The Improved Techniques of Holding the Lens in Endoscopic Thyroidectomy via Bilateral Areola Approach

junxiao wang

China Medical University

Qisheng Lin

China Medical University

Xiaolan Wu

China Medical University

Yuxiang Lin

China Medical University

ezhang liu (✉ 514705789@qq.com)

China Medical University <https://orcid.org/0000-0002-8281-4766>

Research Article

Keywords: endoscopic thyroidectomy, lymph node dissection, thyroid cancer, recurrent laryngeal nerve

Posted Date: July 24th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-723827/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Inexperienced endoscope holder often greatly affect the time and quality of endoscopic thyroidectomy (ET) via bilateral areola approach. We summarized some techniques of holding the endoscopic lens to evaluate the value of the technique in ET.

Methods: We retrospectively enrolled 200 eligible patients during two time peroids: 2015.6-2018.6 (Control group:inexperienced endoscope holder,n = 100) and 2019.9-2021.2 (Improved group:assistants who master the techniques of holding the endoscopic lens,n = 100). Surgery approach:unilateral lobectomy and isthmus resection plus ipsilateral cervical central lymph nodes dissection via bilateral areola approach of ET. Perioperative indicators included Volume of intraoperative blood loss,the time of three stages in the operation, the indwelling time of drainage tube and postoperative hospitalization time were compared. Postoperative complications were simultaneously compared involved temporary hoarseness, tetany, postoperative bleeding, postoperative infection and postoperative subcutaneous effusion.

Results: The time of stage 1 ($p < 0.001$), stage 2 ($p < 0.001$) and stage 3 ($p < 0.001$) in the operation in improved group were significantly shorter than those in control group. The volume of intraoperative blood loss was smaller ($p < 0.001$), postoperative hospitalization time was shorter ($p < 0.001$) and the indwelling time of drainage tube was shorter ($p < 0.001$) for improved group. In terms of postoperative complications, the control group had more cases of temporary hoarseness ($p = 0.002$), tetany ($p = 0.008$) and postprocedure subcutaneous effusion ($p = 0.009$), but there was no difference in postoperative bleeding ($p = 0.477$) and infection ($p = 1.000$) between the two groups.

Conclusions: The skills of holding the endoscopic lens which shorten the operation time and improve the quality of the operation are effective and suitable for novices.

Background

- Thyroid cancer ranks 9th in the global incidence rate in 2020, with 586,202 new cases and 43,646 deaths[1]. Traditional open surgery is a standard procedure for thyroid cancer, and is the most common procedure performed in recent decades. With the renewal of surgical instruments and the maturity of surgical techniques, endoscopic thyroidectomy (ET) has gradually accepted as a new type of surgery nowadays, and its cosmetic effect is beyond the reach of conventional open surgery[2]. As its indications have expanded from benign to malignant tumors, patients with lymph node metastasis are just as viable for endoscopic surgery[3].
- By far, the high acceptance and most commonly utilized approach is the anterier chest approach, one of which is the bilateral areola approach that has become our common approach because of the best cosmetic effect[4]. Base on the anatomical approach was identical to the open surgery,it also became a beginner's approach to ET. The lead surgeon loses the haptic sense of the hands during the surgery, so there is a higher requirement for clarity of vision. As the eye of the main surgeon, the

endoscope holder plays an extremely important role in the operation, which can directly affect the time and quality of the surgery. But the literature is scarce for the endoscope holder, therefore, this study summarized the experience for reference.

Methods

Patients

- We retrospectively enrolled 200 women diagnosed with papillary thyroid carcinoma (PTC) by postoperative histopathological examination who underwent unilateral thyroidectomy with cervical central lymph node dissection (CLND) at The Fifth Clinical Medical College of Fujian University of Traditional Chinese Medicine.
- Data collection was performed during two time periods: 2015.6-2018.6 (Control group, n = 100) and 2019.9-2021.2 (Improved group, n = 100). We examined the eligible patients in two time periods depending on whether the skill used. The time period of inexperienced endoscope holder participating in the operation by holding the endoscopic lens is considered as Group 1. Group 2 is experienced endoscope holder who have mastered the improved techniques after training for 10 operations cooperate with the same lead surgeon to complete the same procedure.

The entry criteria

- The entry criteria for enrollment of PTC are as follows: 1.Both preoperative examination consist of clinical palpation and imaging and intraoperative inspection of cervical lymph nodes were negative; 2.Primary thyroid carcinoma; 3.Tumor smaller than 4 cm in diameter.

The exclusion criteria

- The exclusion criteria of PTC are as follows: 1.local or contralateral recurrence after surgery; 2.Bilateral thyroid cancer; 3.The other type of thyroid carcinoma in addition to PTC; 4.Intraoperative conversion to open surgery; 5.Patients were prolonged the length of hospitalization on account of basal diseases.

Surgical procedure

- Unilateral lobectomy and isthmus resection plus ipsilateral CLND via bilateral areola approach of ET were executed on all the patients.
- The patient assumed herringbone supine position after general anesthesia for tracheal intubation. Raise the shoulders with cushion in order to tilt slightly the head back and expose the anterior neck. A soft head circle was used to avoid head motion so that the mentum osseum, thyroid cartilage, jugular notch were in the straight line. Disinfect the preoperative range with iodophor, up to lower lip, down to umbilical, outside to both sides of midaxillary lines and mid-upper arms. There were three

mini-incisions on the front of the chest: Two 0.5cm operation holes were established in each areola between 10 and 12 o'clock on both sides. One 1cm observation hole was set up in right areola between 2 and 4 o'clock (Fig. 1). Inject the inflation fluid (100ml of normal saline + 0.3ml of epinephrine + 20ml ropivacaine) around the three incisions and endoscopic tunnel of the observation hole.

- STAGE 1: Endoscopic lens and surgical energy instruments were reunited in manubrium area through the three Trocars around the areolas. We use Carbon dioxide at a pressure of 6mmHg (1mmHg = 0.133kPa) to maintain a clear operation visual space during the creation of the cavity. Accustomed electric hook was employed to separate the natural space between the superficial cervical fascia and the superficial layer of the deep cervical fascia which has no vascularity. Finally, a space up to thyroid cartilage and the lateral edge of the sternocleidomastoid muscle was formed (Fig. 2).
- STAGE 2: A neck white line incision was made to sufficiently reveal the thyroid gland. Then exploration the trachea was the first step to prevent recurrent laryngeal nerve (RLN) from injuring. We used ultrasonic knife to separate the pretracheal space and cut off the isthmus, disassociate the suspensory ligament of thyroid. Immediately, we accessed to the cricothyroid interval.
- We inserted the homemade thyroid retractor from the neck under direct vision of endoscope, pulled away the sternohyoid and sternothyroid muscle to unfold common carotid artery, cut off the middle thyroid vein with the ultrasonic knife when you can see it. Then separated the cricothyroid space and common carotid artery upwards, condensed and transected the superior thyroid vessels exceedingly close to the upper pole of the thyroid to avoid damaging the external branch of the superior laryngeal nerve (Fig. 3).
- Close proximity to the lower pole of the thyroid gland to cut off the second and third level branches of inferior thyroid vessel (Fig. 4). Lifted the lower pole of the thyroid to explore the buried RLN in the tracheoesophageal groove. After finding the RLN, we continue to cut off the other branches of inferior thyroid vessel, separate the thyroid from the bottom up along with RLN. Until the ligament of Berry was severed, the superior parathyroid gland was retained in situ superior and external the larynx where the RLN enters, and then the thyroid gland was completely removed (Fig. 5).
- STAGE 3: After diagnosis of malignant thyroid tumor by preoperative fine needle aspiration cytology or intraoperative frozen-section examination, ipsilateral CLND was executed prophylactically without hesitation. The cleaning range was indicated below: up to hyoid bone, down to jugular notch, outside to the medial edge of the common carotid artery of both sides. Following rechecking whether the parathyroid glands were ischemic and placing the drainage tube, the neck white line was sutured tightly (Fig. 6). Autologous transplantation was implemented if poor blood supply of parathyroid glands was observed.
- Finally, discharged the subcutaneous emphysema and sutured the incisions around the areolas (Fig. 7).

Objectives

- The study was designed to evaluate whether conferred the improved endoscopic lens techniques was better than before in terms of time and quality of operation.
- The volume of intraoperative blood loss, the time of three stages in the operation, the indwelling time of drainage tube, postoperative hospitalization time were compared before and after the improved endoscopic lens technique. Postoperative complications included temporary hoarseness, tetany, postoperative bleeding, postoperative infection and postoperative subcutaneous effusion were also compared between the two groups. The three stages were introduced in details as follows:
- STAGE 1: From trocars were built to the neck white line was ready to be cutted.
- STAGE 2: From cutting the neck white line to completing thyroidectomy.
- STAGE 3: From dissection of central lymph node to the neck white line was sutured.

Statistical analysis

- SPSS 23.0 was used for statistical analysis in this study. Measurement data were presented as mean $\pm$ standard error, and then were calculated with independent-sample t test. Enumeration data were expressed as ratio (%) and performed adopting chi-square test. $P < 0.05$ was referred to statistically significant.

Results

- **Clinical data**
- All 200 patients were women at study entry, 100 women per group, including 68 patients undergoing fine-needle aspiration cytology before operation, 78 patients were implemented autologous transplantation of parathyroid gland. Thyroid peroxidase level were elevated in 40 patients. We set the enrolled patients as women because their breast mobility is better, which makes the operation easier. In order to completely remove the tumor, the RLN which went through the tumor in two patients were cutted off, and then sutured it under the endoscope. No tracheal injury and permanent tetany due to hypocalcemia after surgery.
- Clinical characteristics of patients and general data of tumor were listed in Table 1. There were not significantly differences in the diameter of tumor registered from the pathological reports ($P = 0.078$), tumor location ($P = 0.669$) and the number of CLND in the operation ($P = 0.677$). The control group was aged (years) 45.35 ± 6.57 , range (years) 29–75, meanwhile the improvement group was aged (years) 45.25 ± 5.35 , range (years) 38–68, no statistically significant was found ($P = 0.906$) (Table 1).
- **The time of three stages in the operation**
- The time of stage 1 (28.83 ± 4.87 vs 47.61 ± 8.65 min, $p < 0.001$), stage 2 (42.35 ± 7.49 vs 65.86 ± 8.07 min, $p < 0.001$) and stage 3 (35.75 ± 7.21 vs 50.23 ± 7.65 min, $p < 0.001$) were all shorter in improvement group (Table 2).
- **Perioperative data**

- The volume of intraoperative blood loss was smaller (21.75 ± 8.74 vs 33.80 ± 7.32 ml, $p < 0.001$) and postoperative hospitalization time was shorter (2.39 ± 0.70 vs 3.99 ± 0.76 ml, $p < 0.001$) for improvement group. Compared with the control group, the improvement group distinctly shorter time of drainage tube indwelling was observed (2.48 ± 0.76 vs 3.70 ± 0.58 days, $p < 0.001$) (Table 3).
- **Postoperative complications**
- Higher number of cases of temporary hoarseness ($p = 0.002$), tetany ($p = 0.008$) and postoperative subcutaneous effusion ($p = 0.009$) were found in the control group, and there was no significant difference in postoperative bleeding ($p = 0.477$) and infection ($p = 1.000$) between the two groups (Table 4).
- Only one case of postoperative infection in the control group in the form of redness and local pain in the chest wall skin. No abscess was found by ultrasound and puncture, so we given oral cephalosporin antibiotic treatment and healed it after a week. Postoperative hemorrhage occurred in two patients manifested as subcutaneous ecchymosis and swelling of the neck and chest, and drainage volume up to 200ml. We performed the reoperation under the endoscopy after fully communicating with the patients. It turns out that the bleeding site in two patients were small vessel in the superficial cervical fascia.
- All patients with temporary hoarseness recovered within 6 months. When stripped the recurrent laryngeal nerve in the improved group, we retained the fascia and vessels on the surface, and the number of patients with temporary hoarseness were greatly reduced. All tetany patients caused by hypocalcemia were given calcium tablets and alfacalcidol and recovered within two months.

Table 1
Clinical characteristics of patients and general data of tumor

	the control group (n = 100) no.(%)	the improved group (n = 100) no.(%)	P value
Gender			
male	0	0	
female	100(100%)	100(100%)	
Age,year(mean $\pm$ SD)	45.35 $\pm$ 6.57	45.25 $\pm$ 5.35	0.906
Tumor location			0.669
left	57(57%)	54(54%)	
right	43(43%)	46(46%)	
Tumor diameter,cm(mean $\pm$ SD)	0.96 $\pm$ 0.66	0.83 $\pm$ 0.38	0.078
Number of central lymph node(mean $\pm$ SD)	9.03 $\pm$ 3.97	8.81 $\pm$ 3.48	0.677

Table 2 The time of three stages in the operation(mean $\pm$ SD)

	the control group (n = 100)	the improved group (n = 100)	P value
STAGE 1 ^a ,min	47.61 $\pm$ 8.65	28.83 $\pm$ 4.87	< 0.001
STAGE 2 ^b ,min	65.86 $\pm$ 8.07	42.35 $\pm$ 7.49	< 0.001
STAGE 3 ^c ,min	50.23 $\pm$ 7.65	35.75 $\pm$ 7.21	< 0.001

^a, from Trocars were built to the neck white line was ready to be cutted. ^b, from cutting the neck white line to completing thyroidectomy. ^c, from dissection of central lymph node to the neck white line is sutured.

Table 3
Perioperative data

	the control group (n = 100)	the improved group (n = 100)	P value
Intraoperative blood loss,ml	33.80 $\pm$ 7.32	21.75 $\pm$ 8.74	< 0.001
Postoperative hospitalization time,days	3.99 $\pm$ 0.76	2.39 $\pm$ 0.70	< 0.001
Indwelling time of drainage tube,days	3.70 $\pm$ 0.58	2.48 $\pm$ 0.76	< 0.001

Table 4
Postoperative complications

	the control group	the improved group	P value
	(n = 100) no.(%)	(n = 100) no.(%)	
Temporary hoarseness	14(14%)	2(2%)	0.002
Tetany	15(15%)	4(4%)	0.008
Postoperative bleeding	0	2(2%)	0.477
Postoperative infection	1(1%)	0	1.000
Postoperative subcutaneous effusion	9(9%)	1(1%)	0.009

Discussion

- **Surgical approach**
- With color doppler ultrasound screening more and more thyroid carcinoma[5], the development of thyroidectomy is changing with each passing day. ET has become the routine procedure replaced the open surgery in most hospitals, consequently, need assistant to master the technique of holding the lens as soon as possible. There are various surgery approaches for ET, include transthoracic[6], transaxillary[7], transoral[8], and mixed approach[9], each with its own advantages and disadvantages. However, there are no relevant guidelines or consensus to regulate the surgical method. We took into account the difficulty and quality of the operation, combined the patient's cosmetic needs, finally determined the bilateral areola approach as our first choice for most patients.
- Once patients were diagnosed with carcinoma, CLND was performed regardless of the state of the lymph nodes preoperative, although the majority of patients were prophylactic dissection. This view was supported by some published literatures[10–13], and also objected by other literatures[14–17]. Whether to clean or not is still controversial[18]. We were based on the following considerations: The first point is that patients were afraid of cancer, cancel dissection the lymph nodes was identified as incomplete treatment by them. The second point, about 1/3 of postoperative pathological reports of patients with preoperative cN0 have lymph nodes metastasis[19].
- **Skills of holding the endoscopic lens**
- Although the same system and instruments were applied, ET is barely distinguishable from laparoscopic surgery for the gastrointestinal. There are three obvious difference between them. The first are the space and pressure. ET has a small operation space and low carbon dioxide maintenance pressure, while in laparoscopic surgery has a larger space and higher pressure. It makes the endoscopic lens is prone to fogging and difficult to maintain clear vision. The second are the operation form. The longer trocar is employed in ET, which imply longer subcutaneous distance, the lead surgeon is difficult to manipulate due to “level effect”, especially during CLND. The third is the assistant. The laparoscopic surgery requires the assistant to expose the operative area with

forceps and pull the organization to maintain tension. ET is not possible to achieve this since there are only two operation holes. “Chopsticks effect” caused by the establishment of parallel instrument will result in frequent collisions between the left hand of the lead surgeon and the endoscopic lens of the assistant on basis of the nearby holes in the right areola.

- Combined with the aforementioned points, endoscope holder plays a huge role in the operation. But lack of experience at the beginning makes ET more time-consuming, bleeding and traumatic. So how to quickly improve the technique of endoscope holder and cooperative with lead surgeon tacitly is a significant problem. By watching the videos after surgery, we carefully summarized the experience and skills. In particular, we research iteratively the unexpected situation during the operation.
- Finally, we summarized our experience into 8 tips.
- **Placement**
- The purpose of placement is to avoid the entanglement of instruments and wires during the whole operation, and the lead surgeon won't be restricted when changing instrument, so as to improve the smoothness of the operation. The optical fiber and endoscopic lens are placed on the top layer, and enough length is reserved so that the lens can exit the trocar freely. Pneumoperitoneum tube and the suction tube connected to the trocar on the right are placed on the bottom, they won't be moved during the whole surgery. The ultrasonic knife and suction device in the right hand of the lead surgeon should be placed in a suitable position with the aim of replacing quickly when bleeding.

Immersion

- As mentioned earlier, the surgery space is small and a large amount of mist can be generated during the operation, therefore the lens is easily contaminated. Before surgery, place the endoscopic lens in hot water at 70°C for several minutes to make the lens temperature higher than that of the operating space. At the same time, use the trocar connected suction tube on the right side to accelerate the exhaust (Fig. 1), which can keep the surgery picture clear for a long time.

Wipe

- Wiping is the method adopted after the large amount of aerosol or blood generated during the operation with the electric hook or ultrasonic knife can easily contaminate the lens. The entire lens wiping process must be rapid to avoid prolonged exposure to the air to cool the lens. This action requires “make use of every bit of time”, and is often performed when the lead surgeon is changing instruments to improve the smoothness of the operation. When wiping the lens, we use iodophor to moisten the mirror surface, and then use gauze to wipe the lens once from the bottom to the top. Repeated wiping does not make the lens cleaner. Pay attention to observe whether there is blood in the lens Trocar and blur it. When the mist was just generated, controlling the exhaust of the right suction tube is a common way to reduce the number of lens cleaning, because the lens is not contaminated at this time. The pursuit of coherent operation is our goal. Frequent wiping of the lens will not only greatly extend the operation time, but also affect the surgeon's mood.

Level

- Horizontal picture is the guarantee of entering the correct anatomical level. Before crossing the jugular notch, keep in a horizontal line of the deep pectoral fascia. After crossing that, keep the bilateral sternocleidomastoid muscles horizontally symmetrical. The tilt of the picture will cause the main surgeon to separate the level incorrectly, damage the fascia, sternocleidomastoid and anterior cervical muscles, cause bleeding, prolong the operation time. Eventually affect the quality of the operation and even conversion to open surgery. Moreover, incorrectly interstice means larger trauma and more exudate postoperation, which cause drainage liquid volume increased and long indwelling time of the drainage tube.

Focus

- This is important for novices. Laparoscopic gastrointestinal surgery, with a wide field of view, and basically at the same depth without focusing. However, the intraoperative situation of ET is just the opposite. ET is a longitudinal operation, from near to far. As the operation progresses, the field of view will inevitably become blurred. When revealing the RLN, you need to adjust the focus to see the small vessels on it. To observe whether the parathyroid gland is ischemia, we also need to adjust the focus to accurately judge.

Retract

- Blindly extending the lens forward will limit the field of view and cause the lead surgeon to lose the holistic view. When separating the space of the bilateral sternocleidomastoid muscle, the ultrasound knife swings greatly. At this time, the lens should be retracted to expand the observation range so that the lead surgeon can observe bilateral symmetry and avoid bleeding caused by the error of the separation level. During the entire operation, when we separate adipose tissue or hemostasis by electrocoagulation and ultrasound knife, a large amount of mist and splashing liquid or blood can be generated, which can readily blur the lens. Particular in the CLND, the surgical site is close to the trocar, and due to the vaporization effect of the ultrasonic knife, the lens is easily contaminated by adipose droplets. We found that when the main surgeon uses the ultrasonic knife to clamp the adipose tissue or the bleeding site, it can be properly retracted into the trocar and protect the lens, which can reduce the chance of contamination of the lens, but you should keep the operative site inside the screen. If the visual field is blur, the thymus is hard to identify. Type B2 and B3 parathyroid glands are more easily removed in CLND, which may lead to postoperative hypoparathyroidism. More seriously, the consequence of thoracotomy for bleeding caused by damage to the upper mediastinal vessels is disastrous.

Follow

- The endoscope holder is the eye of the lead surgeon. Only understand the surgical habits, proactively try to figure out the idea during the operation and long-term stability and tacit cooperation can be a

eligible assistant. Besides, we hope assistant should be a predictable assistant. It means that when the lead surgeon's operative step is just completed, the assistant immediately move to the place of the next step, instead of moving there after the ultrasound knife of the lead surgeon moves. This is considerable importance to increase the continuity of the lead surgeon operation. The upper pole and dorsal side of the thyroid gland are often difficult to expose when the tumor is large and located in the upper middle. We often combined direction from the medial, the anterior side across the tumor and the lateral, flexibly manipulate the 30-degree lens to cooperate the lead surgeon to deal with the upper pole.

Steady

- A good video with viewability requires a steady picture. Shaking the lens all the time or moving suddenly and sharply are forbidden, these action are not only cannot observe the field normally, but also dizzy the main surgeon. When bleeding occurs, the lead surgeon needs hemostasis with ultrasonic knife at the first time, simultaneously, assistant makes sure that the lens doesn't move absolutely, pays attention to the lens not to be contaminated, lock into the bleeding site and complete hemostasis successfully. If the lens is contaminated by blood, the sternoclavicular joint or thyroid gland can be wiped temporarily to buy time for hemostasis. This is because once you exit the lens and enter again, a large amount of blood has covered the bleeding point which cannot be accurately identified, and the space is difficult to maintain when using the aspirator, which increases the difficulty of hemostasis. If the lens is withdrawn, blood may enter the lens trocar, which makes it impossible to enter for a short time, and the potential of conversion to open surgery is particularly high. The assistant can also press the bleeding site from the skin of the corresponding bleeding site with the hand to buy time for the lead surgeon to replace aspirator.

Limitation

- The biggest limitation exists in this study is that it may be affected by the maturity of the lead surgeon's technique. So when we designed this study, we try our best efforts at minimise this impact. Performing 60 cases of endoscopic thyroidectomy means passing the early stages of the learning curve, and 150 cases means that the proficiency and stability of the surgery have reached the advanced level[21]. For endoscope holder, 30 cases are the early stage and 60 cases are the advanced level[21]. The lead surgeon came into contact with ET 15 years ago. Before the patients began to be enrolled in June 2015, he had completed more than 150 surgeries. We selected inexperienced endoscope holder, informed them of the technical points in detail, and then went through 10 ET, ultimately participated in the operation. When this assistant has involved in 30 surgeries, he will be replaced by another endoscope holder who has been trained in 10 surgeries.

Conclusion

The 8 techniques of holding the endoscopic lens can quickly upgrade the ability of endoscope holder, and cooperate with the lead surgeon to shorten the operation time and improve the quality of the operation, it

is quite suitable for novices to learn.

Abbreviations

ET

Endoscopic thyroidectomy; PTC Papillary thyroid carcinoma CLND Central lymph node dissection RLN Recurrent laryngeal nerve

Declarations

Ethics approval and consent to participate

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. This study was approved by the Research Ethics Committee of The Fifth Clinical Medical College of Fujian University of Traditional Chinese Medicine. Informed consent was obtained from each participant. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013).

Consent for publication

Written informed consent for publication of their clinical details and/or clinical images was obtained from the patient/parent/guardian/ relative of the patient. A copy of the consent form is available for review by the Editor of this journal.

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests.

Funding

This research did not receive funding support.

Authors' contributions

JXW,EZL conception and design. QSL administrative support. XLW collection and assembly of data. JXW,XLW,YXL data analysis and interpretation. All authors wrote the manuscript and approved the final manuscript.

Acknowledgements

Not applicable.

References

1. Sung H, Ferlay J, Siegel RL, et al Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin*. 2021;71(3):209–49.
2. Li-Tsang CW, Lau JC, Chan CC. Prevalence of hypertrophic scar formation and its characteristics among the Chinese population. *Burns*. 2005;31(5):610–6.
3. Wang Y, Liu K, Xiong J, et al Total endoscopic versus conventional open thyroidectomy for papillary thyroid microcarcinoma. *J Craniofac Surg*. 2015;26(2):464–8.
4. Ohgami M, Ishii S, Arisawa Y, et al Scarless endoscopic thyroidectomy: breast approach for better cosmesis. *Surg Laparosc Endosc Percutan Tech*. 2000;10(1):1–4.
5. Cabanillas ME, McFadden DG, Durante C. Thyroid cancer. *Lancet*. 2016;388(10061):2783–95.
6. Wang C, Feng Z, Li J, et al Endoscopic thyroidectomy via areola approach: summary of 1,250 cases in a single institution. *Surg Endosc*. 2015;29(1):192–201.
7. Stang MT, Yip L, Wharry L, et al Gasless Transaxillary Endoscopic Thyroidectomy with Robotic Assistance: A High-Volume Experience in North America. *Thyroid*. 2018;28(12):1655–61.
8. Anuwong A, Ketwong K, Jitpratoom P, et al Safety and Outcomes of the Transoral Endoscopic Thyroidectomy Vestibular Approach. *JAMA Surg*. 2018;153(1):21–7.
9. Mo K, Zhao M, Wang K, et al Comparison of endoscopic thyroidectomy via a modified axillo-breast approach with the conventional breast approach for treatment of unilateral papillary thyroid microcarcinoma. *Med (Baltim)*. 2018;97(45):e13030.
10. Popadich A, Levin O, Lee JC, et al A multicenter cohort study of total thyroidectomy and routine central lymph node dissection for cN0 papillary thyroid cancer. *Surgery*. 2011;150(6):1048–57.
11. Barczyński M, Konturek A, Stopa M, et al Prophylactic central neck dissection for papillary thyroid cancer. *Br J Surg*. 2013;100(3):410–8.
12. Hartl DM, Mamelie E, Borget I, et al Influence of prophylactic neck dissection on rate of retreatment for papillary thyroid carcinoma. *World J Surg*. 2013;37(8):1951–8.
13. Sywak M, Cornford L, Roach P, et al Routine ipsilateral level VI lymphadenectomy reduces postoperative thyroglobulin levels in papillary thyroid cancer. *Surgery*. 2006;140(6):1000–7.
14. Hughes DT, White ML, Miller BS, et al Influence of prophylactic central lymph node dissection on postoperative thyroglobulin levels and radioiodine treatment in papillary thyroid cancer. *Surgery*. 2010;148(6):1100 – 1007.
15. Lang BH, Wong KP, Wan KY, et al Impact of routine unilateral central neck dissection on preablative and postablative stimulated thyroglobulin levels after total thyroidectomy in papillary thyroid carcinoma. *Ann Surg Oncol*. 2012;19(1):60–7.
16. Wang TS, Evans DB, Fareau GG, Carroll T, Yen TW. Effect of prophylactic central compartment neck dissection on serum thyroglobulin and recommendations for adjuvant radioactive iodine in patients

- with differentiated thyroid cancer. *Ann Surg Oncol*. 2012;19(13):4217–22.
17. Chisholm EJ, Kulinskaya E, Tolley NS. Systematic review and meta-analysis of the adverse effects of thyroidectomy combined with central neck dissection as compared with thyroidectomy alone. *Laryngoscope*. 2009;119(6):1135–9.
 18. 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):1–133.
 19. Zhao H, Li H. Meta-analysis of ultrasound for cervical lymph nodes in papillary thyroid cancer: Diagnosis of central and lateral compartment nodal metastases. *Eur J Radiol*. 2019;112:14–21.
 20. Liu S, Qiu M, Jiang DZ, et al The learning curve for endoscopic thyroidectomy: a single surgeon's experience. *Surg Endosc*. 2009;23(8):1802–6.
 21. Liang J, Hu Y, Zhao Q, Li Q. Learning curve for endoscope holder in endoscopic thyroidectomy via complete areola approach: a prospective study. *Surg Endosc*. 2015;29(7):1920–6.

Figures

Figure 1

The placement of various instruments before the operation. ☐Operation hole; ☐Observation hole; ☐Suction tube; ☐Pneumoperitoneum tube.

Figure 2

Surgical space is created (At the beginning of STAGE 2). ☐ Superficial cervical fascia; ☐ Superficial layer of the deep cervical fascia; ☐ Sternocleidomastoid muscle.

Figure 3

Cut off the upper pole blood vessels of the thyroid. ☐Sternohyoid muscle; ☐Sternothyroid muscle; ☐Superior thyroid vessels; ☐Cricothyroid interval; ☐Homemade retractor.

Figure 4

Dissect the lower pole of the thyroid and look for the inferior parathyroid glands. ☐Second and third level branches of inferior thyroid vessel; ☐Common carotid artery; ☐Inferior parathyroid gland.

Figure 5

Reveal the relevant structure when thyroid gland is cutted off (At the end of STAGE 2). ☐Superior parathyroid gland; ☐Recurrent laryngeal nerve; ☐Esophageal; ☐Common carotid artery.

Figure 6

Place the drainage tube and suture the neck white line (At the end of STAGE 3). □ Neck white line;
□ Drainage tube.

Figure 7

Absorbable thread suture the incisions. □ Drainage tube; □ Incisions.

Figure 8

The operation time of three stages and perioperative data for comparison.(A) Comparison of operation time in three stages between the two groups. (B) Comparison of intraoperative blood loss (IBL) between the two groups. (C) Comparison of Postoperative hospitalization time (PHT) between the two groups. (D) Comparison of Indwelling time of drainage tube (ITD) between the two groups.