

Long-Term Results of 45 Thoracoscopic Sympathicotomies for Primary Hyperhidrosis in Children

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Background/Purpose: Thoracoscopic sympathectomy (TS) is successful in treatment of excessive hyperhidrosis of the upper limb after limited follow-up observation. The aim of the study was to assess for the first time long-term results of TS in children.

Methods: A total of 26 children (9 boys, 17 girls) aged 11 to 17 years with severe palmar or axillary hyperhidrosis underwent TS, and 19 patients were treated bilaterally. A total of 19 patients were observed after a median follow-up period of 16 years by questionnaire or clinical examination.

Results: Permanent relief from palmar hyperhidrosis was given in all examined patients. Twelve patients had compensatory and 12 patients gustatory sweating. Postoperatively, 1 subcutaneous emphysema and 1 temporary miosis and ptosis were noted. Eleven patients were fully satisfied with the result. Seven patients were only partially satisfied be-

cause of compensatory or gustatory sweating but would again undergo operation. One patient was not satisfied because of excessive compensatory sweating.

Conclusions: TS is a safe and efficient procedure even after long-term follow-up. Severe palmar hyperhidrosis often starts in childhood; thus, early surgical treatment can improve social development. Compensatory and gustatory sweating are the most frequent and enduring side effects and should be mentioned in preoperative patient and parent information. *J Pediatr Surg* 34:1839-1842. Copyright © 1999 by W.B. Saunders Company.

INDEX WORDS: Hyperhidrosis, minimal-invasive surgery, sympathectomy, thoracoscopy, follow-up, results, complications.

ACCORDING to many reports¹⁻¹⁰ and to the experience of our institution¹¹⁻¹⁴ surgical therapy turned out to be the method of choice in treating severe primary hyperhidrosis of the upper limb. Various access techniques such as the transaxillary, supraclavicular, or paravertebral approach were described. Although Kux¹⁵ already described a one-site thoracoscopic procedure in the 1950s the minimally invasive procedure became popular in the 1990s¹⁶ and largely displaced the open access techniques. Because success rate was almost 100%, and a low complication rate was observed in adult patients, it was decided to offer this treatment even to children to resolve them from embarrassing hyperhidrosis. To date there are only few reports about surgical treatment of primary hyperhidrosis in children^{3,7,10,17-20}; most of them are dealing with conventional techniques.^{7,10,18-20} To our knowledge, just 2 groups reported thoracoscopic procedures in children (Cohen et al,³ Kao et al¹⁷), but long-term results are still not available.

Thoracoscopic sympathectomy (TS) has been performed for approximately 4 decades at our institution. The aim of the study was to elucidate the perioperative and long-term outcome of TS in children operated on within a 28-year period.

MATERIALS AND METHODS

Between 1969 and 1997 we performed 45 TS in 26 children. Nineteen patients were operated on bilaterally in 2 sessions; 7 were treated unilaterally. The median age was 15.4 years (range, 11 to 17).

Twenty-three patients suffered from palmar manifestation of excessive sweating, 1 had isolated axillary manifestation, and 2 patients had combined hyperhidrosis. A total of 38.4% of the patients showed familial history of primary hyperhidrosis.

After induction of general anesthesia, orotracheal intubation, and latent positioning of the patient, a pneumothorax of 1,000 mL is established using a Verres needle and a hydrostatic pneumometer. A trocar is inserted into the pleural cavity in the fourth intercostal space in the midaxillary line. For increasing pneumothorax during the operation, a hand-driven balloon pump is connected to the thoracoscope. Using a left- or right-curved wire loop electrode brought in by the working thoracoscope, the sympathetic trunk is completely divided from the level of the second rib down to the T4 ganglion at the level of the following ribs including the postganglionic communicants and the accessory fibres of Kuntz²¹ if present. To be sure to sever the entire collateral sympathetic fibers we used to dissect the pleura and the subpleural tissue along the first rib up to approximately 5 cm lateral to the sympathetic chain. Finally, after removing the thoracoscope, the pleural cavity is evacuated, the port is removed, and the skin wound is closed during application of continuous positive airway pressure. The operation usually takes about 15 to 20 minutes. A chest radiograph is requested postoperatively and before discharge at the first postoperative day. The extent of the operation did not change over the whole period. At the advent of videoendoscopy we introduced this technique to TS in 1991 to enhance the quality of visualization. In case of an uneventful postoperative course, patients were discharged at the day after opera-

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0022-3468/99/3412-0021\$03.00/0

tion. If appropriate, TS of the contralateral side is performed 3 to 5 weeks thereafter.

For assessment of immediate postoperative success and complication rate, all patient charts were reviewed with respect to intraoperative and postoperative complications (ie, bleeding, lung injury, other organ lesions, conversion to thoracotomy, pneumothorax, hematoma, Horner's syndrome, rhinitis, thoracic pain, emphysema), to reoperations, and to the effect of TS to skin humidity (dry, less sweating or unchanged compared with the preoperative status). Length of hospital stay was also assessed. Nineteen patients further answered a postal questionnaire regarding long-term effect to skin humidity (same or increased when compared with the immediate postoperation period); satisfaction (full, limited or absent satisfaction; "would you undergo the procedure again?"); late-onset complications; and side-effects (ptosis, miosis, enophthalmus, chronic rhinitis since operation, compensatory sweating, gustatory sweating, phantom sweating, other complains). Additionally, 2 patients were reexamined clinically. Complete and clear information about the long-term outcome could be gathered from 19 patients (73.1%). One already died, and the outcome of 6 patients remains unknown. The median observation period of the included patients is 16 years (range, 1 to 26; Table 1).

RESULTS

Operation was successful in all cases with regard to achievement of dry limbs. No conversion to thoracotomy was necessary. No perioperative mortality occurred, and major complications requiring surgical reintervention were not encountered. With regard to postoperative complications, subcutaneous emphysema was observed once, and in 1 case, temporary miosis and ptosis occurred. There was no Horner's syndrome detectable. All patients were discharged on the first postoperative day. Until follow-up 12 patients (63.2%) had compensatory and 12 patients (63.2%) had gustatory sweating. A combination of both persisted in 9 patients (47.4%). At long term follow-up, 11 patients (57.9%) were fully satisfied with the operation result. Seven patients (36.8%) were only partially satisfied but would again undergo operation. One patient (5.3%) was not satisfied. All of the patients with impaired satisfaction suffered compensatory or gustatory sweating (Table 2).

DISCUSSION

All patients complained about substantial influence of hyperhidrosis on their daily life and social interaction for several years. Almost all of them underwent conservative treatment by using antiperspirants, anticholinergic medication, and iontophoresis without sufficient success.

Is it justified to recommend early surgery for excessive

Table 1. Length of Follow-Up

Follow-Up Period	No. of Patients	Percent
<5 yr	5	26.3
6-10 yr	2	10.5
>10 yr	12	63.2
Total	19	

Table 2. Postoperative Satisfaction

Patient Satisfaction	No. of Patients	Percent
Satisfied	11	57
Partially satisfied (agrees with operation)	7	37
Not satisfied	1	5
Total	19	

upper extremity hyperhidrosis within childhood or adolescence? It has been reported previously that social development and scholastic achievement considerably improved after severance of the sympathetic chain.^{10,18,20} In accordance with the positive feedback of our adult patients after TS we intended to treat hyperhidrosis also at an earlier age to spare years of embarrassment, social discomfort, and frustration. Nevertheless, with respect to the retrospective nature of our study we did not have the opportunity to check up on the psychological influence of sympathectomy.

In terms of surgical technique, many different approaches and operation techniques already have been reported. Also, various endoscopic procedures have been developed^{2,4,5,8,9,11,16,22,23} bearing the advantage of diminished tissue trauma and consequent limitation of postoperative pain and length of hospital stay. Some investigators reported lower complication rates by using endoscopic access compared with conventional techniques while achieving similar success rates.^{2,3,9,11,12,16} Not at least the cosmetic outcome plays a role because the majority of patients are girls.

We found 2 groups who reported about thoracoscopic treatment of hyperhidrosis in children and adolescents, presenting short follow-up results.^{3,17} We reevaluated all patients younger than 18 years who underwent TS at our institution. Approximately three quarters of children and adolescents operated on could be reevaluated more than 5 years after surgery; more than 60% had a follow-up period of more than 10 years, reaching up to 26 years. The technique was performed as developed by Erhard Kux using a single port for the working thoracoscope.¹⁵ In contrast to Kux¹⁵ we induced general anesthesia before creating the pneumothorax. To keep the perioperative efforts low and the manipulation time short, we always used endotracheal intubation without experiencing any unbearable technical problems regarding the operation field exposure.

In performing sympathectomy rather than sympathectomy, as it was used by Cohen et al³ just one trocar is required, and manipulation time should be shorter. As reported by Fritsch et al,¹¹ Kux,¹⁵ and later by Byrne et al,²³ Edmondson et al,⁵ Shachor et al,⁹ Chen et al,² and Drott et al,^{4,16} sympathectomy seems to be as effective as sympathectomy, which is clearly more extensive and

presumed to be an overtreatment. Within this series we did not observe any recurrence of hyperhidrosis.

We showed that the endoscopic procedure is safe, whereas postoperative complications after conventional sympathectomy are reported more frequently.^{10,18,19} All operations were successful; only 1 patient was not satisfied because of strong compensatory sweating in spite of having a dry limb.

In good correlation with other reports about sympathectomy and sympathicotomy,^{1,5,17,18,24} we noticed a high rate of compensatory sweating. To the majority of patients in whom compensatory sweating developed in our series, this side effect was only a minor inconvenience compared with the original problem, unless it caused dissatisfaction when it grew to embarrassing dimensions as observed in 1 patient. Unfortunately, these sequelae persist throughout the entire follow-up period. In our opinion, the eventuality of compensatory sweating should be included in preoperative patient information. Comparing the data presented in literature, the incidence of compensatory sweating seemed to depend on the local extent of manipulations to the sympathetic chain²⁴ than on the kind of sympathetic disconnection, resection, or severance. The observations of several investigators contribute to this assumption when they describe fewer side effects by adopting limited procedures.^{3,18} With respect to pediatric patients, Cohen observed compensatory sweating only in 9% of cases,³ presumably because of a lesser extent of sympathetic chain severance compared with our procedure. Nevertheless, Kao et al¹⁷ confined the procedure to extirpate only the T2 segment observing compensatory sweating in approximately two

thirds of patients. Because of these contradictory observations we maintained our concept in severing the sympathetic chain down to T4 even in a case of palmar hyperhidrosis to avoid compensatory sweating in the axilla. In the background of frequent compensatory sweating, the 2-staged procedure became tradition at our institution. We usually treat the "greeting," or the "writing" hand first to give the patient the opportunity to decide whether to undergo operation on the other side after an interval in dependence of the impact of side effects. Some of our patients described that compensatory sweating increased after second-side TS.

The incidence of gustatory sweating²⁵ is unexpectedly high in this series (63.2%). Reviewing the data of our adult patients, gustatory sweating occurred in about 50%, after introduction of video assistance it decreased to about 28%.²⁶ With exception of the possibility of inconcise statements of the patients regarding gustatory sweating within the questionnaire, which possibly can lead to an overestimation of this side effect, we have no clear explanation for the high incidence.

TS by using a single trocar technique is related to a minimum of perioperative morbidity and is having therapeutic success. Long-term follow-up investigation shows that a majority of patients are satisfied and would again undergo operation or recommend it to others. In case of severe hyperhidrosis, early surgical treatment can improve social development and scholastic achievement in childhood. Nevertheless, compensatory sweating restricts operative outcome. Thus, care should be taken about intensive preoperative patient and parent information.

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