Current Opinion

Videoscopic Thyroidectomy: The Uncertain Path to Practicality

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Since 1997, successful attempts at endoscopic thyroidectomy have led to controversies. The procedure has, as yet, no alarming operative complication, but its benefits to patients are debatable. By means of very individualized and ingeniously designed approaches, the procedure has proven to be feasible and safe in trained hands. Cautious trials and evaluations of endoscopic thyroid surgery are now in progress internationally at expert centres. The technique itself is undergoing progressive evolution and larger studies are underway. Although endoscopic thyroidectomy has little chance of acquiring the same popularity as open thyroidectomy due to its inherently higher technical demand, it may become a practical and safe alternative option for selected suitable patients. [*Asian J Surg* 2003;26(3):133–8]

Introduction

Thyroid surgery mainly consists of partial or total thyroidectomy. The essence of the procedure is to resect the planned amount of thyroid gland while protecting everything else, usually the recurrent laryngeal nerve and the parathyroid glands. To achieve this, the surgeon should control and divide only the vascular pedicles of the gland and its pretracheal attachment, and nothing else.

The traditional approach to thyroidectomy is direct access, without much tissue trauma. Thus, the open procedure is already reasonably "minimally invasive". In fact, the opposite may occur when a videoscopic approach is applied to thyroid surgery. Videoscopic surgery empowers the surgeon to transpose the standard anterior transverse skin crease incision to another selected site with subsequently increased surgical dissection. Nevertheless, compared to standard open thyroidectomy, videoscopic surgery is, at present, almost prohibitively technically demanding. In expert hands, the size of the wound in classical open thyroidectomy is the smallest one possible to allow the surgeon to retrieve an intact specimen. The augmented effect on cosmesis subjectively experienced by the patient with endoscopic thyroidectomy may be difficult, if not impossible, to justify against all the documented objective disadvantages of the procedure. Cultural differences in the definition of beauty further complicates the matter. However, cosmesis becomes a significant consideration in thyroid surgery because a large proportion of the surgical candidates are young female patients.

The state-of-the-art in surgery is continuously under trial and evaluation by international experts; endoscopic thyroid surgery would, at present, be one innovation under such trial and evaluation.

Methods and patients

Similar patient selection criteria are used by most experts. A large goitre poses a major problem apart from escalating the difficulties in dissection. According to present standards of surgical oncology, thyroid specimens containing neoplastic growth should be extracted intact. Extending the wound to retrieve large specimens, after successful dissection through small incisions, makes the procedure absurd. Previous neck surgery, radiotherapy, major infection and trauma are also contraindications to endoscopic thyroidectomy as they render the already challenging dissection more difficult. At present, there are three main endoscopic approaches to mobilize the thyroid gland via different anatomical routes: cervical, anterior,

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and axillary. All procedures ultimately create an artificial working cavity in the anterior neck that enables further dissection of the thyroid lobe. The initial construction and subsequent maintenance of the cavity are achieved by either flap lifting using a custom engineered physical device or low pressure CO_2 insufflation. Rubino et al documented that CO_2 cervical insufflation under pressure of less than 10 mmHg induces no elevation of intracranial pressure in large animals.[1] Furthermore, the increase in end-tidal CO_2 due to absorption of surgical emphysema is reported to be minimal and can be easily managed by slightly increasing ventilation.

Cervical approach

The following steps are the initial attempts to achieve cervical wound size reduction and transposition using the endoscopic dissection technique[2–10] (and J.F. Henry, Professor, Department of Endocrine Surgery, University Hospital La Timone, Marseilles, France, written communication, September 2001; P. Cougard, Professor, Service de Chirurgie Generale et Endocriniene, Hopital General, Dijon, France, written communication, June 2001). The incision position for insertion of the instruments and telescope are tailored for the surgeon's convenience and the patient's cosmesis (Figure 1). They are placed at a distance from the lesion so that the initial dissection advances along a naturally bloodless surgical plane, usually the subplatysmal plane. A cavity is then formed by connecting all the incisions. When CO_2 insufflation is used to maintain the dissection cavity, the pressure is kept low (4–8 mmHg) to avoid potential physiological disturbance. The videoscope and endoscopic dissection instruments are then introduced via airtight surgical ports. Even in early attempts with documented long operation times of 300 to 400 minutes, no adverse effects due to such low pressure, cervical, and surgical emphysema were ever reported. When the flap lifting method is used, instruments and the videoscope are introduced via small incisions without surgical ports. Conventional instruments for open surgery can occasionally be used.

More than 400 successful endoscopic thyroidectomies were performed using different cervical approaches (Table 1); Miccoli et al reported their experience with over 200 procedures.[4] Operation-related complications were minimal and the incidences were comparable to classical open thyroidectomy. Their method of minimally invasive video-assisted thyroidectomy (MIVAT) was performed via a 15 mm anterior transverse incision; both conventional and endoscopic instruments were used. The working cavity was maintained by external retractors and is analogous to the flap lifting methods advocated by Japanese authors.

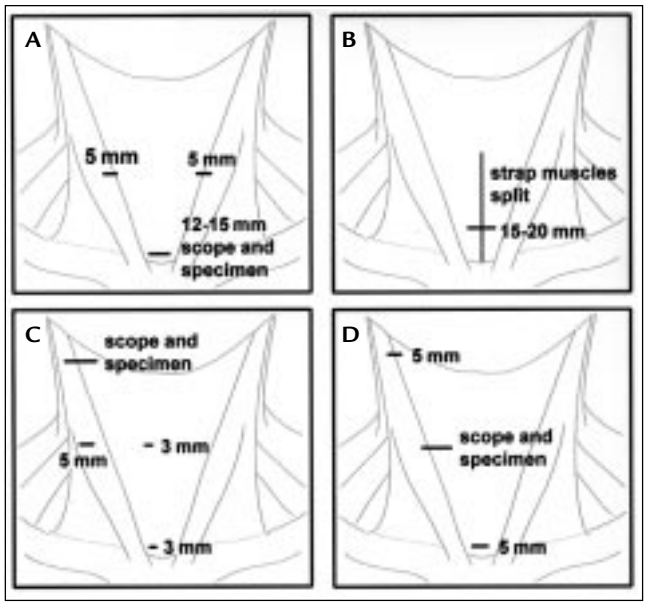

Figure 1. The location and size of skin incisions made by authors performing endoscopic thyroidectomy via cervical approaches: A) Chowbey et al, 1999,[6] Yeung et al, 1998,[9] and Cougard P, written communication, June 2001; B) Miccoli et al, 2000,[4] Bellantone et al, 1999,[5] Yeh et al, 2000,[7] and Henry JF, written communication, September 2001; C) Gagner and Inabnet, 2001;[2] D) Huscher et al, 1997.[3]

Anterior chest approach

The anterior chest approach is advocated mainly by Japanese and Korean authors[11–16] (and Y.L. Park, Professor, Department of General Surgery, Kangbuk Samsung Medical Center, Sungkyunkwan University, Seoul, Korea, written communication, May 2001). Successful surgery results in the total absence of a neck incision; the incisions are transposed to the anterior chest, subclavian areas and circumareolar regions (Figure 2), so can be covered by an undergarment or dress. The working space is also maintained via CO_2 insufflation or skin flap lifting strategies (Table 2). Extensive anterior chest dissection, via less well defined planes, can potentially lead to denervation or ischaemia of the undermined area. Division of the perforating branches of the internal mammary arteries during the development of the anterior chest cutaneous flap is expected. Furthermore, the supraclavicular nerves (C3, C4 sensory) are at risk during the ascending dissection from the anterior chest to the anterior neck area. Flap ischaemia or necrosis have never been documented. The risk of intraoperative haemorrhage, a major cause of failure of the procedure, may also be augmented by the extensive dissection. The

Table 1. Cervical approach to endoscopic thyroidectomy: summary of surgical details

Authors (reference number)	Method	Subcut Adr	US	n	Mean age, yr (range)	Type of surgery	Mean OT, min (range)	Mean lesion size, mm (range)	Blood loss (mL)	CON	Cx
Gagner and Inabnet (2)	CO_2	No	No	18	43 (17–66)	HT	220 (120–330)	27 (7–70)	—	2	0
Miccoli et al (4)	MIVAT	No	Yes	141 78	39 (13–73)	HT TT	50 (35–120) 62 (60–130)	—	—	3	9
Bellantone et al (5)	MIVAT	—	—	38 11 7	—	HT TT CT	150	—	—	4	0
Chowbey et al (6)	CO_2	No	No	8	—	HT	—	—	—	2	0
Yeh et al (7)	VAET	No	Yes	16	—	HT	102 (28–300)	58 (35–80)	< 20	0	0
Alvarez et al (8)	CO_2	—	Yes	28 1	— (17–63)	HT TT	180	— (10–80)	—	0	0
Yeung (9)	CO_2 (8 mmHg)	No	No	18	42 (28–72)	HT	185 (105–330)	25 (12–38)	—	4	0
Henry*	MIVAT	No	Yes	12	—	HT	—	—	—	0	0

*J.F. Henry, written communication, September 2001. Method = method used to maintain working cavity; Subcut Adr = subcutaneous adrenalin solution injection; US = ultrasonically activated scalpel; OT = operation time; CON = conversion to open surgery; Cx = surgical complication; HT = hemithyroidectomy; MIVAT = minimally invasive video-assisted thyroidectomy; TT = total thyroidectomy; CT = completion thyroidectomy; VAET = video-assisted endoscopic thyroidectomy.

ultrasonically activated scalpel is used unanimously for its convenience in achieving haemostasis and tissue cutting without the need for clips or ligatures.

Axillary approach

Advances in electronic surgical imaging have made direct visual access and lighting via a lengthy surgical wound unnecessary. The definitive and indispensable function of the surgical wound may become solely specimen retrieval. The axillae, where surgical scars can turn out to be almost invisible and are quite acceptable by most cultures, are anatomically suitable for instrument insertion. Successful transaxillary endoscopic thyroidectomy was described by Ikeda et al.[17,18] They used low-pressure (4 mmHg) CO_2 insufflation to maintain the working space. Patients were placed in the supine position with abduction of the ipsilateral arm (Table 3). Three surgical ports were used and the videoscopic image was provided by a flexible surgical endoscope. Successful attempts using a similar technique were also reported by Chantawibul et al in 20 consecutive patients using four operative ports, with an additional 5 mm port for suctioning.[19] However, a significant distance between the primary incisions and the operative site,

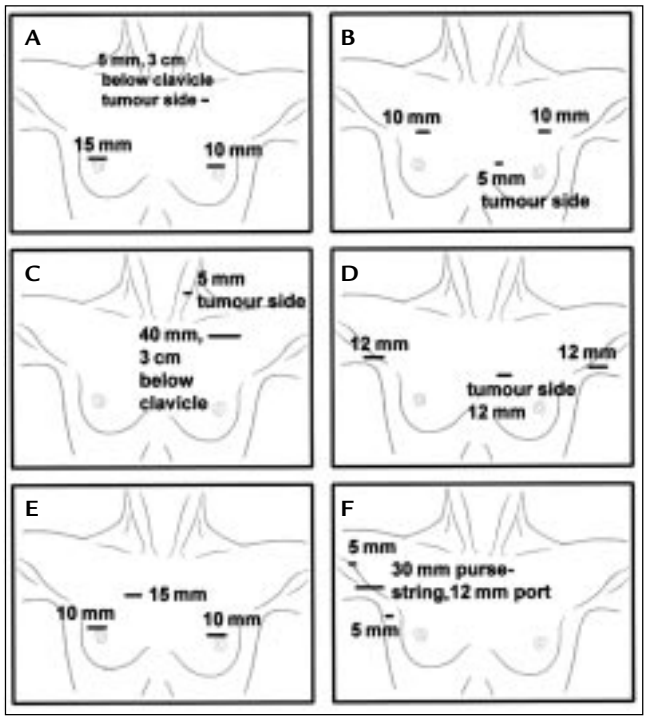

Figure 2. The location and size of skin incisions made by authors performing endoscopic thyroidectomy via anterior chest and transaxillary approaches: A) Park YL, written communication, May 2001; B) Kim et al, 2001;[12] C) Shimizu et al, 1999;[14] D) Kitano et al, 2000;[16] E) Yamamoto et al, 2001;[13] F) Ikeda et al, 2000[17] and Chantawibul et al, 2002.[19]

as well as the highly oblique angle of view (almost 90°) were disadvantageous to endoscopic dissection.

Insufflation with CO_2 also implies obligatory use of endoscopic surgical instruments and difficulties in using surgical suction. Management of haemorrhage is more challenging in all cases of cervical CO_2 insufflation and, when it occurs, may result in surgical complications or the need for conversion to open surgery.

By visualizing the concept that the shortest distance between two points in space, namely the incision and the operation site, is achieved when they are approximated, we devised the "embracing position" (Figures 3 and 4). In our initial attempts at videoscopic-assisted transaxillary thyroid dissection without insufflation, the ipsilateral axilla (or in difficult situations, the bilateral axillae) was brought towards the anterior neck. The forearms were well protected against pressure points and were suspended over a transverse bar over the face of the patient. Both shoulders were thus flexed, adducted and internally rotated. Videoscopic-assisted dissection to the anterior neck with exposure of the thyroid gland was successful by using both conventional and endoscopic instruments. During our first attempt at axillary endoscopic thyroidectomy, safe mobilization of the thyroid lobe, with identification and protection of the important structures, was not feasible due to technical disadvantages. The procedure was converted to classical open thyroidectomy to avoid potential complications. It was followed by the patient's uneventful recovery. A standard thyroidectomy via axillary access would probably be possible with instruments and an imaging device tailored for the axillary approach.

Table 2. Anterior chest approach to endoscopic thyroidectomy: summary of surgical details

Authors (reference number)	Method	Subcut Adr	US	n	Mean age, yr (range)	Type of surgery	Mean OT, min (range)	Mean lesion size, mm (range)	Mean blood loss, mL (range)	CON	Cx
Ohgami et al (11)	CO_2 (6 mmHg)	—	—	5	48 (32–67)	HT	226 (177–281)	— (30–50)	—	0	0
Kim et al (12)	Lifting	Yes	—	156	39 (19–66)	HT	156 (90–240)	30 (5–51)	—	3	1
Yamamoto et al (13)	CO_2 (5 mmHg)	—	Yes	21	28 (15–59)	TT	260 (145–420)	44 g† (13–92)	90 (5–343)	1	1
Shimizu et al (14)	VANS	No	Yes	174	40 (16–74)	HT	102 (54–220)	36 (19–74)	55 (1–350)	4	0
Kitano et al (16)	Lifting	—	—	20 5	39 (18–63)	HT TT	381 (230–530)	—	—	0	1
Park*	CO_2 (6 mmHg)	Yes	Yes	124	39 (7-63)	HT	67 (90–240)	30 (5–51)	—	6	5

*Y.L. Park, written communication, May 2001. †Weight of specimen from subtotal thyroidectomy for Graves' disease. Method = method used to maintain working cavity; Subcut Adr = subcutaneous adrenalin solution injection; US = ultrasonically activated scalpel; OT = operation time; CON = conversion to open surgery; Cx = surgical complication; HT = hemithyroidectomy; TT = total thyroidectomy; VANS = video-assisted neck surgery.

Table 3. Axillary approach to endoscopic thyroidectomy: summary of surgical details

Authors (reference number)	Method	Subcut Adr	US	n	Mean age, yr	Type of surgery	Mean OT, min	Mean lesion size, mm	Mean blood loss, mL	CON	Cx
Ikeda et al (17)	Yes (4 mmHg)	—	Yes	74	—	HT	180	—	—	3	0
Chantawibul et al (19)	Yes (4 mmHg)	—	Yes	20	36.5	HT	175	30	65	0	0

Method = method used to maintain working cavity; Subcut Adr = subcutaneous adrenalin solution injection; US = ultrasonically activated scalpel; OT = operation time; CON = conversion to open surgery; Cx = surgical complication; HT = hemithyroidectomy.

Discussion

The impact of videoscopic surgery on most disciplines of surgery, after its initial triumph in laparoscopic cholecystectomy, has been significant. However, controversy and criticism emerged after the initial cases of successful endoscopic thyroidectomy as the procedure results in few documented objective advantages to patients, apart from subjectively augmented cosmesis. Technically, endoscopic thyroid surgery is not compatible with the principles of minimally invasive surgery, apart from the MIVAT technique devised by Miccoli et al.[4] Although the introduction of the ultrasonically activated scalpel greatly facilitated endoscopic thyroidectomy and allowed the vascular pedicles and potential thyroid parenchymal haemorrhage to be controlled with safety, few benefits accrued to patients compared to open thyroidectomy.

If endoscopic thyroidectomy continues to evolve towards practicality via improvements in imaging devices and instrumentation, there will come a time when the procedure is more widely attempted. If the postulation that the absence of major surgical complications with this technically demanding procedure is due to the skills of expert surgeons is valid, a surge of surgical complications of differing magnitudes may occur as endoscopic thyroidectomy becomes more popular. Such stages in the evolution of laparoscopic cholecystectomy, which is currently the gold standard for cholecystectomy, were also encountered. Therefore, careful and alert evaluation of endoscopic thyroid surgery may generate safe, feasible and practical alternatives to open thyroidectomy for future patients with a need for such surgery.

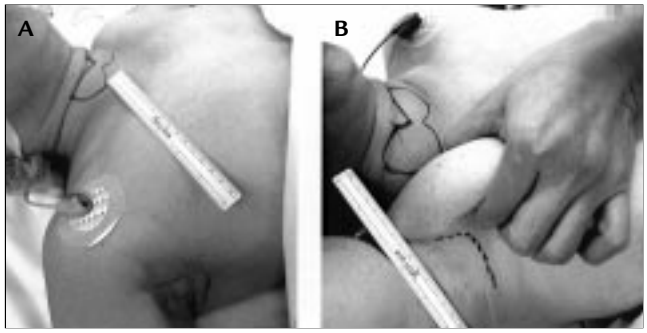

Figure 3. The difference in distance between the axillary incision and the thyroid gland with: A) the patient in a supine position with only abduction of the shoulder joint; B) the shoulder joint in flexion, adduction and internal rotation.

Figure 4. The "embracing position", showing the feasibility of a bilateral transaxillary approach when indicated and the shorter dissection distance.

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