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A Clinical Analysis of 100 Cases of Gasless Endoscopic Thyroidectomy

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무기하 내시경 갑상선절제술 100예의 임상적 고찰

김정수 · 김정구 · 김기환 · 안창혁 · 전해명 · 임근우 · 김응국 · 전정수 · 이재학 · 손현식[1] · 이정민[1] · 김종분[2] · 정현주[2]

Purpose: With recent developments in endoscopic surgery for thyroid tumors, several approaches have been applied to endoscopic neck surgery. Gasless endoscopic thyroidectomy has some advantages over gas insufflating surgery. We evaluated the role of gasless endoscopic thyroidectomies on various thyroid tumors including malignant thyroid tumors.
Methods: We performed thyroidectomies for a total of 195 patients who were admitted to Uijongbu St. Mary's Hospital from November 1999 to February 2002. We compared the clinical data of 100 patients who received gasless endoscopic thyroidectomies with the data of 95 patients who underwent conventional thyroidectomies. Furthermore, we subclassified the 100 patients who received a gasless endoscopic thyroidectomy into two groups, before and after the start of 2001.
Results: The analysis of the clinical data showed that an endoscopic thyroidectomy gave superior results with respect to the time of postoperative recovery and cosmetic results. Also, the patients in the second half group showed significantly shorter operation times reduced from 153.4 min. to 128.6 min. and length of hospital stay similarly reduced (3.55 days vs. 5.35 days).
Conclusion: A gasless endoscopic thyroidectomy is a safe and technically feasible alternative to a conventional thyroidectomy in benign and early malignant tumors, and provides good cosmetic results. **(J Korean Surg Soc 2002;63:18-22)**

Key Words: Endoscopic thyroidectomy, Thyroid tumors
중심 단어: 무기하 내시경 갑상선절제술, 갑상선종양

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INTRODUCTION

Endoscopic surgery was rapidly developed recently. Especially thyroid and parathyroid surgery has been a new field of endoscopic surgery. Since 1997, the first endoscopic operation for thyroid tumor, (*1*) several methods by video-assisted or endoscopic technique were developed and applied by many endoscopic surgeons. (*2-5*) The excellent cosmetic result of endoscopic thyroidectomy has promoted the development of endoscopic surgery for thyroid and parathyroid tumors. CO_2 gas insufflation method was used at the beginning of this operation method. Then, gasless method was developed using prototype retractor system. This method has some advantages over gas insufflation method, such as minimizing possible hazard of hypercarbia, acidosis, subcutaneous emphysema. (*6*) We applied gasless endoscopic thyroid surgery for thyroid tumors including a micropapillary cancer in 100 patients for about 2 years. We analysed the clinical data and evaluated the role of gasless endoscopic surgery for thyroid tumors.

METHODS

From November 1999 to January 2002, 100 patients with 106

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thyroid tumors underwent gasless endoscopic thyroidectomy using a retractor system and an ultrasonic coagulator at the Department of General Surgery, Uijongbu St. Mary's Hospital, College of Medicine, Catholic University of Korea. The patients included 94 women and six men who ranged in age from 19 to 66 years (mean 37.2). Age distribution was shown in Table 1. Most common age group was 31 40 (31%). They were diagnosed preoperatively by ultrasound and isotope scans as having thyroid tumors. Fine needle biopsies were performed on 95 patients, while one patient refused the procedure. In 51 patients, fine needle biopsies revealed nodular hyperplasia or benign cystic lesions. In eight patients, follicular lesions were noted in fine needle biopsies. In 14 patients, the diagnoses were not confirmed preoperatively in fine needle biopsy. One of the patients had a completion total thyroidectomy after a biopsy specimen could not be obtained from a calcified nodule that revealed papillary cancer. The treated patients opted for a gasless endoscopic thyroidectomy due to the failure of repeated aspiration and hormonal suppression treatment to reduce the tumor; the fear of a further enlargement of their tumors; or a desire to avoid a conventional thyroidectomy for cosmetic reasons even if fine needle biopsies revealed a suspicious diagnosis of neoplasm that could eventually require a completion thyroidectomy. The maximal diameter of the tumors ranged from 0.5 to nine centimeters and most tumors were palpated and obviously visible in the anterior neck area. The gasless endoscopic thyroidectomy procedure was performed under general anesthesia. Patients were placed on the operation table in the supine position with the neck extended using a shoulder pillow. About 500 ml of diluted epinephrine solution (1:500,000) was injected with a 20 G long needle into the subcutaneous space in the anterior chest wall and subplatysmal space in the anterior neck to prevent bleeding. A 10-mm skin incision was made two-thirds of the way down from the clavicle to the nipple in a midclavicular line on the anterior chest wall. These areas were then dissected bluntly and gently through a 10-mm skin wound with a 46-cm acrylic bar. When the bar was introduced over the clavicle, careful handling was required because of a risk that the bar could be introduced incorrectly under the clavicle. A 10-mm trocar was inserted and carbon dioxide was insufflated through the 10-mm trocar at a pressure of 6 mmHg. A 5-mm trocar was inserted at the other midclavicular line and another 5-mm trocar was introduced at the parasternal border between the first two trocar sites to minimize the development of a keloid scar. A 30°, 5-mm endoscope was inserted through the 5-mm port at the parasternal border. Any remaining connective tissues in the space were dissected with endoscopic scissors and electrocauterization. During the dissection, intermittent suction was applied via a suction tube which was connected to a 5-mm port to evacuate smoke and to improve visibility. The operative space was made from the anterior chest to the thyroid cartilage level of upper neck above the strap muscle, to the lateral border of sternocleidomastoideus muscle laterally. A prototype gasless retractor system shaped like a question mark was assembled and introduced through the 10-mm port wound site. The skin flap was elevated by a retractor system (Fig. 1). After securing the operative space, the strap muscle was dissected at the avascular midline with an L-shaped hook and ultrasonically activated scalpel (Harmonic Scalpel: Ethicon Endo-Surgery, New Brunswick, NJ, U.S.A.), then retracted laterally with 3 0 vicryl through the skin flap. The vicryl string was tied around the retractor system for securing retraction. The thyroid mass was revealed and dissected from the lower pole with division of inferior thyroid veins, proceeding to the posterior and lateral aspects of the gland with an

Table 1.

Age	Number
>20	5
21 30	25
31 40	31
41 50	24
51 60	12
61>	3
Total	100

Fig. 1. Operative view which shows a gasless retractor system was applied to a gasless endoscopic thyroidectomy.

ultrasonically activated scalpel while the tumor was elevated and retracted with a 5-mm toothed grasping forceps from the other 5-mm port. The inferior thyroid artery and the middle thyroid vein were skeletonized and divided with an ultrasonically activated scalpel, and the thyroid was separated from the trachea. The thyroid tumor mass involving parenchyma was divided at the isthmus. The superior thyroid artery and vein were identified and divided last. Most of thyroid parenchymal tissue was removed except some tissue at superior pole of involved lobe. During the procedure, the parathyroid glands and the recurrent laryngeal nerve were identified and preserved. On the assumption that the tumors are benign, all the operations were done as a subtotal thyroidectomy except one case. The micropapillary cancer which was diagnosed by fine needle biopsy was resected by total thyroidectomy including central node dissection. After the subtotal thyroidectomy, the specimen was retrieved via a 10-mm port wound with a bag. The specimen was sent to the pathology department for frozen section examination. After complete hemostasis, the strap muscles were sutured with 3-0 vicryl. The 5-mm closed suction drain was inserted and placed at the lower part of operative space. The port wounds were closed with double layer sutures. The clinical data of endoscopic thyroidectomy cases was reviewed and analysed according to the operation period statistically. And the data of endoscopic thyroidectomy was compared with that of conventional thyroidectomy.

Table 2.

Location	Number
Right	60
Left	32
Both	6
Isthmus	2
Total	100

Table 3.

Tumor size	Number
<2 cm	12
2 4 cm	60
>4 cm	28
Total	100

RESULTS

A total of 106 tumors in 100 patients were reviewed with clinical data. The location of tumors is shown in Table 2. The average diameter of tumors was 2.25 cm (range, 1 9 cm). The classification of tumor size was shown in Table 3. The average operation time was 141 min (range, 70 290 min) as shown in Table 4. The operation time was decreased in later half period as shown in Table 4 ($P<0.05$). In three cases, a conversion to open operation was made because of the diagnosis as a papillary cancer upon frozen section, bleeding, or tumor size over five cm. All of the conversions were made early in the learning curve period. The average drainage amount was 174.3 ml (range, 27 420 ml). The closed suction drainage was kept for about 3 days. If the amount was over 50 ml, the patient was discharged with closed suction drain due to prevention of postoperative seroma. The patients were hospitalized after surgery for an average of 3.55 days (range, 1 9 days). The patients were discharged after postoperative wound pains were much improved. The postoperative pain was much improved within two days postoperatively in most cases. In the cases of conventional operations, most patients wanted to be discharged after wound healing and improvement of postoperative wound pain. The hospitalization in endoscopic thyroidectomy was shorter than that of conventional operation significantly (3.55 days vs 5.35 days). The final pathologic diagnoses are shown in Table 5. Three of the patients had a completion thyroidectomy after confirmation of pathological malignancy. One patient wanted to transfer to other hospital. Four patients whose pathological diagnoses were micropapillary cancers or a mimi-

Table 4.

Op. time (min)	First half (cases)	Second half (cases)	Total (cases)
60	–	–	–
60 90	–	14	14
90 120	3	14	17
120 150	15	10	25
150 180	19	6	25
180 210	6	3	9
210 240	3	2	5
240 270	2	2	4
270	–	1	1
Average	153.4	128.6	141

Table 5.

Pathology	Endoscopic operation			Conventional operation
	First half	Second half	Total	
Nodular hyperplasia	30	42	72	41
Follicular adenoma	8	7	15	7
Cyst	3	0	3	0
Papillary cancer	4	2	6	25
Follicular cancer	2	1	3	0
Others	1	2	3	22
Total	48	52	100	95

mally invasive follicular cancer were only treated with hormonal treatment. One patient who was diagnosed as a micropapillary cancer received an endoscopic total thyroidectomy. When the data was analysed in terms of learning curve period, there were significant difference in operation time and hospitalization period, statistically. The operation time was decreased in second half group from 153.4 min to 128.6 min ($P<0.05$). The hospital stay was shortened from 3.9 days in first half group to 3.2 days in second half group. In addressing the complication, two cases of transient recurrent laryngeal nerve palsy were noted but recovered within a month postoperatively. Most patients complained anterior chest pain or discomfort especially around the 10mm port wound site. This discomfort or paresthesia on anterior chest wall was maybe due to the injury of the transverse cervical nerve or the supraclavicular nerve during the creation of the operation space and elevation of the skin flap with the retractor system via 10 mm port wound site. But, most patients were relieved of chest wall discomfort within two days. The discomfort and paresthesia were much improved within two months in most patients. All wounds were hidden with underwear. All patients were satisfied with cosmetic results except small lower neck swellings in some cases. Most cases were followed up for 2 months after surgery.

DISCUSSION

Since the first endoscopic thyroidectomy in 1997, endoscopic neck surgery was developed remarkably by several approaches. They include precordial approach, (*2*) breast approach, (*3*) axillary approach, (*4*) gasless approach using Kirshner wire, (*5*) Usui et al. (*6*) modified this method by applying new retractor. Each method has some advantages and disadvantages. For example, precordial approach remains the scar on lower neck or chest wall. Axillary approach remains no scar in chest wall or neck. But this approach may have difficulties in bilateral thyroidal tumors. We used a question mark shaped prototype retractor system which could secure the operation space. In our method, bilateral tumors could be resected without difficulties. This gasless approach has some advantages over CO_2 insufflating endoscopic thyroidectomy such as minimizing the possible risks of hypercapnia, respiratory acidosis, subcutaneous emphysema, air embolism. (*7*) Although these complications could not be happened frequently, Bellantone et al. (*8*) reported potential risk of metabolic and hemodynamic complications at high CO_2 insufflation pressure as much as 15 mmHg in animal model. Rubino et al. (*9*) also showed increased intracranial pressure at high insufflation pressure in animal model. They suggested the pressure under 10mmHg would be safe in terms of such complications. Iacconi et al. (*10*) used short duration of gas insufflation for making the operation space. Brunt et al. (*11*) suggested that the safest approach requires a gasless technique for minimizing the risks of gas insufflation operations. Shimizu et al. (*5*) showed good results using the skin flap retractor system and ultrasonically activated scalpel. This gasless approach has some additional advantages such as a securing good visual field by a continuous low pressure suction device to remove the fume and a easier hemostasis than gas insufflating approach in which suction or irrigation could make a collapsing problem in a small operation space. The recurrent laryngeal nerve and parathyroid gland are visualize clearly and preserved with the optical magnification. The preoperative diagnosis should be made correctly. But in subtle cases such as fine needle biopsy revealed only inadequate results with repeated trials, frozen section can be made. Although frozen section has limitations in the diagnosis of a follicular cancer, calcified lesions or a follicular variant of papillary cancer, it can be made usefully in the case of a papillary cancer. (*12,13*) In our cases, we found nine cases of malignancy. Fine needle biopsy revealed false negative results as four benign lesions, three unsatisfactory results, one calcified lesion and one suspicious result. One patient had a conversion thyroidectomy according to the diagnosis of frozen section. Another patient whose fine needle biopsy revealed a diagnosis of suspicious malignancy had a endoscopic total thyroidectomy with central compartment node dissection. The remaining cases whose final diagnoses were papillary microcarcinomas and a minimally invasive follicular carcinoma had only hormonal therapy and followed up.

Although surgical management of thyroid cancer has a debated issue on the extent of surgery, lobectomy alone is recognized as a adequate surgery for papillary microcarcinoma (< 1 cm) or small (< 4 cm) minimally invasive follicular cancers. (*14,15*) Shimizu et al. (*16*) performed endoscopic hemithyroidectomy and lymph node dissection for papillary microcarcinoma by using gasless approach. Miccoli et al. (*17*) suggested the indication of video-assisted thyroidectomy included single nodule less than 3 cm, thyroid estimated volume less than 20 ml, benign or low grade follicular lesion, low risk papillary carcinoma. Yamamoto et al. (*18*) performed endoscopic subtotal thyroidectomy for Graves' disease with precordial approach. Therefore the indication of endoscopic thyroid operation will be expanded in the near future. Addressing the complication, two cases of the transient recurrent laryngeal nerve palsy were noted but recovered within a month. The recurrent laryngeal nerve could be identified easier in endoscopic surgery which was performed with a magnifying view. And the ultrasonic activated scalpel generates lower temperature (< 80°C) comparing with the electrocoagulation device. We can minimize the risk of recurrent laryngeal nerve palsy with those instruments. With several surgical approaches and new surgical instruments, the development of endoscopic neck surgery will open new horizons for neck surgery with good cosmetic results.

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