

Long-Term Outcomes and Course of Compensatory Sweating after Endoscopic Sympathicotomy

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Abstract

Background Endoscopic thoracic sympathectomy is an effective approach to the treatment of idiopathic localized hyperhidrosis, and compensatory sweating is the main reason for patient dissatisfaction. Our study discusses both the long-term outcomes of sympathectomy and the course of compensatory sweating.

Methods Patients with palmar and/or axillary hyperhidrosis who were operated by the same surgical team between January 2008 and December 2014 were included in the study. After at least 5 years (60 months) from operation, patients were questioned about their treatment outcomes by using an original survey form.

Results Of the 137 patients included in the study, 88 (64.2%) were female and 49 (35.8%) were male. The mean time from the operation to the survey interview was 80.9 ± 14.1 (64–136) months. After operation, complaints disappeared in 95.1% of the patients, and decreased in 4.9% with palmar hyperhidrosis. Complaints completely disappeared in 12.9% and decreased in 81.7% of the patients with axillary hyperhidrosis. Ninety-seven (70.8%) of the patients described increased sweating in some parts of their body after operation but only 47 reached an uncomfortable intensity. The number of patients who regretted the operation due to the compensatory sweating was 13 (9.5%). The patients' overall scoring of the operation and procedure was calculated as 8.0 ± 2.1 (0–10 points) out of 10.

Conclusion Endoscopic thoracic sympathectomy's long-term outcomes are also satisfactory in the treatment of palmar and axillary hyperhidrosis. Compensatory sweating may decrease over time, only a minority of patients will express regret at undergoing the treatment.

Keywords

- ▶ hyperhidrosis
- ▶ thoracoscopy/VATS
- ▶ surgery
- ▶ complication

Introduction

Idiopathic localized hyperhidrosis (ILH) is an issue that causes social and emotional problems and considerable decreases in quality of life, and that can negatively affect professional life.^{1–3} Although conservative treatments may be tried first, most patients resort to surgical treatment due to such reasons

as the side effects of the treatments, the short duration of action, and unsatisfactory outcomes.^{1–7} Previous studies have identified endoscopic thoracic sympathectomy (ETS) as an effective method for the treatment of both palmar and axillary hyperhidrosis (PH and AH). Questionnaires evaluating postoperative quality of life have reported success rates exceeding 90%, especially for PH.^{7,8} Significant advantages associated

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with the operation such as the minimally invasive technique and the ability to return to normal life in a very short time increase the prevalence of the operation. Despite this high prevalence, knowledge of the long-term outcomes of the surgical treatment is relatively limited. In the first stage of our study, we investigate the long-term outcomes of ETS in hyperhidrosis treatment.

Compensatory sweating (CS), in turn, is an important complication that is reported at high rates (60–90%) following ETS, and is the leading complication in patient dissatisfaction.^{7,8} The relationship between various levels of sympathectomy or various surgical techniques (clips-sympathectomy, etc.) with the development of CS has been investigated in literature.^{7–11} Again, there is limited information on the course of CS over time, and so the secondary objective of the our study is to obtain such data as the time to CS development after the operation, its change over time, and the extent to which it affects patient satisfaction.

Materials and Methods

The study population comprised patients who were operated by the same surgical team due to PH and/or AH at least 5 years (60 months) ago. For this purpose, a retrospective analysis was made on the data of patients who underwent sympathectomy between January 2008 and December 2014. The study included patients operated at a bilateral T3 level for PH and bilateral T3 to T4 level for AH. In all procedures, the patients were intubated with a single-lumen intubation tube, two 5-mm Thoracoport incisions were made, and after the sympathetic nerve was identified, the appropriate level of sympathectomy was performed. Patients who did not meet the criteria (those patients who underwent only unilateral operations due to adhesions, those operated with different surgical techniques like clips, etc.) were excluded from the study. An attempt was made to reach each of the 179 patients meeting the criteria by phone. The study continued with 137 (76.5%) patients who could be contacted, who agreed to participate in the study, and who completed all questions in full.

The present study used an original questionnaire form that was prepared by the researchers based on previous similar studies and questionnaires that were used as draft forms. Since the present study aimed also to question patient satisfaction in the late period, different questions for this purpose were also included in the questionnaire. The change of computed tomography over time and the amount of decrease, if any, were also questioned and recorded. Issues such as overall operation satisfaction and the most uncomfortable complaints of patients after the operation were included. Finally, patients were asked to give a score on a 10-point scale to their treatment, considering all their experiences and outcomes of the operation.

Results

Of the 137 patients included in the study, 88 (64.2%) were female and 49 (35.8%) were male. The mean ages of patients during the operation were 28.7 ± 7.2 (16–44) years for

Table 1 Regions of patients' hyperhidrosis complaints

Location of hyperhidrosis	n	(%)
Isolated palmar	24	17.5
Isolated axillary	16	11.8
Palmar and axillary	48	35.0
Palmar, axillary and one other region	29	21.2
Palmar and other	20	14.6
Axillary and other	0	0

females, 24.6 ± 7.2 (13–53) years for males, and 27.3 ± 7.5 (13–53) years overall. The mean duration of follow-up was 80.9 ± 14.1 (64–136) months.

The first question of survey was about in which areas of the body of the patients has experienced excessive sweating. Patients were asked to indicate their sweating areas as palmar, axillary, and other (plantar, facial, abdomen, back, etc.) Of the total, 24 (17.5%) patients described isolated palmar, 16 (11.8%) isolated axillary, and 48 (35.0%) both PH and AH. In addition, 29 (21.2%) patients reported sweating in another region, in addition to PH and AH (► **Table 1**).

When the operations performed for these complaints were examined, it was found that 44 (32.1%) patients had bilateral T3 sympathectomy, while 93 (67.9%) had bilateral T3 to T4 sympathectomy. The nerve of Kuntz was identified as right-sided in 56 (40.9%) patients and left-sided in 51 (37.2%) patients, and dissected.

When the effectiveness of the operation was examined, it was found that the hyperhidrosis completely disappeared in 115 (95.1%) and partially decreased in six (4.9%) of the 121 patients with PH. There were no patients who report any change in their complaints. It was ascertained that the complaint disappeared completely in 12 (12.9%) and decreased in 76 (81.7%) of the 93 patients with AH, while only five (5.4%) patients experienced no change.

When the effect of the operation on the complaint of hyperhidrosis in other regions was examined, it was found that the complaint disappeared completely in eight (16.3%) patients, and decreased in 16 (32.7%) patients. Furthermore, 25 (51.0%) of 49 patients reported that there was no improvement in the sweating complaints in these regions.

This phase was followed by an examination of CS in detail. The patients were asked whether there had been an increase in sweating in any part of their body when compared with the preoperative period. Twenty-nine (65.9%) of patients who underwent T3 sympathectomy and 68 (73.1%) of patients who underwent T3-T4 sympathectomy reported increased sweating. The incidents were statistically similar between surgical procedures ($p = 0.3886$). As a result, 97 (70.8% of all cases) patients described increased sweating. An analysis of individual body parts found that increases in sweating were encountered most frequently on the back (15 patients, 15.5%), followed by the abdomen (8.3%) and chest (7.2%), respectively. Of the total, 25 (25.8%) of the patients experienced increased sweating in three different locations (► **Table 2**).

Table 2 The distribution of the regions where sweating increased after the operation in patients

Regions with increased sweating	Patients with T3 sympatricotomy	Patients with T3–T4 sympatricotomy	Total number of patients	Percentage (%)
Three or more regions	6	19	25	25.8
Back	6	9	15	15.5
Back and abdomen	3	10	13	13.4
Back and chest	2	10	12	12.4
Abdomen	4	4	8	8.3
Chest	3	4	7	7.2
Back and genital	2	4	6	6.2
Other	1	5	6	6.2
Chest and abdomen	1	2	3	3.1
Back and other	1	1	2	2.1

Another issue addressed in the present study was the onset time of the increase in sweating after the operation. Of the patients, 43 (44.3%) reported the onset of increased sweating within 1 week of the operation, 26 (26.8%) between 1 week and 1 month, and 21 (21.6%) between 1 and 6 months, while only seven (7.2%) patients reported it to develop after 6 months (► Fig. 1). Among the 97 patients who described increased sweating, 22 (22.7%) stated a decrease in the complaint over time; 73 (75.3%) reported no change and two (2.1%) reported an increase over time.

The patients were asked about the most uncomfortable condition in the postoperative period. Of the total, 90 (65.7%) reported no negative conditions, 47 (34.3%) reported increased sweating in different regions of body, 11 (8.0%) reported chronic pain, six (4.3%) reported excessively dry hands, four (2.9%) reported paralysis-paresthesia of the upper extremities, and seven (5.1%) reported discomfort due to other reasons (intensive care environment, shortness, etc.).

When the patients were asked whether they regretted having the operation, only 13 (9.5%) patients reported regret (4 (9.1%) of patients who underwent T3 sympatricotomy and 9 (9.7%) who underwent T3–T4 sympatricotomy ($p = 0.9113$), and the reason was CS for all cases.

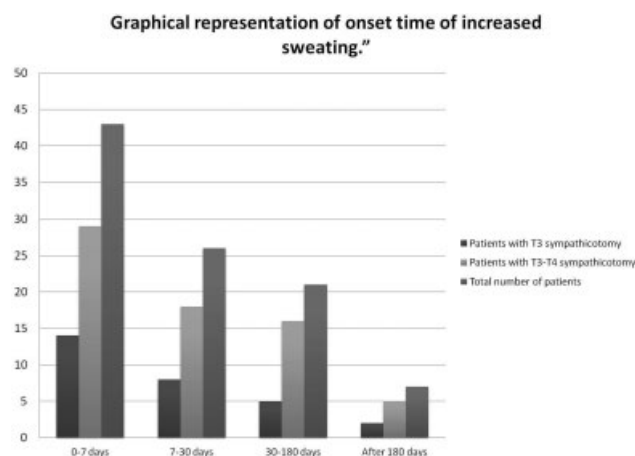


Fig. 1 Graphical representation of onset time of increased sweating.

Finally, the participants were asked to score the operation out of 10, considering their overall experience. While nine (6.6%) patients gave scores of 5 or below, 128 (93.4%) patients gave scores of 6 and above. The total score was 1101, and the mean score given to the operation was 8.0 ± 2.1 (0–10) points.

Discussion

Hyperhidrosis, in general, refers to excessive sweating beyond physiological limits. Despite the various rates reported in literature, it is believed to affect <0.5 to 9% of the population.^{3,12–14} The condition is classified into localized and generalized hyperhidrosis according to the sweating region, and into primary/secondary hyperhidrosis according to the etiology.^{3,12,13} Cases of ILH, in turn, are a special group of patients for whom there is not any secondary disease involved in the etiology, and in which sweating is restricted to only certain parts of the body (such as the scalp, face, and palm),¹² and most of these patients are those with PH and/or AH.^{5,12} Various treatments are available, such as ionophoresis, anticholinergic drug administration, and botulinum toxin injection,^{4–6} but with recent developments in surgical techniques, the efficacy of ETS stands out.

ETS is known to be effective especially for PH (above 90–95%).^{7,8} Although the early positive outcomes are well known, knowledge of the long-term outcomes is still limited.¹⁵ Several publications have reported worrying rates for CS.¹³ The present study garnered detailed data on the long-term outcomes of ETS, as well as on the definition of CS, which is described as a frightening complication, and its development over time.

The high efficacy rate established for PH in the present study is the first remarkable finding. It was found that complaints of PH completely disappeared in 95.6%, and decreased in 4.9% of patients. In other words, a reduction in complaints was achieved in all patients. At this point, it is seen that the long-term efficacy of the operation is similar to the early outcomes, and the rate of success achieved was above 95%. A second implication can be reached from studies' findings about level of sympatricotomy and effectivity. An isolated T3 sympatricotomy was applied to all patients

with PH in our study, and so it seems reasonable to conclude that isolated T3 sympathicotomy is sufficient for the treatment of PH.

The efficacy of the operation was lower for AH. Complaints of sweating decreased in 81.7% of the patients and completely disappeared in 12.9%. Both the eccrine and apocrine sweat glands are involved in axillary sweating, which may play a role in decreasing the efficacy of sympathicotomy.^{5,6,15,16} Despite this general knowledge, it is seen that 94.6% of the patients experienced a reduction in sweating complaints upon T3 to T4 sympathicotomy, while no positive effect was achieved in only 5.4%. The findings support ETS as an effective treatment for AH.

Although all patients were operated for PH/AH, our questionnaire also examined how sweating complaints in other parts of the body changed (increase-decrease), resulting in surprising findings. After a T3 or T3 to T4 sympathicotomy, 24 (49.0%) of the patients experienced a decrease in complaints of sweating in other parts of the body.

CS is another issue to be addressed when it comes to hyperhidrosis and surgical treatment. The CS rates reported in literature range from 60% up to 90%.¹³⁻¹⁹ This vast difference can be attributed to more than one reason. It is known that the level of sympathetic denervation, the surgical technique, and even the patient's body mass index can affect the development of CS.¹³⁻¹⁹ In addition to these variables, another reason may be the fact that the definition of CS varies from researcher to researcher. It has not yet been established what amount of postoperative sweating can be considered CS, and what is attributable to postoperative thermoregulation.^{13,17-19} Although some studies have attempted to group CS as mild or severe, there is no clear boundary between the expected physiological increase and pathological increase in the postoperative period.^{13,17-19} In the present study, great care and attention were paid to this issue. The patients were first asked whether they had experienced any increase in sweating in any part of their body after the operation, and 97 (70.8%) replied in the positive. This value seems to be consistent with the values reported for the incidence of CS in literature. Sweating started simultaneously in more than three parts of the body in approximately one-quarter of the patients. Additionally, it was observed that the increase in sweating developed most frequently (47%) within the first week following the operation. All these findings are consistent with the general knowledge on CS in literature.¹⁷ It was a surprising finding that patients described increased sweating even 6 months after the operation. What merits discussion here is how many of the patients should be evaluated as CS, although our findings are consistent with general CS data. Although 97 (70.8%) of the patients described increased sweating, the number of patients complaining about this change was only 47 (34.3%), and therefore the number of patients who regretted having the operation was only 13 (9.5%). At this point, it would seem to be acceptable to state that the increase was at a level that did not cause discomfort in 50 of the 97 patients who described increased sweating, and was a physiological change secondary to the operation. In a similar vein, it was established that the severity of sweating

decreased by 50% over time, without any additional treatment, in 22 (22.6%) of the patients who described an increase in sweating. Although patients describe an increase in sweating in certain parts of their body, the symptoms may regress over time. Likewise, this change did not lead to any complaints in most of the patients. In brief, only 34.3% of the patients experienced an uncomfortable increase in sweating in the long term, and reached a serious level only in 13 (9.5%).

Although the present study has discussed the definition and actual incidence of CS, it is an undeniable fact that CS progresses quite severely and requires treatment in some cases. Surgical treatment approaches have been described in literature, in addition to medical treatments for CS. It has been reported that removal of the clips with a second operation treats CS in patients who underwent sympathicotomy with endoscopic clips.²⁰ It has also been reported that nerve repair can be performed with newly described techniques in patients undergoing sympathectomy/sympathicotomy with clips.^{21,22} The newly described methods have been reported to achieve high success rates involving repairs with the use of the intercostal nerve.²²

The present study obtained further findings related to some other undesirable side effects of ETS. One important finding was that 8% of patients reported pain in the postoperative period, which highlights the importance of postoperative analgesic therapy. In addition, 4.2% of the patients described excessively dry hands, although none of these symptoms were serious enough to cause the patients to regret having the operation.

Considering the operation process and the outcomes, the patients were asked to score all of their experiences (including regretful patients), and the result was pleasing. The score given by the patients to this experience was 8.0 ± 2.1 (0–10 points), which demonstrates the effectiveness and reliability of ETS for hyperhidrosis.

The retrospective and single-center design of the present study is open to criticism, although having all patients operated by the same surgeon seems to have brought a significant degree of standardization. Another questionable point is the surgical technique used. Many techniques have been described for the treatment of hyperhidrosis, such as sympathicotomy, sympathectomy, and the use of endoscopic clips, and there have been many studies evaluating the advantages of these techniques over each other with focus on different areas, such as complication rates, efficacy, and the chance of reoperation in cases of CS development.^{9,11,17,18,23} The present study made no attempt to compare these techniques with each other, or to identify the safest treatment method. While criticizing this point, it should be noted that the primary purpose of the present study was to try to garner data on the long-term outcomes of the operation in as standardized a patient group as possible.

ETS is an effective and safe method for the treatment of hyperhidrosis. The efficacy of the operation continues in the long term, as well as in the early postoperative period. Some patients may develop increased sweating in certain parts of the body after the operation, but this change is at a level that

does not cause discomfort in many patients and is likely to decrease over time. Only 9.5% of patients develop CS that causes serious complaints.

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