Surg Endosc (2000) 14: 134–136
DOI: 10.1007/s004649900084

Surgical Endoscopy
Ultrasound and
Interventional Techniques

Repeat transthoracic endoscopic sympathectomy for palmar and axillary hyperhidrosis

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Received: 15 September 1998/Accepted: 3 March 1999

Abstract
Background: Patients undergoing an unsuccessful sympathectomy experience dryness on one hand and excessive sweating on the other. This is embarrassing for the patients, and resolution of both a previous failed sympathectomy and recurrent hyperhidrosis is important.
Methods: From September 1995 to January 1998, 24 patients (11 men and 13 women; mean age, 28.2 years) underwent repeat transthoracic sympathectomy (TES). The repeat TES was performed with patients under general anesthesia using either a standard single-lumen endotracheal tube (12 patients) or a double-lumen endotracheal tube (12 patients). Ablation of T2 and T3 ganglia and any Kuntz fiber was performed in treating patients with palmar hyperhidrosis, and a similar procedure was performed on T3 and T4 ganglia for patients with axillary hyperhidrosis.
Results: The reasons for failure of the previous TES were pleural adhesion (14/24), intact T2 ganglion (5/24), aberrant venous arch drainage to the superior vena cava (2/24), incomplete interruption of sympathectic nerve (2/24), and possible reinnervation (1/24). The mean operation time was 28 min (range, 18–72 min). In all, 23 patients had a satisfactory result, without recurrence of palmar or axillary hyperhidrosis. The mean follow-up time was 22 months (range, 5–30 months). The average hospital stay was 1.8 days. There was no surgical mortality.
Conclusion: Repeat TES is a safe and effective method for treating both an unsuccessful sympathectomy and recurrent palmar or axillary hyperhidrosis.

Key words: Hyperhidrosis — Repeat sympathectomy

Hyperhidrosis is a pathologic condition in which sweating exceeds that necessary for thermoregulation. This can be very distressing and a source of intense embarrassment. Palmar hyperhidrosis is a common phenomenon in subtropical areas, with an estimated incidence 0.6% to 1% [1]. Transthoracic endoscopic sympathectomy (TES) is considered the treatment of choice. It has a high initial success rate for palmar and/or axillary hyperhidrosis, and causes minimal morbidity [7, 9, 13]. Although TES is simple and safe, some patients show no improvement or experience recurrence. Patients have complained of dryness on one hand and excess sweating on the other hand after TES. Currently, few reports of repeat sympathectomy exist in the English literature. We report our experience in treating 24 patients with repeat TES and describe our operative method.

Material and methods

From September 1995 to January 1998, 1,700 patients underwent TES, and 24 patients (11 men and 13 women) underwent repeat TES. The mean age of these patients was 28.2 years (range, 17–48 years). With the patients under general anesthesia, TES was performed using either a standard single-lumen endotracheal tube (12 patients) or a double-lumen endotracheal tube (12 patients). Most of the patients were placed in a half-sitting position, with only two in lateral position because of possible severe pleural adhesion and unilateral recurrence. A 0.8-cm incision was made at the third intercostal space below the axillae bilaterally just posteriorly to the pectoralis major muscle. Two patients needed an additional incision wound through the fourth intercostal space at the midclavicular line because of severe pleural adhesion. The endotracheal tube was disconnected briefly by the anesthesiologist to deflate the lung. Then the pleural cavity was entered by using mosquito forceps to avoid damaging the lung parenchyma. An 8-mm, 0° thoracoscope (Karl Storz company, Germany) was introduced into the pleural cavity through an obtuse head trocar. Pneumolysis often was needed for pleural adhesion before the T2, T3, and T4 ganglia could be identified. Ablation of the T2 and T3 ganglia and any Kuntz fibers if present was performed with conventional electrocautery in the patients with palmar hyperhidrosis. A similar procedure was carried out on the T3 and T4 ganglia in patients with axillary hyperhidrosis.

After adequate sympathectomy, the lung was reinflated under visual control. The surgical wound was closed with subcutaneous suture for cosmetic effect. A routine postoperative chest radiograph was taken to rule out pneumothorax or segmental atelectasis. Patients were discharged either the day of the operation or the next morning.

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Table 1. The cause for failure of previous sympathectomy ($n = 24$)

Causes of failure	*n*
Pleural adhesion	14
Intact T2 ganglion	5
Aberrant venous arch	2
Incomplete interruption of T2 ganglion	2
Possible reinnervation	1

Table 2. Incidental findings during repeat sympathectomy ($n = 20$)

Incidental findings	*n*
Diffuse pleural adhesion	12
Congenital bullae or blebs	2
Aberrant great vein drainage to SVC	2
Only adhesion band	2
Hypertension with intrathoracic vessel engorgement	1
Medially located sympathetic chain	1

SVC, superior vena cava

Results

Of the 24 patients in this study, 18 underwent unilateral TES and 6 bilateral TES. Failure of the first sympathectomy was caused by pleural adhesion (14/24), intact T2 ganglion (5/24), aberrant venous arch drainage to the superior vena cava (2/24), incomplete interruption of sympathectic nerve with or without accessory nerve (Kuntz fiber) (2/24), and possible nerve reinnervation (1/24) (Table 1).

All except two patients were placed in a half-sitting position under general anesthesia with either a single- or double-lumen endotracheal tube. In general, the mean operation time was 28 min (range, 18–72 min). The duration of operation time was associated mainly with the degree of pleural adhesion. Incidental findings during operation comprised diffuse pleural adhesion and single adhesion band (14 patients), bullae or blebs (2 patients), aberrant great vein drainage to superior vena cava (2 patients), an unusual, medially located sympathetic chain (1 patient), and hypertension with intrathoracic vessel engorgement near sympathetic chain (1 patient) (Table 2).

Successful repeat sympathectomy was achieved in 23 patients (96%). The main reason for the single failed repeat sympathectomy was severe pleural adhesion and persistent oozing during the operation, with the patient refusing to accept further operation. Operative complications were minimal with mild hemopneumothorax (1/24). Tube thoracostomy was placed for 3 days in this patient. The mean hospital stay was 1.8 day (range, 1–3 days). There was no surgical mortality.

Discussions

Although TES at the T2 to T4 levels is easy, safe, and effective for treating palmar or axillary hyperhidrosis, technique failure or recurrence of hyperhidrosis is possible. Drott and Claes [4] reported that primary failure occurred in 23 cases (<2%), and that 24 cases (2%) developed recurrent symptoms in a total of 1,163 patients during a mean of 31 months follow-up.

Many explanations for these failures have been given. An anatomic variation in the sympathetic chain and failure of surgical technique are the most important factors. Reasons for failure of a previous TES or recurrent symptoms included severe pleural adhesion [11, 15], existence of the Kuntz nerve [5, 8], possible nerve regeneration [12, 14], anatomic variation of the sympathetic chain [14], and incomplete interruption of sympathetic chain.

The incidence of pleural adhesion was found to be 3.4% to 6.4% [11, 15] among patients without previous thoracic disease undergoing TES. In the current study, pleural adhesion occurred in approximately 3.2% of patients with normal chest x-radiograph (CXR). Furthermore, higher rates of pleural adhesion were encountered in older patients, especially patients' older than 40 years.

Both pneumothorax and hemothorax may develop if the surgeon has less experience in treating diffuse pleural adhesion via thoracoscopy. In the current study, the 24 patients who underwent repeat TES were referred by a neurosurgeon who hesitated to perform pneumolysis for severe pleural adhesion.

During TES, one of the current authors prefers to use the special right-angled hook dissector to sever pleural adhesions. This hook dissector also can mobilize and elevate the sympathetic chain from neighboring vessels to prevent possible hemothorax. Sometimes, creation of another incision wound is necessary to shorten the operation time during pneumolysis. The upper sympathetic chain can be well identified after meticulous pneumolysis.

Maintenance of adequate lung ventilation, oxygenation via laryngeal mask, and single- or double-lumen endotracheal tube has been advocated by anesthesiologists for the management of patients receiving the first TES [2, 6]. However, the current authors recommend a half-sitting position with double-lumen anesthesia for patients undergoing repeat TES and single-lumen anesthesia for patients undergoing first TES to avoid hypoxemia during the handling of pleural adhesion.

Approximately, 10% of persons have an extraneural pathway lateral and parallel to the main sympathetic chain (the nerve of Kuntz) through which sympathetic nerve fibers reach the brachial plexus without passing through the sympathetic trunk, thus causing persistent sweating of the hands [5, 14]. Regeneration of preganglionic fiber is another explanation for the return of excessive sweating of the hands [12, 14]. Therefore, ablation of the T2 and T3 ganglia and possible Kuntz fibers is imperative in the management patients with recurrent palmar hyperhidrosis or a previous unsuccessful TES.

Interestingly, in the current study two patients underwent repeat TES because of an aberrant great venous arch draining the superior vena cava. This venous arch covered the T2 ganglion, and the partial T2–T3 interganglionic segment made sympathectomy difficult. In this situation, the T2 and T3 ganglia can be destroyed safely if the surgeon correctly identifies upper sympathetic chain beneath the greater vein just lateral to the trachea (Fig. 1).

The second thoracic ganglion is the key segment for innervation of the upper extremity. If it is missed, TES is bound to fail in the treatment of palmar hyperhidrosis [5, 7]. The T2 sympathetic ganglion lies between the second and

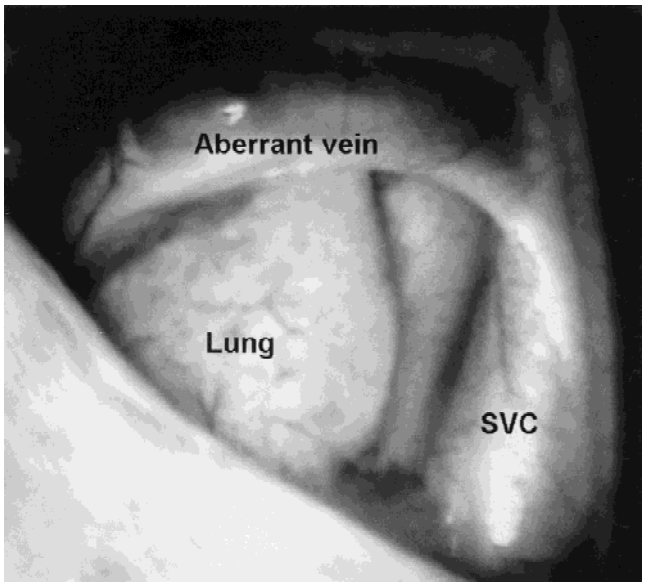

Fig. 1. The aberrant venous arch drainage to the superior vena cava.

third ribs. Hence, transection of the T2 ganglion must be performed on the second and third rib beds [9, 10]. The superior intercostal artery plays a critical role in identifying the second rib [3, 15]. This small vessel arising from the subclavian artery exists in 87.5% of the cadavers studied and consistently runs laterally and parallel to sympathetic chain at an average distance of 10 mm at the second rib [3]. The second rib is just beneath the first intercostal muscle, offering another identification method. In the current study, almost all of the patients with palmar hyperhidrosis undergoing repeat TES had an intact T2 ganglion.

Clinically, patients experiencing an unsuccessful TES would probably suffer from dryness of one hand and excessive sweating of the other. Therefore, the resolution of previous failed sympathectomy and recurrent hyperhidrosis is important.

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