Symposium

Total Endoscopic Thyroidectomy

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We have developed endoscopic thyroidectomy procedures using anterior chest and axillary approaches. Both of our procedures differ significantly from the usual thyroidectomy, which involves lifting both the platysma and the sternohyoid muscle. Because only the platysma is lifted during our procedures, a CO_2 insufflation pressure of less than 4 mmHg is sufficient. While the sternohyoid muscle is transected to obtain greater exposure of the thyroid gland in minimally invasive procedures in the neck, we do not divide it so as to prevent adhesions to the platysma, unless the nodule is large. As we accumulated experience with these procedures in 58 patients, typical operation time decreased to less than 120 minutes for the anterior approach and to less than 150 minutes for the axillary approach. Large follicular tumours can be extracted using the axillary approach, with all of its cosmetic advantages, whereas the anterior chest approach is advocated for removal of bilateral multinodular goitres and parathyroid lesions. Both approaches result in minimal postoperative hypoaesthesia, paraesthesia, and discomfort during swallowing. We conclude that endoscopic neck surgery is the procedure of choice in carefully selected patients with thyroid disease. [*Asian J Surg* 2003;26(2):82–5]

Endoscopic thyroidectomy

Conventional thyroid surgery is performed through a 5- to 8-cm transverse skin incision in the neck, necessitating the creation of a subplatysmal flap to achieve access to the thyroid gland. This approach leads to prominent scars, hypoaesthesia, paraesthesia and other uncomfortable sensations.

Technological innovations have rapidly and dramatically improved minimally invasive thyroid surgery, and improvements in ultrasound and ultrasound-guided fine-needle aspiration have contributed to the development of minimally invasive surgery. New therapeutic interventions, such as ablation by repeated ultrasound-guided ethanol injection, have been used as alternatives to surgical procedures.[1]

Thanks to an increasing understanding of endoscopic cervical anatomy and improvements in surgical techniques and endoscopic instruments, minimally invasive thyroid surgery is now providing excellent results. The minimally invasive thyroid procedures we developed can be classified into "total (pure)" endoscopic approaches (completely closed approaches),[2–6] video-assisted endoscopic approaches[7,8] and minimally invasive mini-incision approaches.[9] The total endoscopic approaches can be subclassified into a supraclavicular approach,[2,5–10] axillary approach,[3,4] anterior chest approach[3] and breast approach.[11]

The scarring of the breast area that occurs after using the breast approach may not be acceptable to the Western world.[12] The axillary approach can be used instead, without prohibitive difficulties, and it may prove to be the ultimate solution.[12] The purpose of endoscopic thyroid surgery is not only to improve the cosmetic results, but to be minimally invasive.[13,14] In terms of invasiveness, the approaches described here are inferior to the video-assisted endoscopic and minimally invasive mini-incision approaches. Nonetheless, the axillary and anterior chest approaches developed by us are less invasive than those performed by other surgeons. Three months after thyroidectomy using either of our approaches, patients did not complain of hypoaesthesia or paraesthesia in the neck or of discomfort while swallowing. Our patients all but forgot that they had undergone surgery because they had no

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complaints. Furthermore, the supraclavicular approach allows access to both sides of the neck, and if bleeding occurs, it allows rapid access to the thyroid basin.[5]

The video-assisted approach is performed under direct and endoscopic vision with conventional instruments and permits a much smaller incision in the neck than conventional thyroidectomy. Minimally invasive mini-incision thyroidectomy is easily mastered by surgeons who are familiar with conventional thyroidectomy,[15–18] and ordinary instruments are used to reach the target mass. Each of these minimally invasive approaches has its own advantages in terms of cosmetic results, extent of invasiveness, safety and ease of use. It is very important that surgeons choose the optimal procedure from among these approaches in well-selected patients with thyroid nodules.

Axillary and anterior chest approaches

We developed an axillary approach and an anterior chest approach that eliminate scars in the neck region and prevent common patient complaints concerning incisions.[3,4,13,14] Because the incisions are made far from the neck region, the cosmetic results are excellent. The surgical technique involved in these approaches is more difficult and more invasive than with the standard video-assisted approach, and the operation time is sometimes longer.

Indications

The indications for endoscopic thyroidectomy include surgical removal of solitary, benign thyroid nodules, follicular cell and oxyphilic cell tumours, papillary microcarcinomas and Graves' disease. The anterior chest approach is favoured for the treatment of bilateral multinodular goitres, papillary microcarcinomas and Graves' disease. The axillary approach is preferred when the thyroid lesions are large, but do not extend contralaterally. The final decision should be made by a fully informed patient in consultation with the surgeon.

Surgical procedures

All endoscopic thyroidectomies are performed under general anaesthesia. For the anterior chest approach (Figure 1), a 12-mm medial skin incision is made in the skin of the anterior chest approximately 3 to 5 cm below the border of the ipsilateral clavicle. [3,4,13,14] Two additional 5-mm trocars are inserted by endoscopic guidance below the ipsilateral clavicle.

For the axillary approach, a 30-mm skin incision is made in the axilla, and 12-mm and 5-mm trocars are inserted through this incision (Figure 2). An additional 5-mm trocar is inserted adjacent to the incision, and CO_2 is then insufflated to a pressure of 4 mmHg. The anterior border of the sternocleidomastoid muscle is then separated from the sternohyoid muscle to expose the sternothyroid muscle. The thyroid gland is exposed by splitting the sternothyroid muscle. The lower pole is retracted upward and dissected from the adipose tissue to identify the recurrent laryngeal nerve. The recurrent laryngeal nerve is accompanied by the inferior laryngeal artery, which gives off a small branch that crosses the nerve medially (Figure 3). 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 inferior parathyroid gland. As the recurrent laryngeal nerve is exposed, Berry's ligament is exposed and incised with a 5-mm clip or Laparoscopic Coagulating Shears slim (LCSs, Johnson-Johnson Medical, Cincinnati, OH, USA). The isthmus is incised with LCSs. The upper pole of the thyroid gland is separated from the

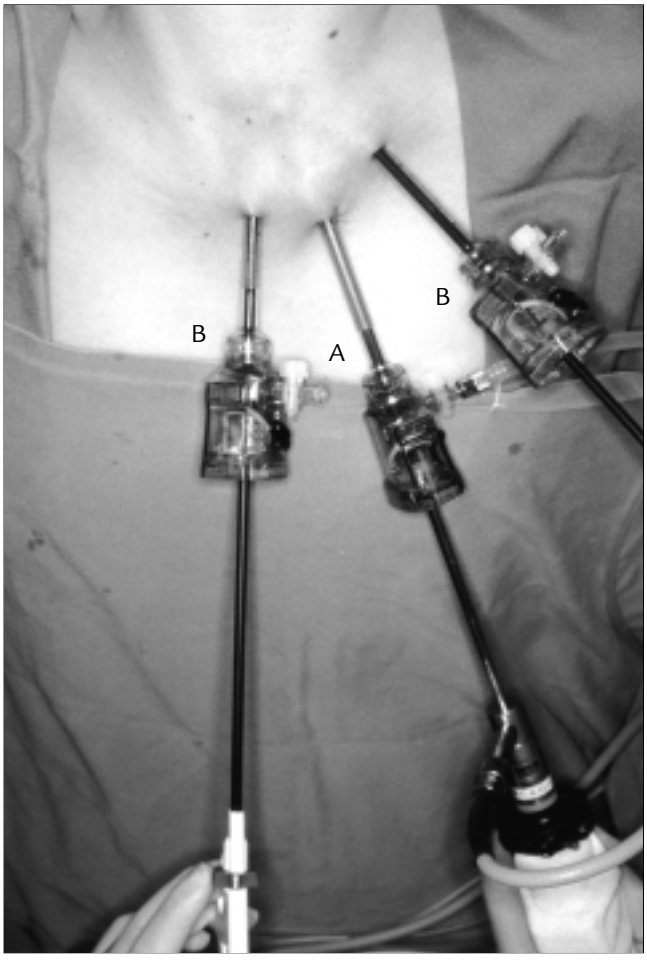

Figure 1. Anterior chest approach to endoscopic thyroidectomy. A 12-mm medial skin incision is made for insertion of a flexible laparoscope (A) and two 5-mm trocars (B) are then inserted into the subcutaneous tissue approximately 3 to 5 cm below the inferior border of the ipsilateral clavicle.

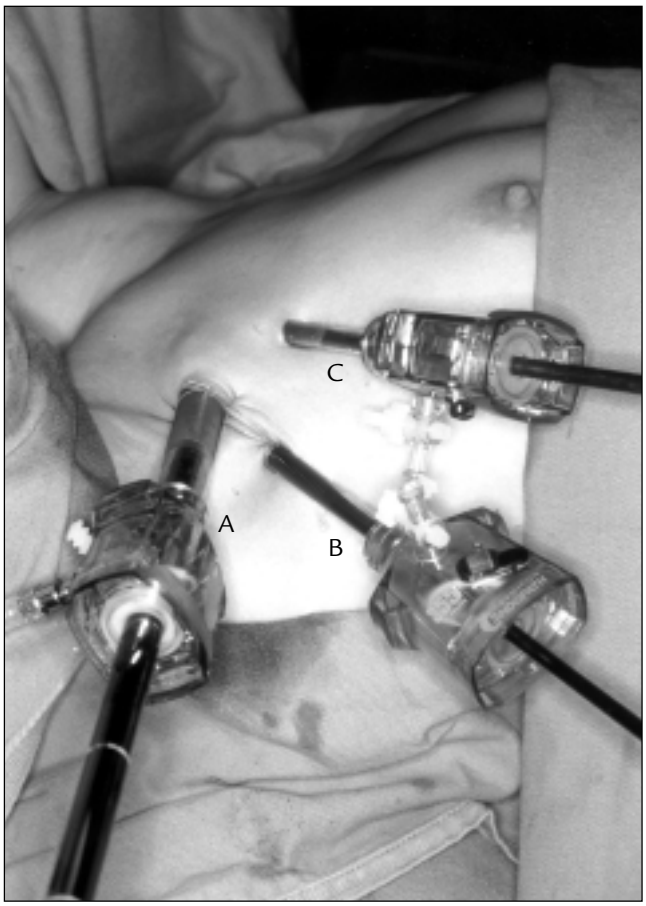

Figure 2. Axillary approach to endoscopic thyroidectomy. A 30-mm skin incision is made to accommodate the flexible laparoscope (A) and forceps (B). An additional 5-mm trocar (C) is then inserted near the 30-mm skin incision in the axilla.

cricothyroid muscle, during which the external branch of the superior laryngeal nerve can be identified. The upper pole of the thyroid gland is then dissected free with LCSs, and the hemithyroidectomy is complete.

The specimen is placed in a plastic bag (Endo Catch, United States Surgical Corporation, Norwalk, CT, USA) and extracted through the skin incision. A 3-mm closed-suction drain is placed on the surgical field through the incision for the 5-mm trocar.

Results and discussion

In total, 58 patients were studied, comprising 50 women and eight men (mean age, 41 yr) who were treated using endoscopic procedures. Twenty-two patients were treated using the anterior chest approach and 36 were treated using the axillary approach. The preoperative diagnosis was follicular tumour in 50 patients, papillary microcarcinoma in four patients, and Graves' disease in four patients. The patients with papillary microcarcinoma were treated by hemithyroidectomy and prophylactic dissection of the ipsilateral pretracheal and paratracheal lymph nodes. The thyroid glands were never ruptured because intact glands are essential for meaningful pathological examinations, especially for the discovery of small well-differentiated carcinomas and evaluation of the capsules of follicular tumours.

Comparisons were made between the two approaches. The mean operating time was 157 minutes (range, 92–285 min) using the anterior approach and 172 minutes (range, 60–350 min) using the axillary approach. When both approaches were used for the first time, the operation times were 285 minutes for the anterior approach and 350 minutes for the axillary approach. After the initial learning phase, the operative times quickly decreased to 120 and 150 minutes, respectively. Thus, the main disadvantage of these approaches is the length of time required for surgery. Intraoperative blood loss was less than 67 mL and end-tidal CO_2 and $PaCO_2$ were maintained below 32 mmHg in all patients.

The mean maximum diameter of the thyroid tissue resected using the anterior approach was 54 mm (range, 45–60 mm), and its mean weight was 28 g (16–38 g). The corresponding values for the tissue removed by the axillary approach were 55 mm (range, 20–72 mm) and 24 g (range, 15–73 g). The mean maximum diameter of the thyroid tissue resected from the patients with papillary microcarcinoma was 45 mm, and its mean weight was 40 g. The mean weight of the tissue resected from the patients with Graves' disease was 63 g.

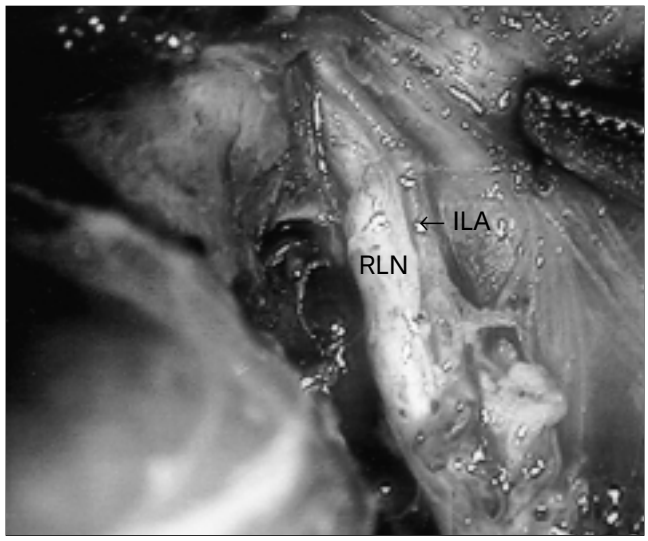

Figure 3. The recurrent laryngeal nerve (RLN) as observed during the axillary approach to endoscopic thyroidectomy is accompanied by the inferior laryngeal artery (ILA), which is the terminal branch of the inferior thyroid artery, giving off a small branch that crosses the nerve medially.

The patients were monitored for a maximum of 34 months, and there were no problems during follow-up. The patients had no surgical scars on the neck, except for one patient whose endoscopic procedure was converted to a conventional operation because of intramuscular bleeding. The patients were satisfied with the cosmetic results and with the minimal degree of postoperative hypoaesthesia, paraesthesia, and uncomfortable catching sensation on swallowing. There were few complaints of postoperative pain and discomfort.

In conventional neck procedures, the platysma muscle is separated from the sternohyoid muscle to create a skin flap, whereas in our procedures, the creation of skin flaps is minimal to prevent postoperative complaints. The sternohyoid muscle is transected to achieve greater exposure of the thyroid gland in conventional thyroid surgery, whereas in our procedures, the sternohyoid muscle is not divided unless the tumours are too large. This prevents the platysma muscle, as well as the skin, from adhering to the sternohyoid muscle. Such adhesions can cause an uncomfortable catching sensation, especially during swallowing.

There was only one case of postoperative emphysema; in that patient, the air extended into the subcutaneous tissue of the neck and face, but not into the soft tissue of the mediastinum. Our procedures require elevation of the platysma muscle alone. Because they do not require lifting of the sternohyoid muscle, they allow low-pressure CO_2 insufflation to be used (i.e. < 4 mmHg). The small working space and CO_2 insufflation pressure of less than 4 mmHg minimizes hypercapnia, respiratory acidosis, subcutaneous emphysema and air embolism. There was no excessive postoperative bleeding or recurrent laryngeal nerve palsy.

Although endoscopic thyroid surgery by our procedures resulted in postoperative pain and neck discomfort, such complaints had ceased by 3 months after surgery. Furthermore, good cosmetic results were achieved without hypoaesthesia, paraesthesia or uncomfortable sensations. Endoscopic thyroid surgery is the procedure of choice in carefully selected patients with thyroid disease.

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