

# Total Endoscopic Thyroidectomy via a Unilateral Axillo-Breast Approach with Two Spatula-Shaped Wires Each Attached to the End of an Endoscopic Aspirator and a Retractor-Shaped Wire

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**Objective:** With a total endoscopic thyroidectomy, it is extremely important to establish sufficient space. To solve this problem, the author has developed a new device, which is a retractor-shaped wire for retraction of the strap muscles without an additional port. Atraumatic tools for pushing and pulling without breaking the thyroid are necessary because intra-operative bleeding is a frequent cause of conversion to open procedure. To solve this problem, the author has developed a new device, which is a spatula-shaped wire that is attached to the end of an endoscopic aspirator. This spatula-shape wire can be used to push and pull the thyroid firmly without it breaking of thyroid tissue.

**Material and Method:** From 15 March 2011 to 15 April 2014, the author used these new devices in 18 consecutive patients who were considered eligible for the surgery.

**Results:** Lobectomy with isthmusectomy was performed on 12 patients (67%). Through the same incisions, a subtotal thyroidectomy was accomplished in four cases (22%) and the Hartley-Dunhill procedure was performed on two cases (11%). The mean specimen weight on the histological report was 33.12 grams (range, 8.4 to 79.6 grams). Two cases of left lobectomy with isthmusectomy had previously had a conventional right lobectomy. There was one case with the same procedure which had had a suspicious nodule on Graves' disease treated with radioactive iodine one and a half years ago. There was a case of chronic thyroiditis in one Dunhill procedure. No hemorrhage occurred during the procedures. There were three cases of subcutaneous bruising. There were no other complications detected and no cases were converted to open thyroidectomy.

**Conclusion:** Thyroid surgery with the unilateral axillo-breast approach and the new tools is safe and effective. These tools make it possible to operate on larger thyroid lesions and perform thyroid surgery on patients who have had traditional thyroid surgery, Graves' disease, and chronic thyroiditis.

**Keywords:** Spatula-shaped wires, Retractor-shaped wire, Endoscopic thyroidectomy

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Endoscopic surgery in the neck was attempted in 1996 for performing parathyroidectomy. A similar surgical technique was used for performing thyroidectomy in the following year<sup>(1,2)</sup>. The popularity has, however, persisted and increased due to the cosmetic improvement. Endoscopic thyroidectomy has progressed to more remote sites of access to improve cosmetic results and provide patients with a scarless neck. The use of endoscopic thyroid surgery offers a better cosmetic result.

It is extremely important to establish sufficient exposure and room for manipulation during endoscopic thyroidectomy<sup>(3)</sup>. To solve this problem, the author has developed a new device, which is a retractor-shaped wire for retraction of the strap muscles. In addition, the surgeon can use two hands to manipulate the thyroid because the strap muscles are retracted.

Atraumatic tools for pushing and pulling the thyroid without breaking it are necessary in endoscopic thyroidectomy, because intra-operative bleeding is a frequent cause of conversion to the open procedure<sup>(4)</sup>. To solve this problem, the author has developed a new device which is a spatula-shaped wire attached to the end of an endoscopic aspirator. This spatula-shape wire can be used to push and pull the thyroid firmly without breaking it. The aspirator can still be used to

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suck out fluid. The spatula-shaped wire maximizes contact with the thyroid surface.

The author, hereby, reports an early experience of using two spatula-shaped wires each attached to the end of an endoscopic aspirator and a retractor-shaped wire in the total endoscopic thyroidectomy in eighteen patients, focusing on technical feasibility and safety.

### Material and Method

All cases were evaluated retrospectively and data were collected. From 15 March 2011 to 15 April 2014, 18 consecutive patients were considered eligible for subtotal thyroidectomy, Hartley-Dunhill procedure<sup>(5)</sup>, or lobectomy with isthmusectomy based on the following criteria.

Inclusion criteria are 1) Diffuse toxic goiter (Graves' disease) that has indication for surgery<sup>(6)</sup>, 2) Toxic multimodal goiter, 3) Toxic adenoma, 4) Chronic thyroiditis (lymphocytic or Hashimoto's thyroiditis) surgery indicated for suspicion of malignancy or for goiter causing compressive symptoms or cosmetic deformity, 5) Multinodular goiter that causes obstructive symptoms, has malignancy suspected, or is cosmetically unacceptable, 6) A solitary thyroid nodule that causes compressive symptoms, is suspicious, or has a follicular lesion, 7) A colloid nodule that enlarges on TSH suppression, causes compressive symptoms, or for cosmetic reasons, 8) Low-grade follicular carcinoma or papillary carcinoma less than 2 cm, and no evidence of lymph node metastases or local invasion<sup>(7)</sup>.

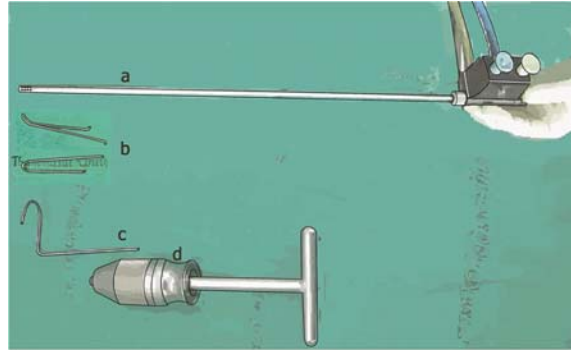
Exclusion criteria are: 1) A large thyroid gland that makes it impossible to create a working space, 2) Locally advanced cancer, 3) Lymph node metastasis, 4) Medullary or undifferentiated carcinoma.

### Instrumentation

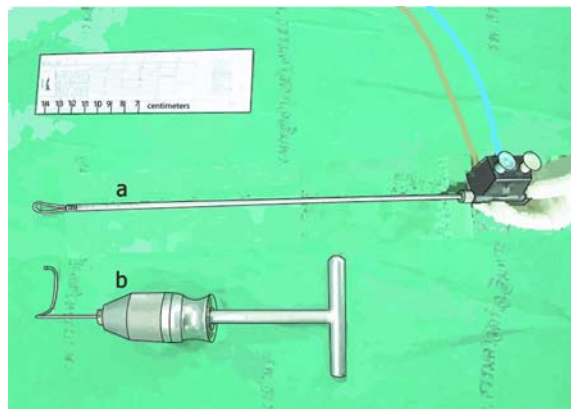
The new devices are shown in Fig. 1, 2.

### Operative technique

The procedure was performed with the patient under general endotracheal anesthesia. The patient was placed in the supine position with a pillow under the shoulder. The neck was extended slightly and the lesion-side arm was raised and fixed for the shortest distance from the axilla to the anterior neck. Graves' disease or multinodular goiter was approached from the dominant side or the right-hand side. Two 1-cm skin incisions parallel to the skin crease were made on the lesion side for two 12-mm trocars in the anterior



**Fig. 1** A) 5-mm endoscopic aspirator. b) The spatula-shaped wire. C) The retractor-shaped wire. D) Universal chuck with T-handle. The spatula-shaped wire is made from 1.8-mm Kirschner wire. The retractor-shaped is made from 2-mm Kirschner wire.



**Fig. 2** A) The spatula-shaped wire is attached to the endoscopic aspirator. B) The retractor-shaped wire is mounted in the universal chuck with T-handle.

axillary fold and a 1-cm skin incision was made for a 12-mm trocar on the upper circumareolar area on the same side as the lesion. A 10-mm 30° rigid endoscope was used. The subcutaneous fat and platysma muscle were dissected using a 5-mm Steinmann pin through the axillary skin incision until the anterior border of the sternocleidomastoid muscle was exposed and the space was sufficiently large; all three 12-mm trocars were introduced. Carbon dioxide insufflation up to 10 mm Hg was used to inflate the area. A 10-mm 30 degrees rigid endoscope and the endoscopic aspirator with the spatula-shaped wire were inserted through the axillary trochars. Through the circumareolar trochar, the Harmonic scalpel (Johnson and Johnson Medical, Cincinnati, OH, USA) was introduced. The dissection

proceeded under CO<sub>2</sub> insufflations to 10 mmHg with the Harmonic scalpel from the lateral to the medial aspect toward the thyroid. The flaps were raised to the thyroid notch superiorly and to the suprasternal notch inferiorly. The strap muscles were separated by opening the linea alba cervicalis from just below the thyroid cartilage up to the jugular notch. The plane between the strap muscles and the thyroid gland was established. With proper retraction and dissection using ultrasonic shearers and an endoscopic aspirator with a spatula-shaped wire, the loose fascia between the strap muscles and the thyroid parenchyma was then separated for both the superior and the inferior poles of the thyroid. The thyroid gland was mobilized and the middle thyroid vein was divided with the ultrasonic shearers. The skin was then punctured with a 1.5-mm Kirshner wire and the retractor-shaped wire was inserted through this puncture into the manipulating space under vision. A surgical assistant then retracted the strap muscles at the point as to provide the best exposure. The surgeon could adjust the location of the retractor-shaped wire according to the requirements of the operation to be performed.

The surgeon used the harmonic scalpel, endoscopic grasping forceps, endoscopic dissecting forceps, and one or two endoscopic aspirators each with a spatula-shaped wire throughout the operation. With one or two endoscopic aspirators each with a spatula-shaped wire, the thyroid lobe can be gently mobilized cephalad, caudad, medially, and laterally.

The inferior thyroid veins were divided near the thyroid gland. The thyroid lobe was now free to be rotated. The gland was freed from the trachea by division of the small vessels.

Attention was then focused on the inferior pole. The inferior thyroid artery was searched for. The recurrent laryngeal nerve (RLN) was identified in the triangle formed by the trachea, common carotid artery, and the inferior border of the thyroid gland<sup>(6)</sup>. Meticulous dissection was performed in a direction parallel to the anticipated course of the nerve.

The superior thyroid vessels were exposed fully and divided close to the thyroid gland using the Harmonic Scalpel, with care taken to avoid injuring the external branch of the superior laryngeal nerve. The external branch of the superior laryngeal nerve could be identified during most of the procedures.

Pushing the thyroid lobe medially using the spatula-shaped wire and opening the fascia allowed visualization of the superior parathyroid gland. Its vascular supply was then preserved by selectively

ligating the branches of the inferior thyroid artery close to thyroid gland.

The Berry ligament was dissected. To prevent thermal injury, especially near the RLN, great care was taken to maintain a distance of at least 5 mm from the major neurovascular structures. The isthmus was then dissected from the trachea and divided from the opposite lobe. The resected specimen was placed into a plastic bag and extracted through the axillary skin incision.

When performing a subtotal thyroidectomy, the contra lateral lobe was dissected in a similar fashion with the same incisions. The retractor-shaped wire was inserted into the contra lateral neck space. In a subtotal thyroidectomy the inferior thyroid vessels were preserved and about 2 grams of bilateral thyroid tissue were left<sup>(5)</sup>. In the Hartley-Dunhill procedure a total lobectomy and isthmectomy was performed on one side and about 4 grams of thyroid tissue was left on the other side (Fig. 3, 4).

#### Statistical analysis

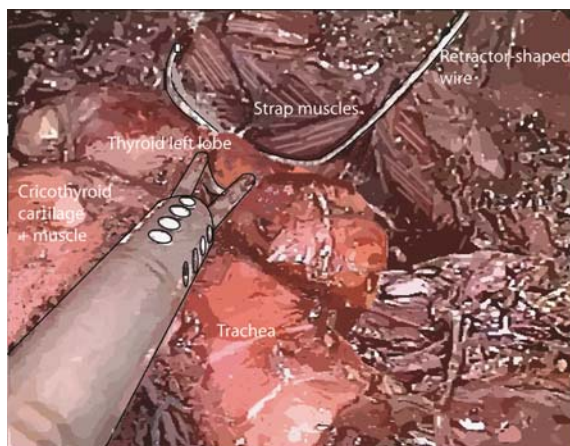
This is a descriptive study using descriptive statistics such as mean and range.

#### Results

The results were shown in Table 1. A total



**Fig. 3** A patient with nontoxic multinodular goiter underwent the Hartley-Dunhill procedure. After a total lobectomy with isthmectomy on the right side, the retractor-shaped wire was removed from the right side. The skin on the left side of the neck was then punctured with a 1.5-mm Kirshner wire and the retractor-shaped wire was inserted through this puncture into the manipulating space under direct vision.



**Fig. 4** The strap muscles were retracted by the retractor-shaped wire at the point that might provide the best exposure. The surgeon could adjust the location of the retractor-shaped wire according to the requirements of the operation to be performed. The spatula-shaped wire maximized contact with the thyroid and was atraumatic. It could be used to push and pull the thyroid firmly without breaking it.

endoscopic thyroidectomy via a unilateral axillo-breast approach with the new devices was performed in 18 consecutive cases that meet the criteria. Lobectomy with isthmusectomy was performed on 12 patients (67%). Through the same incisions, subtotal thyroidectomy was accomplished in four cases (22%) and the Hartley-Dunhill procedure was performed in two cases (11%). The mean specimen weight on the histological report was 33.12 grams (range, 8.4 to 79.6 grams). The mean operative time for lobectomy with isthmusectomy was 175 min (range, 135 to 230 min); the subtotal thyroidectomy was accomplished in 227.5 min (range, 145 to 300 min). The Hartley-Dunhill procedures were accomplished in 195 and 200 min. No hemorrhage occurred during the procedures. There were three cases of subcutaneous bruising. There were no other complications and no cases were converted to open thyroidectomy. Two cases of left lobectomy with isthmusectomy had previously had a conventional right lobectomy. There was one case of the same procedure who had had a suspicious nodule on Graves' disease treated with radioactive iodine one and a half year ago. There was a case of chronic thyroiditis in the Dunhill procedure. The weight of the specimen in one case of a dominant nodule within a multinodular goiter was 79.6 grams.

## Discussion

These 18 patients presented with diverse diagnoses. These included nontoxic multinodular goiter (MNG), toxic MNG, nontoxic nodular goiter, adenoma, Graves' disease, and chronic thyroiditis (Hashimoto's disease). There were also patients who had previously had conventional thyroid surgery. A unilateral axillary breast approach with the use of the new devices can be performed for a variety of thyroid diseases. A contraindication for surgical procedures using the tools of the author is not a large thyroid itself but rather a large thyroid gland that makes it impossible to create an adequate working space. Some people have fairly large thyroids and their necks are short or the skin is tight, who cannot be operated by using this technique.

The minimally invasive video-assisted technique (MIVAT) by Miccoli has limited the size of the nodule to not more than 3 cm, thyroid volume <25 cc, Graves' disease <30 ml. Relative contraindications are thyroiditis, previous thyroid surgery, hyperthyroidism, or irradiation<sup>(9)</sup>. These restrictions are because a surgical wound in the neck cannot be extended beyond 3 cm. However, the relative contraindications are due to a difficult endoscopic thyroid surgery. They are thyroiditis, previous thyroid surgery, hyperthyroidism, previous irradiation. On the contrary, the unilateral axillo-breast approach using the new devices makes it possible to operate on larger lesions. The largest one weighed 79.6 grams. A lobectomy with isthmusectomy was performed with this technique in two patients who had previously had a conventional thyroid lobectomy. A subtotal thyroidectomy could be performed also in Graves' disease with specimen weighting 51.4 grams. A Hartley-Dunhill procedure was performed in a patient with chronic thyroiditis (Hashimoto's disease). The spatula-shaped wire attached to the end of an endoscopic aspirator can manipulate the thyroid without its breaking easily, thus bleeding is reduced. The retractor-shaped wire can be placed to provide good thyroid exposure. These tools make endoscopic thyroid surgery possible for these patients. There had been no cases converted to conventional thyroidectomy and no major complications detected except for three cases of subcutaneous bruising.

## Conclusion

Thyroid surgery with the unilateral axillo-breast approach and the new tools is safe and effective. The retractor-shaped wire provides more surgical space without division of the strap muscles. The

**Table 1.** Demographic characteristics and results of 18 consecutive endoscopic thyroidectomy

Case	Age (years)	Sex	Operative duration (min)	Largest diameter of nodule (cm)	Diagnosis	FNAC <sup>(6)</sup>	Operation	Weight of specimen (g)	Final pathology	Complications
Case 1	45	F	300		NMTG	No	STT	35	NMNG	No
Case 2	48	F	145		NMTG	Benign	STT	44.6	NMNG	No
Case 3	75	F	165		NMTG	No	STT	39.9	NMNG	No
Case 4	30	F	300		GD	No	STT	51.4	GD	No
Case 5	60	F	180	3.3	NTNG	Benign	Rt LwI	16.4	NTNG	No
Case 6	26	F	195	1.5	NTNG	Suspicious	Rt LwI	8.4	NTNG	No
Case 7	41	F	200		Chronic thyroiditis	No	Dunhill procedure	60	Chronic thyroiditis	No
Case 8	65	M	195		NMTG	No	Dunhill procedure	36.4	NMNG	No
Case 9	42	F	210	1.6	Adenoma	Suspicious	Rt LwI	19.2	Adenoma	No
Case 10	58	F	210	3.7	Adenoma	Suspicious	Rt LwI	24.5	Adenoma	Subcutaneous bruising
Case 11	38	F	230	3.8	Adenoma*	Suspicious	Lt LwI	43.5	Adenoma	Subcutaneous bruising
Case 12	59	F	105	3.7	NTNG in NMTG	Suspicious	Lt LwI	79.6	Nodular goiter	Subcutaneous bruising
Case 13	45	F	185		TMNG**	Benign	Lt LwI	24.7	TMNG	No
Case 14	56	F	180	6.3	NTNG***	Suspicious	Lt LwI	20.7	NTNG	No
Case 15	59	M	210	3.4	NTNG	Benign	Rt LwI	28	NTNG	No
Case 16	39	F	165	2.9	Adenoma	suspicious	Lt LwI	21	Adenoma	No
Case 17	41	F	120	3.9	NTNG	Benign	Lt LwI	21	NTNG	No
Case 18	33	F	135	2.8	Adenoma	Suspicious	Rt LwI	21.8	Adenoma	No

FNAC = fine needle aspiration cytology; F = female; M = male; NMTG = nontoxic multinodular goiter; GD = Graves' disease; NTNG = nontoxic nodular goiter; TMNG = toxic multinodular goiter; STT = subtotal thyroidectomy; Rt = right; Lt = left; LwI = lobectomy with isthmusectomy; Dunhill procedure = Hartley Dunhill procedure  
 \* Previous conventional right lobectomy from Nodular goiter; \*\* Previous conventional right lobectomy for TMNG 8 years ago; \*\*\* NTNG in Graves' disease treated with RAI (radioactive iodine) one and a half year ago

bleeding is reduced by using the spatula-shaped wire attached to the end of the endoscopic aspirator. These tools make it possible to operate on larger thyroid lesions and perform thyroid surgery on patients who have had traditional thyroid surgery, Graves' disease, and chronic thyroiditis.

**Potential conflicts of interest**

None.

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การผ่าตัดไทรอยด์โดยกล้องวิดีโอทัศนผ่านทางรักแร้และขอบบนของหัวนมโดยใช้ลวดที่ขดเป็นรูปช้อน ที่ต่อเข้ากับปลายท่อ  
เครื่องดูดสองชุดและลวดที่ขดเป็นเครื่องมือดึงรั้ง

วีรวัดณ์ เหลืองชนะ

วัตถุประสงค์: ในการผ่าตัดไทรอยด์โดยกล้องวิดีโอทัศนมีความจำเป็นที่ต้องทำให้พื้นที่เพียงพอ เพื่อแก้ปัญหาที่ผู้พิมพ์ได้พัฒนาเครื่องมือใหม่เป็นลวดที่ขด  
เป็นเครื่องมือดึงรั้งเพื่อใช้ในการดึง strap muscles การมีเครื่องมือที่ไม่ทำให้เกิดการบาดเจ็บขณะดึงและดันต่อมไทรอยด์เป็นสิ่งที่มีความจำเป็นด้วย  
เพราะการมีเลือดออก ขณะผ่าตัดเป็นสาเหตุของการเปลี่ยนการผ่าตัดเป็นแบบเปิดที่พบบ่อย เพื่อแก้ปัญหาที่ผู้พิมพ์ได้พัฒนาเครื่องมือใหม่ คือลวดที่ขด  
เป็นรูปช้อนที่ใส่เข้าทางปลายของ endoscopic aspirator ที่สามารถใช้ดึงและดันโดยแนบติดกับไทรอยด์และไม่ทำให้ไทรอยด์แตก

วัสดุและวิธีการ: จากวันที่ 15 มีนาคม พ.ศ. 2554 ถึงวันที่ 15 เมษายน พ.ศ. 2557 ผู้พิมพ์ได้ผ่าตัดโดยวิธี axillo-breast approach โดยใช้เครื่องมือ  
ดังกล่าวในผู้ป่วย 18 รายที่เข้าเกณฑ์

ผลการศึกษา: ได้ทำ lobectomy with isthmusectomy ในผู้ป่วย 12 ราย (67%) ทำ subtotal thyroidectomy 4 ราย (22%) และ Hartley  
Dunhill procedure 2 ราย (11%) น้ำหนักเฉลี่ยของชิ้นเนื้อคือ 33.12 กรัม (อยู่ในช่วง 8.4 ถึง 76.6 กรัม) มีผู้ป่วย 2 รายที่ทำ left lobectomy  
with isthmusectomy เคยผ่าตัดไทรอยด์แบบเปิดมาก่อน ผู้ป่วย 1 รายที่ทำการผ่าตัดแบบเดียวกันมี suspicious nodule เป็น Graves' disease  
ได้รับการรักษาแบบ radioactive iodine มาก่อน มี 1 รายทำการผ่าตัด Dunhill procedure เป็น chronic thyroiditis ไม่มีภาวะแทรกซ้อนของการมี  
เลือดออกพบผู้ป่วย 3 รายหลังผ่าตัดมี subcutaneous bruising ไม่มีผู้ป่วยที่ต้องเปลี่ยนการผ่าตัดเป็นแบบเปิด

สรุป: การผ่าตัดไทรอยด์โดยเครื่องมือใหม่ ทำให้สามารถผ่าตัดไทรอยด์ที่มีรอยโรคใหญ่ขึ้น ผ่าตัดในผู้ป่วยที่เคยผ่าตัดไทรอยด์แบบเปิดมาก่อน ผู้ป่วยที่เป็น  
Graves' disease และ chronic thyroiditis

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