

Endoscopic Thoracic Sympathectomy for Primary Hyperhidrosis of the Upper Limbs

A Critical Analysis and Long-Term Results of 480 Operations

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Objective

This evaluated the long-term outcome after endoscopic thoracic sympathectomy (ETS) from below D1 to D4, using a single-site access technique for primary hyperhidrosis of the upper limbs.

Summary Background Data

Primary hyperhidrosis of the upper limbs is a distressing and often socially disabling condition. Endoscopic thoracic sympathectomy is considered the treatment of choice, causing minimal morbidity and high initial success rates. However, data regarding long-term results are scarce.

Methods

Two hundred seventy of 323 patients (83.7%), in whom 480 sympathectomies were performed, answered a questionnaire after a mean of 14.6 years postoperatively regarding the early postoperative result, side effects, and complications caused by the operation and long-term results with particular emphasis on patient satisfaction.

Results

There was no postoperative mortality and no major complications requiring surgical reintervention. A majority of the patients (98.1%) were relieved, and 95.5% were satisfied initially. Permanent side effects included compensatory sweating in 67.4%, gustatory sweating in 50.7% and Horner's trias in 2.5%. However, patient satisfaction declined over time, although only 1.5% recurred. This left only 66.7% satisfied, and a 26.7% partially satisfied. Compensatory and gustatory sweating were the most frequently stated reasons for dissatisfaction. Individuals operated for axillary hyperhidrosis without palmar involvement were significantly less satisfied (33.3% and 46.2%, respectively).

Primary hyperhidrosis is considered a very distressing and embarrassing condition that affects various body ar-

eas. Several treatment modalities have been devised, including psychotherapy, biofeedback, palmar or axillary iontophoresis, and surgery.¹⁻¹¹ Surgical methods employ open and minimally invasive approaches.^{1-5,7,12} For palmar or axillary hyperhidrosis, endoscopic thoracic sympathectomy (ETS) is regarded as the treatment of choice.^{7,12} Kux reported his technique of ETS and extensive experience of more than 1400 cases in 1954.¹³ To

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evaluate the outcome after ETS, with particular emphasis on patient satisfaction with the long-term results, our department investigated cases operated between 1965 and 1992.

MATERIAL AND METHODS

Operation

A thoracoscopy set consisting of a pneumothorax insufflator with water manometer, a pneumothorax side-hole needle, a 9-mm trocar with air valve, a straight Hopkins telescope with fiber-light transmission, a sheath for the telescope with a connection for high-frequency diathermy, right and left curved wire loop electrodes for electrocautery, and a combined suction coagulation probe (Stortz/Germany) is used.

After induction of general anesthesia and orotracheal intubation, patients are brought into the lateral position and the free arm is abducted at a right angle. An artificial pneumothorax is established using the pneumothorax needle, which is connected to the water manometer, and 1000 mL of room air is allowed to enter the pleural cavity. Then a stab incision is made in the midaxillary line, just anterior to the inferior margin of the scapula and the trocar inserted into the pleural cavity. The surgeon is working from the patient's anterior side. After overall orientation, the pleura overlying the sympathetic trunk is incised using the curved electrode. The interganglionic fibers and the postganglionic communicants are divided from D1/D2 to D4. Special care is taken not to injure the crossing vessels in the intercostal spaces. Any additional fibers running parallel to the main trunk also have to be severed.¹⁶ Finally, the thoracoscope is withdrawn, and the pleural cavity is evacuated by suction. The skin wound is closed by one or two stitches. One side is treated at a time.

Patients

Three hundred twenty-three patients with palmar and axillary hyperhidrosis were operated on at our institution from 1965 to 1992. Data were extracted from hospital and outpatient charts, and patients were sent a questionnaire regarding the early postoperative result, side effects, and complications caused by the operation, and long-term results. Two hundred seventy individuals (83.6%) responded to our questionnaire and form the basis of this report. There were 150 men and 120 women with a mean age of 31.1 years at operation (range 13–56 years). The locations of excessive sweating indicating operation were palmar in 175 patients (61.1%), axillary in 39 patients (14.4%), and a combination of both in 56 patients (20.7%). One hundred sixty-five patients (61.1%) com-

Table 1. TRIGGER STIMULI FOR HYPERHIDROSIS IN 270 PATIENTS

Trigger	n	Percent of 270
Emotional	119	44.1
Heat	12	4.4
Physical exercise	4	1.5
Gustatory	3	1.1
Others	18	6.7
None	114	42.2
Total	270	

plained of hyperhidrosis since childhood, 81 (30%) since puberty, and 24 (8.9%) for less than 10 years. A trigger stimulus was found in 156 patients (57.8%; Table 1), and no obvious trigger was present in 114 cases. Preoperative medical therapy had been tried by 74 patients, 47 patients had tried several conservative modalities, and 3 patients had been operated on previously for hyperhidrosis. One hundred forty-six patients (45.2%) had not had any other therapy before endoscopic surgery. Palmar and plantar hyperhidrosis were seen in 136 cases preoperatively (42.1%), and 117 patients (36.2%) reported hyperhidrosis combined with palmar hyperhidrosis at other locations. A positive family history was stated by 85 patients (31.5%).

RESULTS

Two hundred six patients (76.3%) were operated on both sides; in 68 cases, only one side was treated (56 right, 12 left). Altogether, 480 operations were performed on 270 patients. No postoperative mortality occurred, and major complications requiring surgical re-intervention were not encountered. Minor postoperative complications included pain at the trocar site in 59 patients (12.3%) and respiratory pain in 69 patients (14.4%). A Horner trias was seen in 12 instances (2.5%; unilateral in ten patients and bilateral in one). A unilateral ptosis occurred in seven cases (1.5%). In 12 cases (2.5%), chest drains had to be inserted (Table 2).

Mean follow-up for the 270 responding patients was 16.4 years, ranging from 9 months to 27.1 years. Two hundred thirty-seven patients (87.8%) reported an immediate success postoperatively with warm and dry hands. Of the 33 remaining patients, 28 had dry hands within a couple of days; therefore, the operation was successful in 98.1% of patients. In five cases (1.9%), the operation failed. Considering the results of the 39 patients with only axillary hyperhidrosis, 76.9% (30 patients) experienced relief of symptoms immediately, 17.9% (seven cases) patients reported an improvement within some

Table 2. MINOR COMPLICATIONS FOLLOWING 480 ENDOSCOPIC THORACIC SYMPATHECTOMIES IN 270 PATIENTS

Complications	n	Percent of 480
Respiratory pain	69	14.4
Local pain	59	12.3
Pneumothorax	11	2.3
Plus pleural effusion	1	0.2
Horner trias	12	2.5
Ptosis	7	1.4
Others	6	1.2
Total	165	34.4

days, and 5.2% (two cases) remained unchanged. This difference is not statistically different. An increase in palmar temperature was seen in 98 patients (36.6%), and 51 patients (18.9%) reported a reddening of the forearm skin.

The early result of the procedure was considered satisfying by 258 patients (95.5%), 7 patients (2.6%) were satisfied partially, and only 5 patients (1.9%) were not satisfied.

Considering the side effects of ETS, 182 patients (67.4%) reported compensatory sweating. The most frequent locations are listed in Table 3. Gustatory sweating was seen in 137 cases (50.7%). The occurrence of these symptoms was reported most often to be the reason for only moderate satisfaction or disappointment, despite the fact that patients had dry hands. Furthermore, 10% of the patients reported an increased susceptibility to influenza or rhinitis. The combination of rhinitis and gustatory sweating occurred in 7%.

Finally, long-term outcome was assessed. One hun-

Table 3. LOCATIONS OF COMPENSATORY HYPERHIDROSIS IN 182 OF 270 PATIENTS FOLLOWING ETS

Location	n	Percent of 182
Foot	59	32.4
Face	49	26.9
Axillary	31	17.0
Chest and back	23	12.6
Chest	16	8.8
Back	11	6.0
Other	76	41.8
Total	265	

265 locations = 1.46 per patient.

dred eighty patients (66.7%) were satisfied, 72 individuals (26.7%) were satisfied partially, and 18 patients (6.7%) were not satisfied. However, only in five of these patients (1.9%), ETS had not been primarily successful, and patients remained unchanged. A recurrence of hyperhidrosis was seen in four patients (1.5%). For the 39 patients with only excessive axillary sweating, 13 (33.3%) were satisfied, 18 (46.2%) were satisfied partially, and 8 (20.5%) were dissatisfied. The respective figures and percentages for the remaining 231 cases were 169 (73.2%), 52 (22.5%), and 10 (4.3%). This difference is statistically significant ($p \leq 0.001$; χ^2 test). Reasons for dissatisfaction were compensatory or gustatory sweating, severe dryness of the hands, and Horner's syndrome.

DISCUSSION

Primary hyperhidrosis of the hands and axillae is a condition of unknown cause that can have devastating consequences on the patients' social well-being.¹⁴ Many report the fear of social contact and embarrassment caused by excessive sweating. Whereas axillary or palmar hyperhidrosis often can be treated successfully by medical therapy, and these body areas can easily be concealed with clothing, reports of conservative treatment for palmar hyperhidrosis have not been too enthusiastic, although various treatment modalities have been applied.^{9,15} Endoscopic thoracic sympathectomy of the inferior part of the stellate ganglion and the ganglia Th₂ to Th₄ appears to be effective for palmar hyperhidrosis with reported success rates of 90% to 100%.^{7,12} Different surgical approaches to the ganglia have been reported.^{1-5,7,12} We have performed ETS from below D1 to D4, as described.

The operation was successful in 98.1%, and 95.5% of our patients were satisfied with the early postoperative outcome after endoscopic thoracic sympathectomy and had dry hands and axillae. These results are in accordance with reports by Golueke et al. and Byrne et al.^{7,8} Most patients experienced relief immediately after the operation, but we also saw relief of symptoms in 28 patients a couple of days later. In five patients, surgical treatment was unsuccessful, although the sympathetic trunk could be identified intraoperatively. An explanation could be insufficient electrocautery of the trunk or an anatomical variation, described by Kuntz in 1927, with sympathetic nerve fibers reaching the brachial plexus without passing the sympathetic trunk.¹⁶ In those cases, autonomic stimulation will be transmitted, although the sympathetic trunk was severed.⁶

The most frequent side effects observed after ETS are compensatory hyperhidrosis and gustatory sweating. Compensatory hyperhidrosis has been reported in 30% to 85%^{3,4} of patients. Shelley et al. believe that postsym-

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pathectomy hyperhidrosis is compensatory and serves as a thermoregulatory function. They found that the larger the number of glands excluded from thermoregulatory control, the greater the chance of compensatory sweating from the remaining glands.¹⁷ Because thoracic sympathectomy for palmar or axillary hyperhidrosis denervates an area rich with sweat glands, the possibility of thermoregulatory compensation of the remaining glands is high. Our observed frequency of compensatory hyperhidrosis of 67.4% lies within the reported range.

Gustatory sweating occurred in 50.7% of our patients and was reported between zero and 56% of cases. Whereas Golueke did not see this effect,⁷ more recent reports always reported facial sweating in 4% to 50%^{3-5,15,18} of patients. This phenomenon has been explained either as compensatory sweating or as being caused by sprouting of vagal nerve fibers into the severed sympathetic chain.⁴ With long-term follow-up, it is not our experience that "compensatory and gustatory sweating are not very embarrassing to the patients".^{4,18} As both side effects do occur in a significant number of cases and—as our data indicate—do bother even postsympathectomy patients with dry hands and axillae, we believe that this represents a major issue to be discussed with patients before operation. In contrast, the appearance of postsympathectomy rhinitis does not seem to be a common finding³ and occurred in only 10% of our patients. Whittet et al. speculated that the appearance of rhinitis after sympathectomy might be caused by diminished sympathetic but increased parasympathetic stimulation of nasal mucosa leading to nasal obstruction because of mucosal edema.¹⁹

Endoscopic thoracic sympathectomy can be regarded as a safe and minimally invasive procedure because of a low complication rate. No major complications requiring surgical reintervention occurred. Chest drains for pneumothorax had to be inserted in 2.5% of our patients. These findings are in accordance with Edmondson et al., who reported a rate of 2%.⁴ The use of CO₂ instead of air for insufflation should further reduce the occurrence of pneumothorax, because any residual CO₂ in the pleural cavity will be absorbed more rapidly than air.⁴

A Horner reportedly occurs in 2% to 5% of patients,^{2-6,15} but there are studies reporting no Horner trias at all after ETS.^{7,8} Although a transient Horner trias was seen in up to 43%,³ we did not observe this in our patients, but a permanent trias occurred in 2.5% of cases, and a unilateral ptosis was seen in another 1.4%.

For the subjective assessment of success after ETS in the long-term outcome, measures change. Although the operation was successful in 98.1%, and 95.5% of our patients reported a satisfying immediate result, disappointment occurred over time in approximately 30%, despite the fact that most of these patients still had dry

hands and axillae. This left 66.7% of patients with long-term satisfaction after a mean of 14.6 years, which is at variance with more favorable results reported elsewhere.^{1,3,5,8,12} However, this might be because of the shorter follow-up in these studies, because the early results in our clinical series compare well. In particular, patients operated for axillary hyperhidrosis without palmar involvement were the least satisfied. For these patients, the side effects obviously outweighed the benefit of dry axillae, because the objective short-term and long-term results as compared with patients treated for palmar sweating were not different.

Endoscopic thoracic sympathectomy is a minimally invasive and highly successful treatment for patients with hyperhidrosis of the upper limbs. The operation is successful in 98.1%, the early results are satisfying 95.5% of cases, and long-term outcome is reasonable. However, compensatory hyperhidrosis and gustatory sweating occur in a significant number of patients. These side effects are responsible mainly for dissatisfaction in the long term, and should be discussed explicitly with patients preoperatively.

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