CHAPTER 10

UNIPORTAL ENDOSCOPIC THORACIC SYMPATHECTOMY FOR TREATMENT OF PALMAR AND AXILLARY HYPERHIDROSIS: ANALYSIS OF 2000 CASES

OBJECTIVE: Primary hyperhidrosis of the upper limbs is a common and troublesome condition in Taiwan. Therefore, we present our experience in treating hyperhidrosis via unportal endoscopic thoracic sympathectomy.

METHODS: Between April 1993 and March 2000, a total of 2000 patients underwent endoscopic thoracic sympathectomy for treatment of palmar or axillary hyperhidrosis. There were 1520 patients with palmar hyperhidrosis and 480 patients with axillary hyperhidrosis. There were 788 male and 1212 female patients, with a mean age of 22.9 years (range, 9–60 yr). All patients were placed in a semi-sitting position, with single-lumen-intubation anesthesia. We performed T2 sympathectomy at the second and third rib beds for patients with palmar hyperhidrosis, using an 8-mm, 0-degree, offset thoracoscope (Karl Storz GmbH & Co., Tuttlingen, Germany), via a 0.8-cm incision below each axilla. Similar procedures were used for T3 and T4 sympathectomies at the third, fourth, and fifth rib beds for patients with axillary hyperhidrosis. Questionnaires were sent to all patients after surgery.

RESULTS: Among these 2000 patients, successful bilateral sympathectomies were performed for 1992 patients. The operations were usually completed within 20 minutes (range, 10–30 min). Most patients were discharged within 4 hours after surgery. The surgical complications were minimal, including pneumothorax (10 cases, 0.5%), segmental atelectasis (7 cases, 0.35%), hemothorax (2 cases, 0.1%), and mild wound infections (2 cases, 0.1%). There were no surgery-related deaths. The mean postoperative follow-up period was 51.7 months (range, 6–89 mo). A total of 1720 patients (86%) developed compensatory sweating of the trunk and lower limbs. The recurrence rates for palmar and axillary hyperhidrosis after surgery were 0 and 4.1% in the first year, 0.1 and 8.2% in the second year, 0.5 and 10.4% in the third year, 0.6 and 14.1% in the fourth year, and 1.3 and 16.7% in the fifth year, respectively.

CONCLUSION: Uniportal endoscopic thoracic sympathectomy is a safe, effective method for the treatment of patients with palmar or axillary hyperhidrosis. For surgery, both a semi-sitting position and single-lumen-intubation anesthesia are recommended.

KEY WORDS: Axillary hyperhidrosis, Palmar hyperhidrosis, Uniportal endoscopic thoracic sympathectomy

Primary hyperhidrosis can be defined as perspiration beyond physiological needs, particularly in response to heat or emotional stimuli. The cause is still unknown and epidemiological studies are few, but Adar et al. (1) reported an incidence of 0.6 to 1% in the general population. This condition usually affects the palms, axillae, and soles (6), as well as the face, groin, and legs in some cases. Primary hyperhidrosis develops in childhood and adolescence (15). Nonsurgical treatments, such as medications and topical powders, are seldom sufficient, and their effects are usually transient. Endoscopic thoracic sympathectomy (ETS) is currently the treatment of choice for palmar and axillary hyperhidrosis; it can be performed with either conventional electrocautery or laser treatment (2–5, 9, 11, 12–14). We present our experience with uniportal ETS instead of ablation of the ganglia for treatment of primary hyperhidrosis, and we discuss perioperative management and complications.
PATIENTS AND METHODS

Between April 1993 and March 2000, 2000 patients underwent ETS. Among this group, successful bilateral sympathectomies were performed for 1992 patients. There were 1520 patients with palmar hyperhidrosis and 480 patients with axillary hyperhidrosis. There were 788 male and 1212 female patients, with a mean age of 22.9 years (range, 9–60 yr); more than 80% of the patients were 17 to 30 years of age. There was no difference in age distribution between the male and female patients. The indications for uniporal ETS consisted of educational and learning handicaps, as well as severe social effects among patients with palmar or axillary hyperhidrosis. For treatment, all patients were placed in a semi-sitting position with abduction of both arms, and ETS was performed with single-lumen-intubation anesthesia (Fig. 10.1). Throughout the procedure, the patients underwent ventilation with 100% inspired oxygen and were anesthetized with propofol (Diprivan; Leiras Oy, Turku, Finland). Peripheral arterial oxygen saturation was monitored with a pulse oximeter. A 0.8-cm incision was made below each axilla, just posterior to the pectoralis major muscle. The endotracheal tube was briefly disconnected by the anesthesiologist to deflate the lung, and then the pleural cavity was entered by using mosquito forceps, to avoid damaging the lung parenchyma. An 8-mm, 0-degree thoracoscope (Karl Storz GmbH & Co., Tuttingen, Germany) was introduced into the pleural cavity through an obtuse-head trocar. Pneumolysis for pleural adhesions was sometimes required before identification of the sympathetic trunk. The sympathetic trunk crossing the necks of the ribs was easily identified by using the thoracoscope. A T2 sympathectomy was performed at the second and third rib beds, with conventional electrocautery, for patients with palmar hyperhidrosis (Fig. 10.2). A similar procedure for the T3 and T4 ganglia was performed at the third, fourth, and fifth rib beds for patients with axillary hyperhidrosis (Fig. 10.3). Basically, we only sectioned the sympathetic trunk; we did not remove any segment of the sympathetic nerve or ganglion. In addition, the Kuntz fiber around the T2–T4 ganglia was transected. After adequate sympathectomies, the lung was reinfated under visual control. It was important for the anesthesiologist to exert continuous positive pressure for a few seconds, to prevent pneumothorax and possible incomplete expansion of the lung before skin closure. No thoracic drains were needed. The surgical wound was closed with subcutaneous sutures, for cosmetic reasons. Routine chest x-rays were obtained after surgery, to exclude the possibility of hemopneumothorax or incomplete lung expansion. Most patients were discharged on the day of surgery and returned to their ordinary activities within 1 week.

RESULTS

The ETS was generally performed within 20 minutes (range, 15–30 min), unless severe pleural adhesions were encountered. Incidental findings during surgery consisted of pleural adhesions (38 cases, 1.9%), bullae (8 cases, 0.4%), and aberrant great venous vessel drainage to the superior vena cava (2 cases, 0.1%). Successful bilateral sympathectomies were performed in all except eight cases, in which ETS failure was attributable to severe pleural adhesions. All except 12 patients were discharged within 4 hours after surgery. The surgical complications were minimal, including pneumothorax (10 cases, 0.5%), segmental atelectasis (7 cases, 0.35%), hemothorax (2 cases, 0.1%), and wound infections (2 cases, 0.1%). There were no surgery-related deaths. A tube thoracostomy was placed for 2 to 3 days for the patients with pneumothorax. It was not necessary to perform tube thoracostomy to treat segmental atelectasis after ETS. The mean postoperative follow-up period was 51.7 months (range, 6–89 mo). Of the 1520 patients with palmar hyperhidrosis, 1398 patients (92%) exhibited simultaneous improvement of plantar perspiration after T2 sympathectomy. A total of 1720 patients (86%) developed compensatory sweating of the trunk and lower limbs (back, 86%; lower chest and abdomen, 48%; thigh and leg, 78%; sole, 1.4%). Permanent or transient Horner’s syndrome did not occur in any case. The recurrence rates for palmar and axillary hyperhidrosis after surgery were 0 and 4.1% in the first year, 0.15 and 8.2% in the second year, 0.5 and

![Fig. 10.1. Diagram indicating patient placement in a semi-sitting position, with single-lumen-intubation anesthesia. Only one 0.8-cm incision below each axilla is required.](image)

![Fig. 10.2. Diagram indicating T2 sympathectomy at the second and third rib beds for patients with palmar hyperhidrosis.](image)

![Fig. 10.3. Diagram indicating T3 and T4 sympathectomies at the third, fourth, and fifth rib beds for patients with axillary hyperhidrosis.](image)
10.4% in the third year, 0.65 and 14.1% in the fourth year, and 1.3 and 16.7% in the fifth year, respectively. The therapeutic results were generally excellent, with minimal morbidity and low recurrence rates. Detailed data on clinical manifestations and patient outcomes are summarized in Table 10.1.

**DISCUSSION**

Adar et al. (1) reported that the epidemiological incidence of primary hyperhidrosis in Israel was 0.6 to 1%. People living in subtropical regions might exhibit a higher incidence of primary hyperhidrosis. In Taiwan, palmar hyperhidrosis is very common. Among 2000 patients with primary hyperhidrosis, 1630 patients (81.5%) had developed hyperhidrosis in childhood, 318 patients (15.9%) had developed hyperhidrosis in adolescence, and only 52 patients (2.6%) had developed hyperhidrosis in adulthood. The indications for ETS include educational and learning handicaps among students, as well as psychological and social problems among patients with primary hyperhidrosis.

ETS has been established as a good choice for treatment of primary hyperhidrosis. Uniportal ETS is mainly used to perform division or ablation of the sympathetic trunk. Two ports below each axilla are not needed for patients undergoing ETS, unless severe pleural adhesions are encountered. We have used video-assisted, thoracoscopic, T2 sympathetic clipping to treat 52 patients with palmar hyperhidrosis, with satisfactory results. During endoscopic thoracic sympathetic clipping, two ports are needed, with one port for insertion of a thoracoscope and the other port for application of endo clips (12).

The T2 ganglion is critical for innervation of the upper extremities. If it is overlooked during ETS, palmar hyperhidrosis treatment failure can result (2, 5, 10, 11). Chiou and Liao (2), in studies of 17 adult cadavers, classified the relationship between the T2 ganglion and the third rib into three types and observed the T2 ganglion at the second intercostal space, near the upper border of the third rib, in most cases. In our experience, the second rib is just beneath the first intercostal muscle, offering the best landmark for identification of the T2 ganglion (11). Therefore, T2 sympathectomy should be performed at the second and third rib beds for treatment of patients with palmar hyperhidrosis (9–11). Similarly, T3 and T4 sympathectomies should be performed at the third, fourth, and fifth ribs (11). Ablation of T2–T3 or T2–T5 ganglia has been advocated by some authors for treatment of primary hyperhidrosis (1, 3, 6). Drott et al. (3) recommended ablation of the T2 and T3 sympathetic ganglia to treat palmar hyperhidrosis, ablation of the T4 ganglion to treat axillary hyperhidrosis, and ablation of the lower part of the T1 ganglion to treat facial involvement. Comparing the reports of Kao and Lin and associates (5, 9, 11, 12), we suggest that T2 sympathectomy alone is effective in improving palmar hyperhidrosis, with a low recurrence rate, whereas T3 and T4 sympathectomies are recommended for treatment of axillary hyperhidrosis (3, 11).

Drott et al. (3) reported that, of a total of 1163 patients, 23 patients (1.9%) experienced primary failure and 24 patients (2%) developed recurrent symptoms, with a mean follow-up period of 31 months. In our series, eight patients (0.4%) experienced primary failure of ETS. Among the eight patients who experienced failure, six demonstrated severe unilateral pleural adhesions and two exhibited bilateral pleural adhesions. The incidence of pleural adhesions in ETS was reported to be approximately 3.4 to 6.4% (2, 7, 9–11). Among the total of 2000 patients, pleural adhesions were observed for 38 patients (1.9%); the adhesions were severed by using conventional electrocautery combined with right-angled forceps. In our series, we did not use laser treatment, because it can cause dangerous bleeding under some circumstances, such as in vessels overriding or close to the sympathetic chain. However, these problems could be solved with the use of special right-angle forceps, to mobilize and elevate the sympathetic trunk away from the vessels and divide it without difficulty.

Kux (6) was the first researcher to use endoscopy for sympathectomy, together with the creation of an artificial pneumothorax condition, to treat primary hyperhidrosis. The upper sympathetic trunk from the level of the first to the fifth rib beds can be easily approached, because of a spontaneous shift of the lung toward the diaphragm with gravity, when the patient is placed in a semi-sitting position and the patient’s endotracheal tube is briefly disconnected from the ventilator by the anesthesiologist. Therefore, we recommend a semi-sitting position and single-lumen-intubation anesthesia, without artificial pneumothorax, for patients undergoing ETS (8, 9, 11).

Compensatory hyperhidrosis was the most common complication in previous studies (1–3, 5, 6, 9–12, 15, 16), with compensatory sweating developing in approximately 45 to 98.6% of cases (1, 6–8, 11, 12, 15). In our study, 86% of patients

| TABLE 10.1. Clinical manifestations and outcomes for 2000 patients with palmar or axillary hyperhidrosis, after endoscopic thoracic sympathectomy |
|-----------------------------------|-----------------|-----------------|-----------------|-----------------|
| Disease                          | No. of patients | Surgical method | Incidental findings | Surgical complications | Recurrence rate (%) |
|                                  |                 |                 |                   |                  | 1 yr | 3 yr | 5 yr |
| Palmar hyperhidrosis             | 1520            | T2 sympathectomy| Pleural adhesions  | Pneumothorax (0.5%) | 0    | 0.5  | 1.3  |
|                                  |                 |                 | (1.9%)            | Hemothorax (0.1%)  |      |      |      |
|                                  |                 |                 | Bullae (0.4%)     | Atelectasis (0.3%) |      |      |      |
|                                  |                 |                 | (0.1%)            | Wound infection (0.1%) |    |      |      |
| Axillary hyperhidrosis           | 480             | T3/T4 sympathectomy | Atelectasis (0.3%) |        | 4.1  | 10.4 | 16.7 |
developed compensatory hyperhidrosis after ETS, with the discomfort being greatest during the first summer after the operation. The degrees of compensatory sweating observed after T2 and T3/T4 sympathectomies were classified as follows: none, 22 and 12%; mild, 68 and 48%; moderate, 8 and 35%; severe, 2 and 5%, respectively. The use of T2 sympathectomy alone to treat palmar hyperhidrosis might represent the explanation for the subsequent mild compensatory sweating. However, compensatory hyperhidrosis after T3 and T4 sympathectomies to treat axillary hyperhidrosis was obviously greater.

Most hemothorax and pneumothorax could be avoided with the use of an obtuse-head trocar and transient disconnection of the endotracheal tube before insertion of the trocar. We observed two cases of hemothorax. In the first case, intraoperative bleeding from a neovascular vessel occurred in a patient with pleural adhesions; the vessel was safely ligated with endo clips, via another 1-cm incision, without thoracotomy. For the second patient, who underwent pneumolysis during ETS, hemothorax was observed in postoperative chest x-rays, and a tube thoracostomy was placed for 2 days. The incidence of Horner syndrome has been reported to be 0 to 6.9% (2, 5, 8, 11, 12, 15). However, we did not observe any cases of permanent or transient Horner’s syndrome. This can be explained on the basis of preservation of the stellate ganglion, which could be identified with the endoscopic probe and video camera system.

CONCLUSION

Uniportal ETS is a simple, safe, effective method for treatment of palmar and axillary hyperhidrosis. Single-lumen-intubation anesthesia, in combination with a semi-sitting position during surgery, is recommended.

REFERENCES


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