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ENDOSCOPIC THYROIDECTOMY VIA AN AXILLARY OR ANTERIOR CHEST APPROACH

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INTRODUCTION

The surgical treatment of thyroid diseases typically requires a long incision in the neck that can lead to prominent scars, hypesthesia, and paresthesia, but minimally invasive procedures have recently been developed for the surgical treatment of thyroid diseases. Minimally invasive thyroid procedures can be classified into "pure" endoscopic approaches (completely closed technique) characterized by constant gas insufflation (1–3), video-assisted gasless techniques that are performed under direct and endoscopic vision (4,5), and minimally invasive "open" surgery (6,7). Each of these approaches has its own advantage in terms of cosmetic result, invasiveness, safety, and ease of use. The "pure" endoscopic approach can be subclassified into a neck approach (1,8,9), anterior chest approach (2), breast approach (10), and axillary approach (2,3). The neck approach inevitably involves skin incisions and punctures in the neck region, but it is generally the least invasive. We have developed an anterior chest wall and axillary approach that eliminates scars in the neck region and prevents some common patient complaints concerning incisions (2,3,11,12). The anterior chest and axillary procedures are performed by remote control, and the cosmetic result is excellent because the incision is made far from the neck region. In addition, the operative field is clearly visualized with a high-magnification video monitor. However, when the incision is far from the neck region, a large working space must be developed; therefore, this endoscopic approach can be more difficult and invasive than the endoscopic neck approach, resulting in a longer operating time. In this chapter, we describe the surgical technique and results of endoscopic thyroidectomy by the anterior chest wall and axillary approaches.

INDICATIONS

The indications for endoscopic thyroidectomy include follicular tumors, oxyphilic cell tumors, microcarcinomas, and Graves' disease. The anterior chest approach is indicated for bilateral multinodular goiters, microcarcinomas, Graves' disease, and parathyroid adenomas. When a thyroid lobectomy is indicated, an axillary approach is usually employed.

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PREOPERATIVE EVALUATION

The preoperative diagnosis is established by a combination of clinical presentation, thyroid function tests, fine-needle aspiration (FNA), and high-resolution ultrasonography. Whenever ultrasonography suggests a microcarcinoma (i.e., punctate calcifications), an ultrasound-guided FNA is used to help establish the diagnosis. Preparation for Graves' disease is the same as for open surgery.

OPERATIVE TECHNIQUE

Hemithyroidectomy via the Anterior Chest Approach

Under general anesthesia, the patient is placed in the supine position with the neck extended. A 12-mm skin incision is made in the chest about 5 cm below the inferior border of the ipsilateral clavicle, and the lower layer of the platysma is opened. A 12-mm trocar is inserted through the incision, and a purse-string suture is placed at the site to prevent gas leakage and trocar slippage from the wound. Carbon dioxide is then insufflated up to 4 mm Hg, and a flexible laparoscope (Fujinon Inc., Tokyo, Japan) is inserted through the trocar. Two additional 5-mm trocars are inserted under endoscopic guidance, one below the sternal notch and the other below the ipsilateral clavicle (Fig. 7.1). The anterior border of the sternocleidomastoid muscle (SCM) is dissected from the sternohyoid muscle, and a space is created between the sternohyoid muscle and the sternothyroid muscle (Fig. 7.2). The thyroid gland is exposed by dividing the sternothyroid muscle. The lower pole of the thyroid is retracted upward, and the middle thyroid vein is divided with laparo-

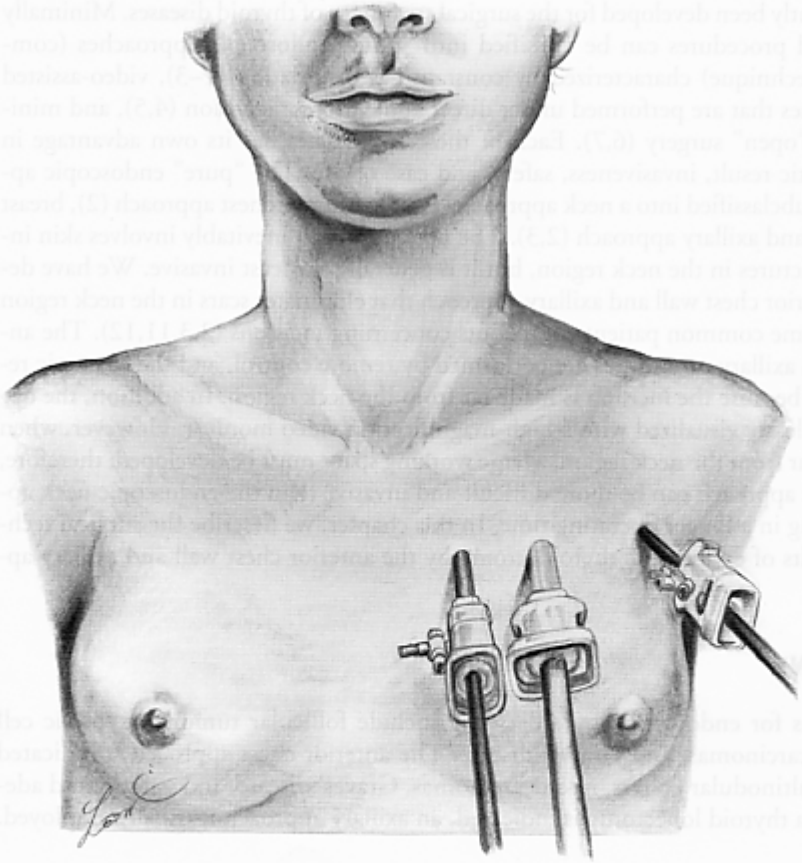

Fig. 7.1. Anterior chest approach. After making a 12-mm median skin incision for insertion of a flexible laparoscope, two additional 5-mm trocars are inserted into the subcutaneous tissue about 5 cm below the inferior border of the ipsilateral clavicle. (Illustration by Leon Sakuma.)

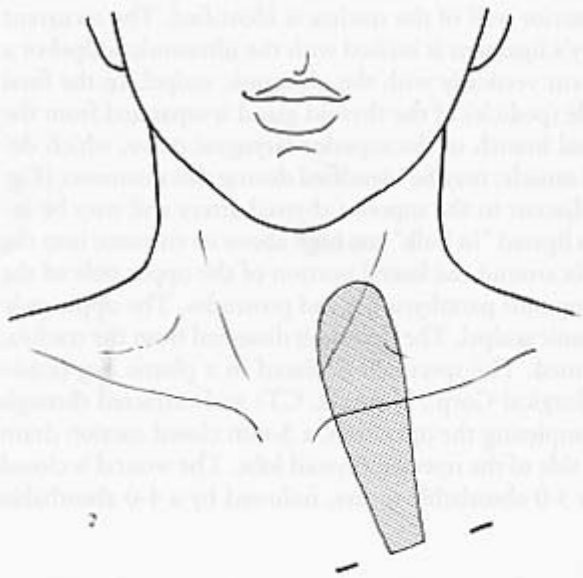

Fig. 7.2. The plane of dissection is indicated by shaded area. (Illustration by Leon Sakuma.)

scopic coagulating shears (LCS Harmonic Scalpel, Johnson&Johnson Medical, Cincinnati, OH). The posterolateral portion of the thyroid gland is then retracted medially to dissect it from the surrounding tissue with endoscopic scissors or the ultrasonic scalpel. After this maneuver, the recurrent laryngeal nerve is usually seen crossing the inferior thyroid artery (Fig. 7.3). The perithyroid fascia is cut carefully to avoid injury to the nerve and the inferior parathyroid gland. Identification of the inferior thyroid artery and careful ligation of its branches close to the gland is an excellent means of preserving the nerve and the parathyroid glands. The recurrent laryngeal nerve is often accompanied by the inferior laryngeal artery, which gives off a small branch that crosses the nerve internally (Fig. 7.4). The recurrent laryngeal nerve may be mistaken for the inferior laryn-

Fig. 7.3. Identification of the inferior thyroid artery (*ITA*) and careful ligation of its branches close to the gland is an excellent means of preserving the recurrent laryngeal nerve (*RLN*) and the parathyroid glands.

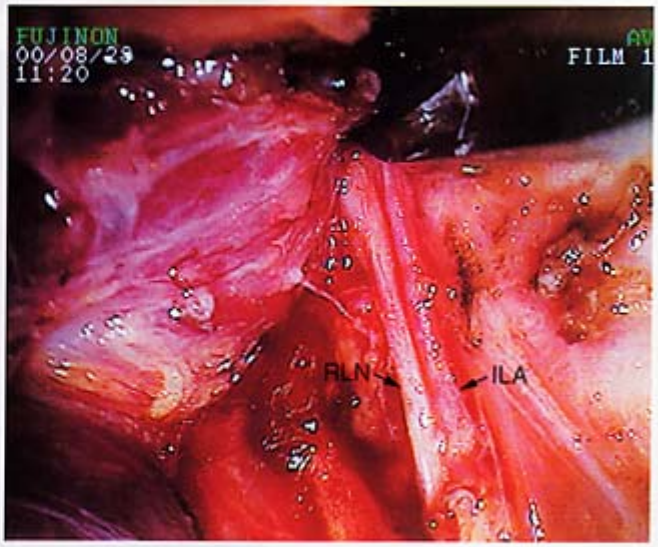

Fig. 7.4. The recurrent laryngeal nerve (*RLN*) is accompanied by the inferior laryngeal artery (*ILA*), which is the terminal branch of the inferior thyroid artery and gives off a small branch that crosses the nerve medially. The recurrent laryngeal nerve may be mistaken for the inferior laryngeal artery.

geal artery. Next, the lateral and anterior wall of the trachea is identified. The recurrent laryngeal nerve is exposed, and Berry's ligament is incised with the ultrasonic scalpel or a clip. The isthmus of the thyroid is cut vertically with the ultrasonic scalpel. In the final part of the procedure, the upper pole (pedicle) of the thyroid gland is separated from the cricothyroid muscle, and the external branch of the superior laryngeal nerve, which descends to innervate the cricothyroid muscle, may be identified during this maneuver (Fig. 7.5). This nerve lies immediately adjacent to the superior thyroid artery and may be injured if the superior thyroid artery is ligated "in bulk" too high above its entrance into the thyroid gland. The perithyroid fascia around the lateral portion of the upper pole of the thyroid is carefully cut so that the superior parathyroid gland protrudes. The upper pole vessels are transected with the ultrasonic scalpel. The thyroid is dissected from the trachea, and a hemithyroidectomy is performed. The specimen is placed in a plastic bag (Endo Cath, Auto Suture, United States Surgical Corp., Norwalk, CT) and extracted through the 12-mm skin incision. Before completing the operation, a 3-mm closed suction drain is placed under the platysma on the side of the resected thyroid lobe. The wound is closed by closing the adipose tissue with a 3-0 absorbable suture, followed by a 4-0 absorbable monofilament suture in the skin.

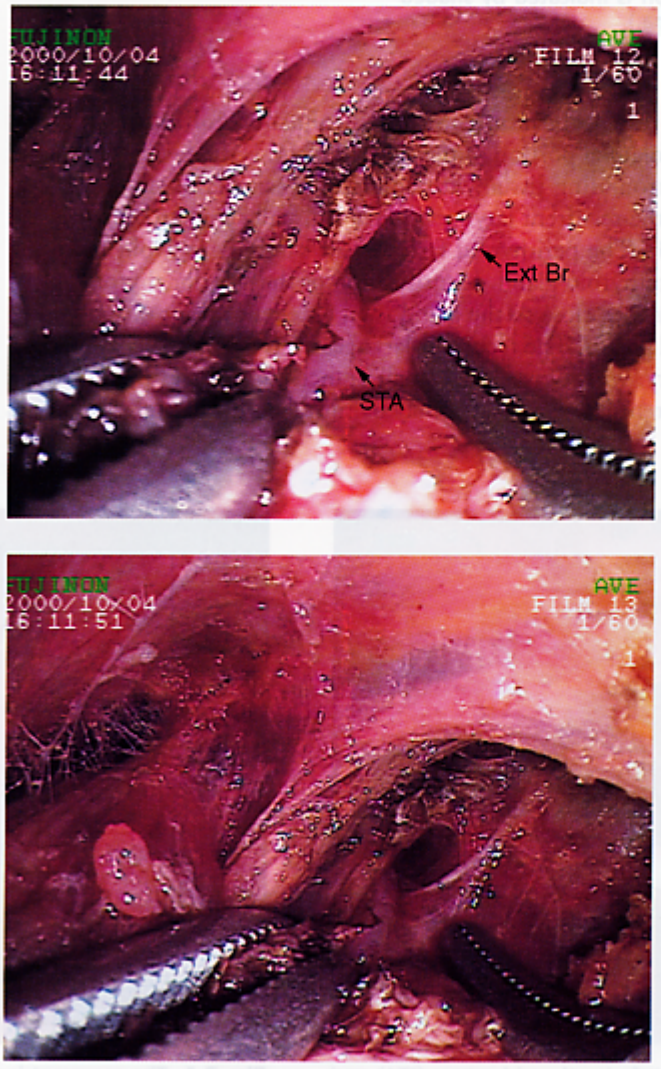

Fig. 7.5. The external branch of the superior laryngeal nerve (*Ext Br*) can be identified. It lies immediately adjacent to the superior thyroid artery (*STA*).

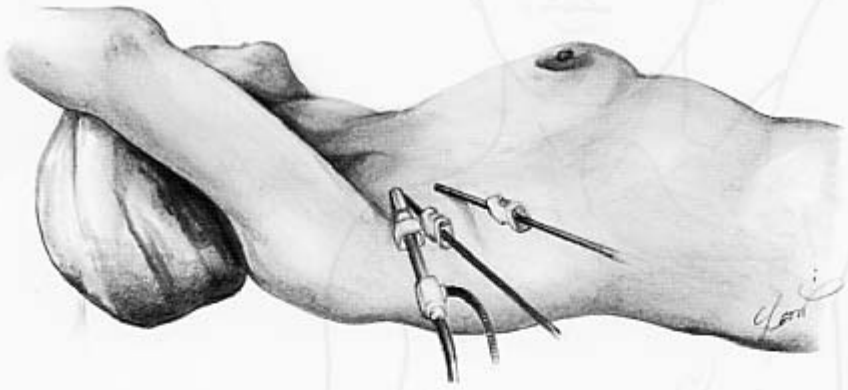

Fig. 7.6. Axillary approach. After making a 30-mm skin incision for the flexible laparoscope, an additional 5-mm trocar is inserted near the 30-mm skin incision in the axilla. (Illustration by Leon Sakuma.)

The anterior chest approach minimizes the invasiveness of the operation. The area of dissection from the anterior chest to the anterior border of the SCM and the ipsilateral sternohyoid muscle is minimized because panoramic exposure is obtained by contrast gas insufflation. Furthermore, a contralateral lobectomy can be performed by adding two additional trocars below the contralateral clavicle.

Hemithyroidectomy via the Axillary Approach

Under general anesthesia, the patient is placed in the supine position with the neck slightly extended. The arm ipsilateral to the nodule is raised, and the axilla is completely exposed (Fig. 7.6). A 30-mm skin incision is made in the axilla, and the lower layer of the platysma is exposed. This dissection under the skin is performed with long forceps. A 12-mm and a 5-mm trocar are inserted through the incision, and a purse-string suture is placed to prevent gas leakage and trocar slippage from the wound. Carbon dioxide is then insufflated to 4 mm Hg, and a flexible laparoscope is inserted through the trocar. After an adequate dissection space has been created, one additional 5-mm trocar is inserted near the 30-mm skin incision in the axilla. Endoscopic scissors are used for additional blunt and sharp dissection to enlarge the subplatysmal space (Fig. 7.7). The anterior border of the SCM is dissected from the sternohyoid muscle, and a space is created between the sternohyoid and sternothyroid muscles (Fig. 7.8). The thyroid gland is exposed by dividing the sternothyroid muscle at the upper pole. The upper pole of the thyroid is thoroughly explored from the lateral side. The thyroid tissue is grasped and retracted toward the operating surgeon, and the perithyroid fascia of the upper pole is separated from the cricothyroid muscle so that the external branch of the superior laryngeal nerve is left intact. The superior pole pedicle is ligated with the ultrasonic scalpel or with endosurgical clips. The lower pole of the thyroid is elevated upward and dissected away from the adipose tissue and cervical thymus with the ultrasonic scalpel. The lateral side of the thyroid is then retracted medially to enable the perithyroid fascia to be cut with the endoscopic scissors or ultrasonic scalpel, taking special care not to injure the recurrent laryngeal nerve. If the parathyroid gland has been identified, it is also left intact. The recurrent laryngeal nerve, which is exposed peripherally, is visualized embedded in Berry's ligament, posterior to the cricothyroid muscle, before the nerve enters the larynx (Fig. 7.9). Berry's ligament is carefully severed with a clip or the ultrasonic scalpel. The thyroid is then dissected from the trachea to complete the hemithyroidectomy.

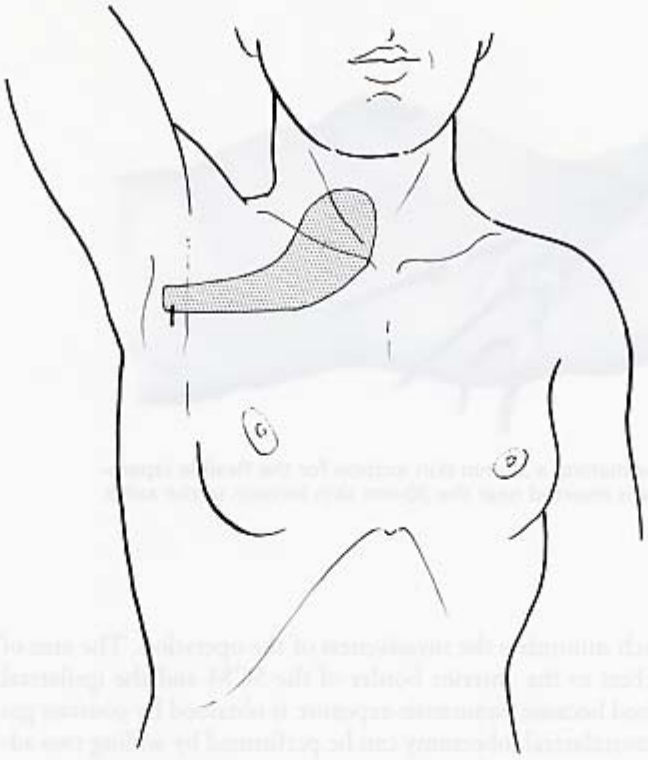

Fig. 7.7. The plane of dissection is indicated by shaded area. (Illustration by Leon Sakuma.)

There are several theoretic advantages of the axillary approach. The thyroid gland can be visualized laterally by our method, and the perithyroid fascia can be carefully cut, providing an operative field of view equivalent to that of open surgery. This allows the recurrent laryngeal nerve and the parathyroid glands to be identified easily. CO_2 insufflation at

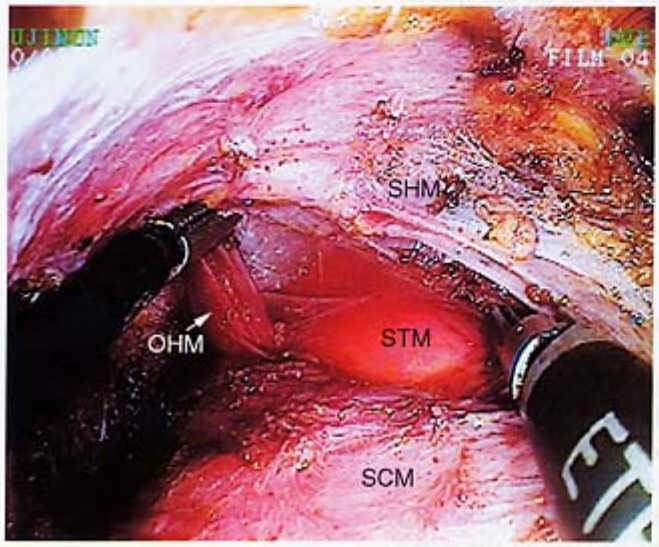

Fig. 7.8. The anterior border of the sternocleidomastoid muscle (*SCM*) is dissected from the sternohyoid muscle (*SHM*), and a space is created along the sternothyroid (*STM*), sternohyoid, and omohyoid muscles (*OHM*).

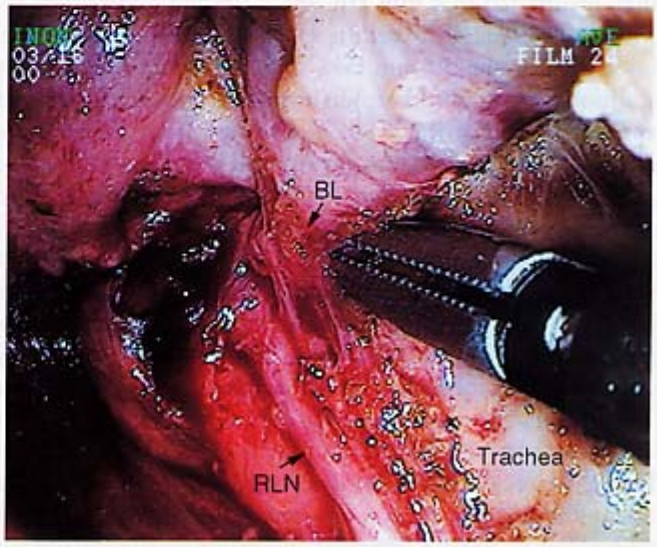

Fig. 7.9. The recurrent laryngeal nerve (*RLN*) is exposed traversing Berry's ligament (*BL*).

a pressure of less than 4 mm Hg is adequate because only the platysma needs to be lifted. This method is significantly different from those described by other authors who create a working space by lifting both the platysma and the sternohyoid muscle by a neck approach. Because of the small working space and CO_2 insufflation pressure of less than 4 mm Hg, the chance of hypercarbia, respiratory acidosis, subcutaneous emphysema, and air embolism is minimized. The disadvantages of this approach include the time required for surgery and its invasiveness because of the extensive exploration from the axilla to the neck.

RESULTS

Forty patients (36 women and 4 men; mean age, 42 years) have been treated by endoscopic neck surgery: 15 via the anterior chest approach and 25 via the axillary approach. Follicular tumors were diagnosed preoperatively in 32 patients, and hemithyroidectomy was performed via either the anterior chest approach or the axillary approach. Micropapillary carcinoma was diagnosed in four patients and treated by hemithyroidectomy with prophylactic lymph node dissection of the ipsilateral pre- and paratracheal lymph node group. Four patients underwent subtotal thyroidectomy via an anterior chest approach for Graves' disease. All cases were completed via an anterior chest approach or axillary approach; however, one patient required conversion to a standard open procedure for bleeding from the SCM after the axillary approach. The thyroid capsule was never ruptured, its integrity being necessary for accurate histologic examination. Mean operation time by the anterior chest approach was 175 minutes (range, 98 to 285), compared to 203 minutes (range, 60 to 350) for the axillary approach. For the first two cases, the duration of surgery was 285 for the anterior chest approach and 350 minutes for the axillary approach, but after this initial phase of the learning curve the operating time decreased to approximately 120 and 150 minutes, respectively, for these approaches. Intraoperative blood loss was less than 67 mL. End tidal CO_2 pressure and the $PaCO_2$ during surgery were maintained under 36 mm Hg in all patients. For the anterior chest wall approach, the mean maximum diameter of the resected thyroid gland with follicular tumors was 52 mm (range, 45 to 60), with a mean weight of 25 g (range, 16 to 34), whereas the corresponding values for the axillary approach were 54 mm (range, 20 to 72) and 26 g (range, 15 to 73), respectively. The mean maximum diameter of the resected thyroid in the four patients with micropapillary carcinoma was 47 mm, with a mean weight of 42 g. The mean weight of the resected thyroid of the four patients with Graves' disease was 67 g.

Fig. 7.10. Appearance of the patient 5 days after hemithyroidectomy via an axillary approach. The scar in the axilla is completely covered by the patient's arm in its natural position.

Postoperative hospital stay was shorter than after conventional open surgery. In our series, the patients were followed for 14 months, with no observable problems or physiologic abnormalities. There were no operative scars in the neck except in the one patient who required conversion to conventional open surgery, and all operative scars were covered by the patients' clothing. When the axillary approach was used, the scar in the axilla was completely covered by the patient's arm in its natural position (Fig. 7.10). All patients were fully satisfied with the cosmetic results and with the minimal postoperative hypesthesia and paresthesia.

COMPLICATIONS

One patient developed subcutaneous emphysema around the neck. Another patient developed subcutaneous emphysema of the neck and face. No postoperative bleeding or recurrent laryngeal nerve palsy was noted in any of the patients. There were far fewer complaints of postoperative pain and discomfort after these approaches than after conventional open surgery.

CONCLUSIONS

The anterior chest approach minimizes the invasiveness of the operation, and the area of dissection is minimal since panoramic exposure is achieved by contrast gas insufflation. The scars on the anterior chest are completely hidden by clothing, even by clothes having a wide neck. Our procedure for creating a working space by the anterior chest and axillary approaches is significantly different from the regular procedure, which lifts both the platysma and the sternohyoid muscle. Since only the platysma is lifted during our axillary approach, CO_2 insufflation at a pressure of less than 4 mm Hg is sufficient. The axillary approach is more invasive than the anterior chest approach, but we believe that postoperative pain and discomfort will decrease with greater experience. The axillary approach is more advantageous cosmetically than the anterior chest approach because it completely eliminates the surgical scar. The sternohyoid muscle is divided transversely to obtain better exposure of the thyroid, but we do not divide the sternohyoid muscle to prevent adhesions to the platysma unless the nodule is large. Regional adhesions between the skin and the sternohyoid muscle cause an uncomfortable catching sensation in the neck on swallowing. The operation time has decreased to less than 120 minutes by the anterior chest approach and to less than 150 minutes by the axillary approach as the surgeons have accumulated experience with the procedure.

Large follicular tumors can be extracted through an axillary incision, providing cosmetic benefits. The anterior chest approach is indicated for bilateral multinodular goiter, microcarcinomas, and parathyroid adenomas. Both of these approaches provide minimal postoperative hypesthesia, paresthesia, and uncomfortable sensations on swallowing.

Endoscopic surgery of the neck is the procedure of choice in well-selected patients with thyroid disease.

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