusual lymph nodes were found via color Doppler ultrasound. Thyroidectomy via the areola approach was carried out for 21 patients. The operation via breast approach was carried out for 29 patients. There were no statistically significant differences in general parameters of the two groups of patients ($P>0.05$) (Table I). Inclusion criteria included: i) Age, 14-45 years; ii) papillary thyroid carcinoma with diameter ≤ 1 cm and no invasion of adjacent organs; iii) no lymphatic metastasis seen with color ultrasonography; iv) no lymphatic metastasis on the superior mediastinum; v) patients with strong cosmetic requirements. The exclusion criteria were: i) No specific cosmetic requirements; ii) those suspected of having distant metastasis prior to surgery; iii) postoperative recurrence of thyroid cancer; iv) history of neck surgery or radiotherapy; v) lymphatic metastasis at the lateral zone; vi) thyroid extension; vii) male; and viii) obese.

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Areola approach. Anesthesia and position: General anesthesia and endotracheal intubation were used. Patients were in the supine position with their shoulders elevated and legs spread apart. The surgeon was positioned between the legs of the patient, while wearing a head-mounted monitor. Routine

Table I. Comparison of operation indexes.

Group	Group of complete breast areola approach	Group of breast approach	T-value	P-value
Age (years)	32.81±6.68	32.14±7.68	0.32	0.7489
Maximum diameter of lump	7.14±1.68	7.34±1.56	-0.44	0.6644
No. of lymph nodes dissected	5.90±1.64	6.07±1.67	-0.35	0.7309
Operation duration	99.95±10.71	99.17±11.14	0.25	0.8050
Blood loss during operation	23.81±7.33	28.21±11.68	-1.52	0.1353
Post-operation hospitalization duration	5.19±1.40	6.07±1.33	-1.74	0.0880
Grade of aesthetics	8.81±0.87	6.59±0.82	9.18	<0.0001
24-h pain score	3.67±0.86	3.48±1.09	0.64	0.5236
48-h pain score	2.05±0.67	1.69±0.76	1.73	0.0909

disinfection was conducted. At first, inflation fluid (250 ml of normal saline + 1 mg of epinephrine) was injected near the incision site. A 12-mm incision (direction, at 2-4 o'clock) was made in the right mammary areola. Fifty milliliters of inflation fluid (250 ml of normal saline + 0.5 mg of epinephrine) was then injected between the deep layer and superficial layer of the superficial fascia, in front of the manubrium. A flap dissection stick was used to separate the marked area before the sternum. Unnecessary inflation fluid was cleared with gauze. A 30° endoscope was imbedded in the 12-mm punctured sheath. Incisions with a length of 5 mm were made at point 11 of the right mammary areola and point 11 of the left mammary areola. With the guidance of an endoscope, the 5 mm of puncture sheath and operating apparatus were imbedded.

The surgeon initially blocked the avascular area at the superficial layer of the deep fascia at the breast with endoscopic scissors, and then used an ultrasonic knife to divide the fibrous connective tissue and perforating vessels at the suprasternal fossa. An operative space was gradually built with the outer edges of both sides of the sternocleidomastoid, upper border of thyroid cartilage, deep surface of the platysma at the superficial layer, anterior strap muscles at the deep layer, strap muscles in the middle and linea alba cervicalis in the center. Subsequently, the surgeon longitudinally cut the linea alba cervicalis to the position between the genuine and fake thyroid envelopes. The anterior muscle group was pushed towards the two sides with a surgical retractor for thyroid under the endoscope to expose the thyroid on the affected side. An ultrasound knife was then used to cut off the isthmus of the thyroid gland, disassociate the pretracheal fascia, and partly sever Berry's ligaments. The surgeon then disassociated upward and divided the suspensory ligaments of the thyroid, entered into the cricothyroid interval, and relieved the rigid fixation of the thyroid. Next, the surgeon pulled the thyroid towards the inside, cut the thyroid veins, divided all branches of the superior thyroid artery, disassociated the upper pole of the thyroid, lifted the lower pole, turned the gland upwards, divided it carefully, divided the inferior blood vessels of thyroid closely to the gland, and handled the inferior blood vessels of the thyroid. At this time, the surgeon needed to carefully distinguish the recurrent laryngeal nerve (RLN) to relieve the soft fixation of the thyroid. The thyroid was turned upwards. Closely against the trachea, the genuine and fake thyroid enve-

lopes were bluntly dissected upwards near the laryngotracheal groove. The RLN was then found and exposed behind the fake envelope. Generally, the right-side nerve was slightly on the outside of the laryngotracheal groove and the left-side nerve was inside the laryngotracheal groove. The RLN was isolated with saline gauze strips. An ultrasonic knife was used to incise perineural tissues with the cutting head far from the RLN, to maintain a safe distance and avoid heat damage. The nerve was fully mobilized to the position near the larynx at the inferior horn of thyroid cartilage. Then, the surgeon determined whether there was a branch of the RLN outside of the larynx. If there is a branch of the laryngeal nerve in Berry's ligament, the rear envelope of the thyroid should be reserved until the gland is completely cut. The central group lymph nodes were cleaned. The specimen was placed in a bag made from sterile gloves and was removed from the observation hole. The wound surface was washed with distilled water followed with normal saline. A drainage tube was placed in front of the throat to be drawn forth for fixation through offside puncturing. The intradermal suture was made at the incision and the wound was conglutinated with biological glue.

Breast approach. After the patients were placed under general anaesthesia with a tracheal cannula, they were placed in the supine position. The patients' neck and shoulders were elevated to ensure neck hyperextension and hypsokinesis. Subsequently, routine disinfection and draping was conducted. Two arch-shaped incisions with a length of approximately 0.5 cm were made inside each areola. A 1.2-cm incision was made at the position of skin fold nearer to the right breast in the middle point of a link-line between areolas on the two sides. The remaining steps were the same as those in the areola approach.

Observational indexes. Operating time, blood loss during surgery, post-operative hospitalization time, number of lymph nodes dissected, operative complications (including subcutaneous emphysema and tunnel bleeding), degree of post-operative incision pain and patient satisfaction with cosmetic results of incisions were recorded. The degree of pain was evaluated with the visual analogue scale (VAS). The 10-point scoring system was as follows: A score of 0 signified no pain, while a score of 10 signified intense pain and middle number scores reflected pain of different degrees. The cosmetic results

Table II. Comparison of complications.

Group	Group of complete breast areola approach		Group of breast approach		χ^2 -value	P-value
	Positive	Negative	Positive	Negative		
Subcutaneous emphysema	19	2	28	1	0.7884	0.3746
Tunnel bleeding	18	3	28	1	1.9523	0.1623
Transient recurrent laryngeal nerve injury	20	1	28	1	0.0541	0.8161
Transient hypocalcemia	20	1	28	1	0.0541	0.8161

of operative incisions were evaluated with the VAS. A score of 0 indicated dissatisfaction and of 10, satisfaction.

Statistical analysis. Data were analyzed with SAS 8.0 software (Cary, NC, USA). Data are presented as mean \pm standard deviation. The Student's t-test was used for group comparisons. A χ^2 test was used for the enumeration data. Since the enumeration data of complications were <5 , it was tested with Fisher's exact value. $P < 0.05$ was considered to indicate a statistically significant difference.

Results

Operation parameters. Operations were completed effectively in the two groups of patients with the use of endoscopy. We compared operating time, blood loss during surgery, and average hospitalization time in the two groups, and the differences were not statistically significant ($P > 0.05$). None of the patients in either group had postoperative infections.

Complications. The results showed that complications of hypocalcemia and transient RLN injury occurred in the two groups (hypocalcemia: areola approach, $n=1$ vs. breast approach, $n=1$; transient RLN injury: areola approach, $n=1$ vs. breast approach, $n=1$). All of these cases recovered within three months of surgery.

Complications in the two groups included tunnel bleeding and subcutaneous emphysema. The difference in postoperative complications between the two groups was not statistically significant ($P > 0.05$). Comparison of postoperative pain also showed no statistically significant differences. Of note, patients in the areola approach group had significantly higher satisfaction scores with the operative incisions compared with patients in the breast approach group ($P < 0.05$) (Table II).

Discussion

Surgery remains the most common therapeutic method for thyroid tumors. However, the obvious neck scar left after traditional thyroid surgery causes psychological problems in patients, especially females (6). The majority of patients with thyroid diseases are female, who can have the tendency for high aesthetic demands. In addition, Asian women pay particular attention to the beauty of their necks. Therefore, these patients have high cosmetic and prognostic requirements related to thyroid surgery. In 1997, Hüscher *et al* first reported

video-assisted thyroidectomy (VAT) (7). Subsequently, Ikeda *et al* and Ohgami *et al* successively reported on the total ET (TET) (8,9). In 2002, Chou *et al* reported the first traceless neck ET in China (10). From that point onwards, approaches to ET have been continuously developed and perfected. With the development of endoscopic techniques, thyroid cancer is no longer a contraindication of ET. In recent years, the techniques of ET have been rapidly improved and applied (11-13).

Classification of ET and selection of approaches. ET is divided into the cervical approach or remote approach (non-cervical approach), and divided into VAT or TET based on surgical methods. VAT, which is popular in America, is seldom performed in Asian countries. However, TET is developing rapidly in Asia (14). TET has more than 10 approaches including the neck, infraclavicular, anterior chest wall (breast, complete areola, single areola), axilla (unilateral and bilateral), axilla-breast (one side and both sides) and oral approaches. As modern women cannot cover the scars caused by the neck and clavicle approaches, patient satisfaction with the two approaches is low and therefore, they are seldom used. The oral approach belongs to the group of natural orifice transluminal endoscopic surgeries, so there are more chances to contaminate wounds. The principle behind scarless ET (SET) is to make a small incision at a position far from the neck. The flap is separated to the neck and the operation is performed with the laparoscopic apparatus with the assistance of an endoscope.

The surgical techniques for the axillary approach are complicated. Regardless of the hidden incision, treatments of bilateral thyroid glands and thyroid isthmus are limited, therefore the axillary approach is usually used in unilateral thyroid operations. The breast approach is used more commonly in SET. The observation direction is similar to open thyroid surgery, thus the breast approach can be completed conveniently and learned easily and becomes the first choice for beginners. At present, ET via the breast approach has been the most widely used method. However, due to the dissection factor and compact subcutaneous tissue in the sternum area, it is easy to cause scar contracture or hyperplasia, keloids and even pain and itching. These complications largely affect patients, especially young females, making it difficult for this approach to meet the cosmetic demands of patients. Similar to the breast approach, surgeons can easily handle bilateral thyroid gland lesions via the areola approach since all incisions are hidden in the areola and there is no obvious postoperative hypertrophic

scar. The cosmetic effect is therefore better. In addition, because of loose breast skin and areola size, the distance between the areola and the trocar can be increased via traction so it is difficult to cause friction between the endoscopic lens and surgical instruments, and thus the difficulty of the operation is reduced. As shown in our results, compared with the breast approach, operating time, blood loss during surgery, number of lymph nodes dissected, postoperative hospitalization time and incidence of postoperative complications did not increase significantly with the areola approach, so surgical safety is guaranteed by this technique. Furthermore, the differences in grades of postoperative pain were not statistically significant. Regarding patient satisfaction of cosmetic results, the areola approach was superior to the breast approach. Therefore, this approach is more suitable for women. The ET via the areola approach is an improved version of the traditional breast approach, so its indications and contraindications are similar and are related to the experience of the surgeon.

Difficulties and solutions of endoscopic thyroid microcarcinoma via the areola approach. In ET via the areola approach, the distance between the areola observation hole on one side and the operating hole is short; consequently, surgical apparatus are disturbed easily. Compared with the breast approach, the view changes because the observation hole is moved to the inside of the areola on one side, so operations become more difficult. From our experience, the following conclusions from the practical operating processes were drawn: i) When the operative space was initially established, apparatus were disturbed easily due to the small space. To solve this issue, the surgeon can change the angle of the observation lens for a better operative view. ii) If the patient's areola is small, the surgeon can properly move the operating hole in a position 0.5 cm from the areola to increase the distance from the trocar, and prevent the distance between the two holes from being too short and affecting the operation, thus reducing the 'chopstick effect'. iii) The female's breast skin is loose in order to allow for the moving and pulling of apparatus during operation. The observation hole can be pushed towards the middle of the sternum to recover the normal operative view and reduce view shift. Consequently, the surgeon can better handle the bilateral thyroid lesions, and the difficulty in operation is not significantly different from the breast approach. The entirety of the trocar for the breast approach is placed on the areola, so deep punctures and incisions are not needed, thus avoiding damage to the latex vessel or mammary tissue. It is better to perform punctures and incisions in the superficial fascia layer of the skin. The dissection and division layer should be between the deep and superficial fascias, and between the platysma and deep cervical fascia. This plane is loose connective tissue without bleeding after division, so the patient distress can be alleviated after surgery.

Prevention of complications. There are complications common to the areola approach and breast approach including tunnel bleeding, subcutaneous emphysema, hypercapnia, subdermal ecchymosis, fat liquefaction, RLN injury and parathyroid injury (15,16). Postoperative bleeding is mostly from trocar tunnel bleeding. To avoid trocar tunnel bleeding, a lens can be placed in the tunnel before the operation is finished

to observe whether there is bleeding under the lens. Once bleeding is found, an electric coagulation hook can be used for hemostasis. Subdermal ecchymosis and fat liquefaction are mostly caused by incorrect spatial separation layers, so it is necessary to properly control the layers during the operation. The dissection and division layer should be between the deep and superficial fascias, and between the platysma and deep cervical fascia. To avoid the occurrence of hypercapnia, the CO₂ pressure should be controlled within 6 mmHg during surgery. As the endoscope can amplify the view and make the partial dissection clearer, there are few injuries to the RLN, parathyroid and other crucial tissues during ET. To avoid RLN injuries, we propose the following recommendations:

Maintain a clear operative field. Initially use a high-definition endoscopic system and become familiar with the functional aspects of the equipment. Adjust the lens and focal length and set the endoscopic equipment to optimal conditions before surgery, including the gamma value, color balance, saturation and sharpness. Avoid using an unclear endoscope damaging the RLN and parathyroid.

Use smoke treatment technology. The smoke generated by an ultrasonic knife will affect the clarity of view due to the small space of the endoscopic surgery, so we use smoke treatment technology to guarantee a clear view. The specific measures are as follows: i) Actively withdraw the lens at proper times. When the ultrasonic knife works, actively withdraw the lens into the bridge card to alleviate the phenomenon of smoke directly covering the lens. ii) Set the pneumoperitoneum pressure to 6 mmHg. Additionally, set the flow of the pneumoperitoneum apparatus at maximum. Two routes of vacuum aspiration are used during operation. One route is connected to the aspirator to proactively aspirate blood in the event of errhysis and seepage in the operative field and to help exposure. The other route of vacuum aspiration is connected 5 mm from the side hole of the bridge card, so one can adjust the smoke discharging strength, lead the direction of smoke and achieve automatic smoke discharge. This, not only guarantees visibility, but also eliminates smoke from affecting the view. Use such measures to reduce the interference of smoke in the operative field so that nerve injuries caused by reduced clarity are limited.

Initiatively expose and protect the RLN. Just as in open surgery, good exposure is the key to a successful operation. Build a necessary space during the operation. Use the dedicated retractor for ET. Pull the strap muscles outward by adjusting the surgical bed to incline in the opposite direction of operation. Push the trachea toward the opposite side to expose the operative zone. Usually, micro bleeding occurs when one is handling the small vessels near the RLN entry point into the larynx. The operator should remain calm and not clamp blindly. The bleeding can be stopped after compression with small gauze strips for several minutes. Then, the position should be washed with normal saline and the operation should be continued after it is clear.

From the use of ultrasound knife. Cut the blood vessel connective tissue on the outside of Berry's ligament. Push the RLN downwards with gauze strips. Further pull and lift the thyroid tissue upwards and into the inside. While maintaining a safe distance, use the ultrasonic knife to dissect Berry's ligament and remove the thyroid gland.

In conclusion, compared with the breast approach, the areola approach is more difficult, however, has the advantages of hidden incision points, improved cosmetic result, allowing the treatment of bilateral lesions simultaneously. Among the approaches to ET, the areola approach can achieve the best cosmetics result, and can serve as a safe and effective surgical method for treatment of thyroid diseases, and is worthy of being widely applied. However, selection of approach should be based on individualized needs of the patients. Physicians must insist on prioritizing disease treatment over cosmetic result. Physicians cannot only emphasize cosmetic results without considering the surgical effects. Nor can they increase the risks associated with an operative to achieve improved cosmetic results. Physicians should have extensive surgical experience with the breast approach before choosing the areola approach.

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