ORIGINAL ARTICLE

Endoscopic Transthoracic Sympathectomy in the Treatment of Primary Hyperhidrosis

A Review of 290 Sympathectomies

Dov Shachor, MD; Robert Jedeikin, MBChB; David Olsfanger, MBChB; Jose Bendahan, MD; Galit Sivak, MD; Uri Freund, MD

Objectives: To describe the surgical technique of endoscopic transthoracic sympathectomy for the treatment of palmar hyperhidrosis and to identify associated complications.

Design: Prospective clinical study.

Setting: University referral center.

Patients: A consecutive series of 150 patients with primary palmar hyperhidrosis.

Intervention: The surgical procedure is performed under general anesthesia. A trocar and endoscope are inserted into the chest cavity. The sympathetic chain and the second, third, and fourth ganglia are then identified, cauterized, and cut. After reinflation of the lung, the procedure is repeated on the other side.

Results: Two hundred ninety sympathectomies were performed with a 98% success rate. Complications of the procedure included pneumothorax in seven patients (2.4%), hemothorax in three (1.0%), and temporary Horner's syndrome in two (0.7%). Severe postoperative pain during the first 2 to 4 hours required treatment. Of 60 patients who were followed up for 12 months, 50% developed compensatory sweating and 8.3% developed rebound sweating. Hyperhidrosis recurred in three patients.

Conclusion: Endoscopic transthoracic sympathectomy is an effective form of treatment for palmar primary hyperhidrosis, is associated with a low morbidity, and can be performed as an ambulatory procedure.

(Arch Surg. 1994;129:241-244)

From the Departments of Surgery A (Drs Shachor, Bendahan, Sivak, and Freund) and the Departments of Anesthesia and Intensive Care (Drs Jedeikin and Olsfanger), Meir Hospital, Kfar Saba, Israel, and the Sackler School of Medicine, University of Tel Aviv, Israel.

PRIMARY PALMAR hyperhidrosis is a condition of unknown origin, with an estimated incidence of 0.6% to 1.0%, and occurs mostly in adolescents.[1] It usually affects the axillae and palms (43%), causing embarrassment or even psychological trauma. Some patients avoid holding or shaking hands, while others may find difficulty in writing, particularly when under stress. The groin, feet, and face may also be affected[2-4] but cause less anguish than palmar hyperhidrosis and rarely require surgical treatment.

The treatment of palmar hyperhidrosis is multifarious and includes drug therapy,[5] biofeedback,[6] iontophoresis,[7] and percutaneous phenol block.[8] Medical treatment of hyperhidrosis appears to be successful in only the mildest cases.[2] Surgical excision of axillary sweat glands[9] and suction-assisted lipolysis[10] have also been advocated. The best results have been achieved with upper thoracic sympathectomy[11-14] performed through a variety of surgical approaches of which the cervical and transaxillary are the most popular.[13]

In 1978, Kux[14] revived interest in endoscopic thoracic sympathectomy (ETS) with a detailed review of 124 endoscopic sympathectomies in 63 patients. Using a similar technique to that described by Malone et al,[3] we report our results of 290 endoscopic thoracic sympathectomies in 150 patients.

RESULTS

Two hundred ninety sympathectomies were performed in 150 patients, with a 98% suc-

See Patients and Methods on next page

PATIENTS AND METHODS

From January 1990 to December 1992, a consecutive series of 150 healthy patients, aged 13 to 55 years (89 females and 61 males), underwent ETS for the treatment of primary palmar hyperhidrosis.

The surgical procedure is performed under general anesthesia as described previously.[15] Following induction of general anesthesia, a double lumen endobronchial tube is inserted into the trachea, ensuring unilateral collapse of the lung on the side of the operation and a clear view of the upper chest cavity. By placing the patient in a 20° anti-Trendelenburg position with both arms abducted to 90°, the collapsed lung is encouraged to fall from the upper chest cavity and easy access is gained to the incision site. Throughout the procedure, the patients' lungs are ventilated with 100% inspired oxygen and peripheral arterial oxygen saturation (SpO_2) is monitored with a pulse oximeter because of the possible danger of a fall in the arterial partial pressure of oxygen, which can occur during one-lung anesthesia. The blood pressure level, electrocardiogram, heart rate, end-tidal carbon dioxide concentration, and peak airway pressure are continuously monitored. The temperature of the palms of both hands are measured to confirm the success of the sympathectomy.

Through a 1-cm incision in the skin and subcutaneous tissue of the third intercostal space on the anterior axillary line, a Veress insufflation needle is inserted into the pleural cavity and between 1 and 1½ L of carbon dioxide is carefully insufflated into the interpleural space. Before insufflation, the ipsilateral side of the double lumen tube is disconnected from the patient and one-lung ventilation is commenced. This allows the lung to partially collapse and fall from the side of the chest wall, thereby avoiding trauma with the insertion of the Veress needle. The Veress needle is then removed and a 10-mm trocar is inserted through the same incision. An endoscope with a special working channel is passed through the trocar and is attached to a camera and video system. The thoracic cavity and anatomy are clearly displayed on the video screen. The sympathetic chain can easily be seen under the parietal pleura, lateral to the azygos vein on the right side and to the aorta on the left side. The sympathetic ganglia are identified on the heads of the ribs. The stellate ganglion is uniquely identified by a pad of yellow fat covering it above the head of the first rib. A diathermy probe is then passed through the working channel of the endoscope and is used to further confirm the identification of the sympathetic chain by palpating and rolling the nerves over the ribs. The second, third, and fourth ganglia are then cauterized and cut on the ribs, thereby avoiding damage to the intercostal vessels and nerves. In the event of the nerve being close to a blood vessel, it can easily be moved away from it with the probe before cutting and cauterization. Success of the operation is confirmed by observing the increase in skin temperature of the hand on the side of the sympathectomy. Similarly, an increase in the amplitude of the SpO_2 plethysmograph curve may be considered a sign of improved tissue perfusion caused by the vasodilation of a successful sympathectomy.

At the end of the procedure, the probe is removed, the tap of the trocar is opened to the atmosphere, and carbon dioxide is allowed to escape from the chest cavity. The lung is manually reinflated, and only when it is seen bulging into the lumen of the trocar is the trocar removed and two-lung ventilation is resumed. Chest drains are unnecessary and not routinely inserted. The procedure is then repeated on the other side of the chest. On admission to the recovery room, chest roentgenography is performed, the SpO_2 is monitored, oxygen is administered with a face mask, and opiates are given for pain as required.

cess rate as assessed by dry, warm hands at the end of the operation and patient satisfaction with the procedure. Palmar temperature increased by 1°C to 1.5°C in the first hour after sympathectomy. Unilateral ETS was performed in four patients who had previously undergone surgical sympathectomy on the other side. In three patients, sympathectomies could not be performed because it was impossible to visualize and identify the sympathetic chain. In two patients, pleural adhesions prevented collapse of the lung and in one obese patient, excessive adipose tissue completely obscured the sympathetic chain.

Temporary Horner's syndrome occurred in two patients (0.7%). In one patient, complete resolution occurred within 7 days, and in the second patient, within 6 months. Pneumothorax was diagnosed in seven patients (2.4%) on chest roentgenography. In five patients, resolution occurred within 24 hours, and in the remaining two patients, underwater chest drains were inserted for 24 hours. Subcutaneous emphysema occurred in eight patients but caused no discomfort and resolved within 24 to 48 hours. Hemothorax was diagnosed in three patients (1.0%). In two patients, the diagnosis was made with the postoperative chest roentgenogram. These patients were treated with chest drains over 3 days and did not require blood transfusions. The third patient had a normal postoperative chest roentgenogram but became tachycardic and hypotensive 12 hours after surgery. A chest roentgenogram confirmed the diagnosis of hemothorax and a chest drain was inserted. The patient continued to bleed; a transaxillary thoracotomy through the third intercostal space was performed and a bleeding intercostal vessel, in the area where coagulation of the fourth sympathetic ganglion had been performed, was identified and sutured.

Postoperative retrosternal and upper thoracic back pain was a problem in most patients. Initially severe but of short duration (2 to 4 hours), the pain nearly always responded to a single dose of opiates.

Complications Occurring With the Surgical Techniques Used for Thoracic Sympathectomy in the Treatment of Hyperhidrosis

Source, y	No. of Patients	No. of Sym	No. of Complications*			
			Pne	Hem	Horner's Syndrome	Other
Transaxillary						
Atkins,[16] 1954	26	42	0	0	0	Brachial palsy (1)
Sternberg et al,[17] 1982	54	80	0†	0	0	Winged scapula (1)
Berguer and Smit,[18] 1981	22	44	4	0	0	0
Supraclavicular						
Adar et al,[1] 1977	100	198	6	0	40	Brachial palsy (11) Recurrent laryngeal (1)
Bogokowsky et al,[11] 1983	42	84	0	0	0	0
Conlon and Keaveny,[12] 1987	75	135	1	0	2	Chylothorax (1)
Hashmonai et al,[19] 1992	85	170	1	3	5	Chylothorax (1)
Greenhalgh et al,[20] 1971	28	56	2	0	1	Phrenic nerve (1)
Anterior thoracic						
Cloward,[21] 1969	82	148	4	0	3	0
Shih and Wang,[22] 1978	457	914	3	1	0	0
Palumbo et al,[23] 1966	65	98	65	0	8	0
Endoscopic						
Byrne et al,[2] 1990	112	170	1	0	0	0
Malone et al,[3] 1986	7	13	1	0	0	0
Kux,[14] 1978	63	122	0	1	0	0
Lin,[24] 1992	130	260	0	1	0	0
Edmonson et al,[25] 1992	25	50	1	0	0	Arm neuralgia (1)

**Sym indicates sympathectomies; Pne, pneumothorax; and Hem, hemothorax.*
†Chest drains are routinely inserted.

Sixty patients have been followed up for 12 months. Thirty patients (50%) developed compensatory sweating of the back, abdomen, and thighs. Often, all three areas of the body were affected simultaneously. Five patients (8.3%) developed rebound sweating 3 to 4 days after ETS, which lasted for less than 24 hours. All were satisfied with the cosmetic results of ETS. Hyperhidrosis recurred in three patients: in one patient, bilaterally and in two patients, unilaterally; however, in all three patients, the amount of palmar sweating was substantially less than before surgery.

COMMENT

Four different surgical approaches are currently used for upper thoracic sympathectomy (**Table**), which is the definitive treatment of severe palmar hyperhidrosis.[13] They are the transaxillary,[16-18] cervical or supraclavicular,[1,11,12,19,20] and anterior thoracic[21-23] approaches for thoracotomy and ETS.[2,3,14,24,25]

Permanent Horner's syndrome is a distressing complication of dorsal sympathectomy. It most frequently occurs when using the supraclavicular approach[1,19] but has also been reported following other open surgical approaches (Table).[21,23] With ETS, only temporary Horner's syndrome has been observed and is usually short term.[3] This can be explained by the clarity with which the stellate ganglion can be identified with the endoscope and video camera system. Direct trauma to the stellate ganglion and subsequent permanent Horner's syndrome is therefore most unlikely to occur during ETS. Temporary Horner's syndrome, when it occurs, is probably caused by the heat of the diathermy probe transmitted to the lower part of the ganglion.

Another, perhaps the most serious, complication we encountered was hemothorax. In two patients, the diagnosis was made on routine postoperative chest roentgenography, but the third patient developed hypotension and underwent thoracotomy to stop the bleeding. Although a relatively rare complication of surgical sympathectomy, hemothorax has been reported following endoscopic,[14,24] anterior thoracic,[22] and supraclavicular[19] sympathectomies (Table). During ETS, bleeding may occur following trauma to an intercostal artery or vein or a branch of the azygos vein. Early recognition of this complication and treatment by pressure, coagulation, and lung reinflation may prevent the formation of a hemothorax and the necessity for performing an exploratory thoracotomy. For patients undergoing thoracotomy to control the bleeding, the transaxillary approach is adequate. Damage to a blood vessel during ETS is more likely to occur when the nerve is lifted off the rib before being cut. This technique is used to perform a biopsy and obtain microscopic confirmation of the sympathectomy. We prefer to cauterize and cut the sympathetic nerve and ganglia where they lie on the ribs (an area free of blood vessels), thus decreasing the risk of a bleed. The extra chest wound, needed for a second trocar and probe required to lift and cut the nerve, is avoided, thus keeping the procedure simple and less risky. The final results are probably no different regardless of whether a biopsy of the nerve is done.

In contrast to the other thoracotomy approaches, postoperative chest drains are not needed with ETS. The pneumothorax seen postoperatively with ETS is usually the result of a failure to completely expel the insufflation gas from the chest cavity and rarely requires active treatment and drainage (Table). Carbon dioxide is forced out of the pleural cavity at the end of the procedure by manual hyperinflation and reexpansion of the collapsed lung. This is done under direct vision, and only when the lung is seen to be completely reexpanded and bulging into the lumen of the trocar is the trocar withdrawn and the wound sutured. Nevertheless, pneumothorax occurs, but it is usually small and is reabsorbed within 12 to 24 hours, as was seen in five of our seven patients. Pneumothorax may also result from inadvertent trauma to the lung during ETS. In this instance, pneumothorax fails to reabsorb and requires drainage.

Brachial palsy,[1,16] winged scapula,[17] recurrent laryngeal nerve,[1] and phrenic nerve damage[20] have been reported following thoracic sympathectomy (Table). Except for one patient who developed neuralgia of the arm, neurological damage has not been seen to occur after ETS and similarly was not a complication in our series.

Although only a few complications of the transaxillary approach via the third intercostal interspace are reported,[16,17] there are several disadvantages of this technique when compared with ETS. Two separate hospital admissions are advocated as it is considered unsafe to operate on both sides at one time. In our experience, we found that these patients require a longer hospital stay, usually need chest physiotherapy, and occasionally develop wound infection. Wound infection was not observed in any of our patients and is not a reported complication of ETS. Adhesions between the parietal and visceral pleura are considered a contraindication to the transaxillary approach and may similarly complicate ETS. Adhesive bands, seen in seven of our patients, prevented collapse of the lung and obscured the surgical field. Except for two patients in whom the lungs could not be freed and surgery had to be abandoned, the adhesions were successfully severed through the endoscope and surgery was completed uneventfully.

The presence of large deposits of adipose tissue on the parietal pleura of an obese patient completely obscured the sympathetic chain and prevented ETS from being performed. Although this occurred only in one patient, it would seem prudent to inform the obese patient of this possibility preoperatively.

Postoperative pain occurred in nearly all our patients. It was especially severe on awakening from the anesthesia, but patients responded well to a single dose of opiates and pain rarely persisted for more than 2 to 4 hours. Pain was mostly localized to the back or retrosternal area and was probably the result of pneumomediastinum.

In conclusion, from our experience and survey of the literature (Table),[2,3,14,18,24,25] ETS is definitely superior and offers distinct advantages over the other surgical approaches mentioned above. The main reasons for this are the simplicity and ease with which the procedure is performed together with excellent cosmetic results, low incidence of perioperative complications, and the option to treat both sides at one time as an outpatient service with subsequent lower cost and convenience.

Presented at the 18th Annual Surgical Congress of the Israel Society of Surgeons, Jerusalem, May 21, 1992.

Reprints not available.

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