



# Single-port Endoscopic Thoracic Sympathectomy in Cases of Primary Hyperhidrosis: Single-center Experience

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## Abstract

**Objective:** Pathological excessive sweating that can occur in specific parts for else throughout the body is known as hyperhidrosis. Although there are different medical and surgical options, medical treatment applied to many patients provides temporary relief. With advances in surgical techniques, the most commonly used surgical treatment method is endoscopic thoracic sympathectomy (ETS). In this study, we examined the results of ETS operations performed in our clinic considering the current literature.

**Methods:** Between 15.03.2011 and 30.10.2020, 45 single-port ETS operations were performed on 23 patients due to palmar and/or axillary hyperhidrosis. Patients' demographic data, complaints, complications, therapeutic results, and post-treatment satisfaction were evaluated.

**Results:** Thirteen of the 23 patients were male and 10 were female, with average age of 25. Ten patients were operated for palmar hyperhidrosis, two for axillary hyperhidrosis, and 11 for axillary and palmar hyperhidrosis. Forty-five thoracic sympathectomy operations were performed with bilateral single port ETS in the same session in all but one of the 23 patients. Mean operative time was 28 min, and hospitalization time was 1.1 (0-8) days. Two patients exhibited compensatory sweating during follow-up, and one patient showed rebound sweating. At follow-up, 91% of patients (21) were satisfied with their operations.

**Conclusion:** Endoscopically-assisted single-port thoracic sympathectomy appears to be a reliable and practicable technique for treating hyperhidrosis, with effective results, high patient satisfaction, and early discharge time. We believe that the most important advantages of this technique are an early return to normal life, less pain, and a positive return to social life.

**Keywords:** Hyperhidrosis, thoracoscopy, thoracic sympathectomy

## INTRODUCTION

Pathological excessive sweating exceeding normal limits is known as hyperhidrosis (HH). This can develop in specific regions, or throughout the body. There are two types of HH. The pathological state characterized by excessive sweating alone unassociated with any underlying disorder is known as primary HH, whereas HH associated with another underlying condition is known as secondary HH. Secondary HH is more common in individuals with a body mass index >28. Other frequently encountered secondary causes of HH include hyperthyroidism,

diabetes mellitus, pheochromocytoma, and infection. A lack of distinction between daytime and nighttime sweating is typical. The etiology of primary HH is still unclear. Excessive sweating in the body or in a few regions thereof occurs involuntarily when the individual feels under psychological stress and in certain seasons. Sweating in primary HH does not occur during nocturnal sleep. The incidence of this form in the community is 1-3% (1,2). The prevalence of primary HH is equal in both genders, but increases in early adulthood (2). It tends to start in early childhood, severity worsens in puberty, and the incidence decreases progressively with age (3,4).



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Treatment of HH depends on the type. Treatment with secondary HH targets the underlying disease. Various medical and surgical options are available for treating primary HH, although medical treatment applied in several cases produces temporary improvement. Oral anticholinergic drugs, topical agents, iontophoresis, and botulinum toxin injections can be employed as medical treatments (5). The most widely employed surgical option as surgical techniques have improved is endoscopic thoracic sympathectomy (ETS) (6). ETS is normally performed using a double port, although it can now be performed with a single port due to increased experience. This study aims to report our experience of ETS surgery with a single port applied in cases of primary HH, with a discussion of the current literature.

## METHODS

Approval for the study was granted by the Kahramanmaraş Sutcu Imam University Ethical Committee (session 2021/04, decision no: 15, dated: 25.01.2021). The research was performed in compliance with the 1975 Declaration of Helsinki through a retrospective examination of the records of patients undergoing ETS with a single port due to palmar and/or axillary HH in the Kahramanmaraş Sutcu Imam University Medical Faculty Thoracic Surgery Clinic between 15.03.2011 and 30.10.2020. Before the sympathectomy surgery, the risks of the surgery were explained to all patients and an informed consent form was obtained by signature. All patients' demographic data, symptoms, thoracic sympathectomy sites, complications, treatment outcomes, and post-treatment satisfaction were evaluated.

### Surgical Procedure

Patients were placed in a semi-sitting position with both upper extremities in 90-degree abduction. The procedure was performed with patients under general anesthesia using a double-lumen endotracheal tube. Following single-lung ventilation, a 1 cm skin incision was made to the midaxillary line, and the thoracic cavity was entered through a blunt dissection. A port was installed in the hemothorax scheduled for the procedure. Depending on the patient's symptoms, the second sympathetic ganglion was resected in the presence of facial HH, the third and fourth sympathetic ganglia if palmar HH was present, and the fourth and fifth ganglia in case of axillary HH by cauterization with an electrocautery hook passed through the camera without the need for a second incision (Figure 1). The objective was to prevent recurrence following sympathectomy by cauterizing alternative sympathetic nerve connections such as the nerve of Kuntz. Following this procedure, an elastan catheter was inserted inside the lung through the port entrance, while the other end

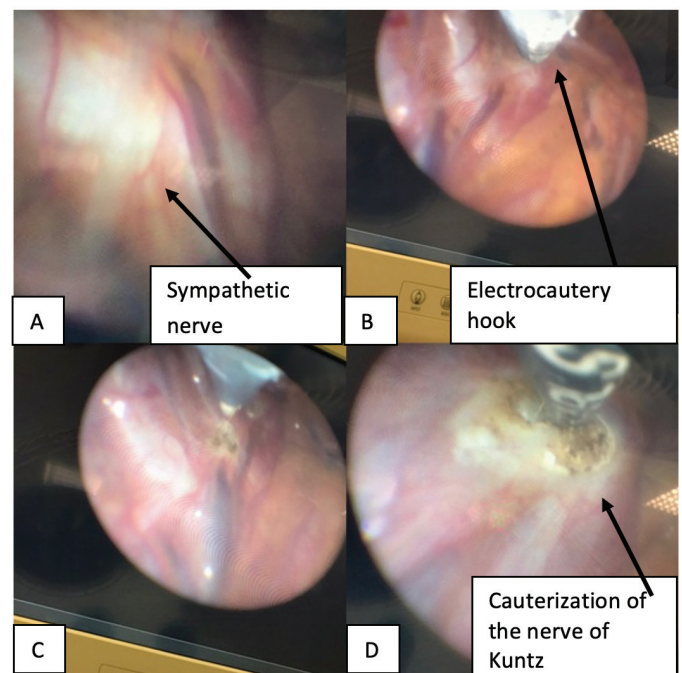
was placed inside a container filled with saline solution. The procedure was maintained until the air outflow ended through ventilation of the lung. Following air outflow termination, the catheter was withdrawn and the entry site was sutured. The same procedure was also performed on the other hemothorax in patients under going bilateral thoracic sympathectomy. The procedure was concluded with the installation of a chest tube. Patients were evaluated with postoperative lung X-rays taken in the operating room and sent to the ward.

### Statistical Analysis

Statistical analysis was performed on IBM SPSS 25 for Windows software. Continuous variables were expressed as mean  $\pm$  standard deviation. Categorical variables were analyzed using Fisher's Exact test and were expressed as frequency and percentage values.

## RESULTS

Thirteen of the 23 patients with a mean age of 25 years (17-36) operated due to HH at the Kahramanmaraş Sutcu Imam University Thoracic Surgery Department were men, and 10 were women (Table 1). Ten patients were operated for palmar HH, two for axillary HH, and 11 for both palmar and axillary. Bilateral thoracic sympathectomy was performed on all 23 patients, with



**Figure 1.** Images of the endoscopic thoracic sympathectomy operation (A: Endoscopic image of the sympathetic nerve, B: Image of the electrocautery hook capable of being passed through the camera, C: Cauterization of the sympathetic nerve with the electrocautery hook, D: Cauterization of the nerve of Kuntz)

one exception, using the single-port ETS method in the same session, 45 thoracic sympathectomies thus being carried out (Table 2).

The mean operative time was 28 min, and mean length of hospital stay was 1.1 days (0-8). All patients apart from one were transferred to the chest surgery ward without requiring chest tube insertion. Three patients were discharged on the same day, and 19 following control X-ray on the first day postoperatively. Primary repair using mini-axillary thoracotomy was performed on one patient due to parenchymal laceration during single-port ETS due to pulmonary parenchymal adhesion to the chest wall. The operation was concluded following the insertion of a chest tube. The patient was discharged on the eighth day with removal of the chest tube. Patients attended clinical follow-ups 10 days, and two and 12 months after discharge.

No mortality occurred in the operated patients. Compensatory sweating was determined at follow-ups in two patients. This was in the inguinal region alone in one patient and in the inguinal region and back in the other. Sweating in the inguinal region improved spontaneously after the second month, while the other patient's symptoms resolved in the postoperative 12<sup>th</sup> month. Rebound sweating occurred in one patient, but improved without intervention after the third week. Recurrence was observed in one patient during postoperative follow-ups. Repeat left-side ETS was performed in the sixth month postoperatively in this case.

When asked about their satisfaction with the procedure during postoperative follow-ups, 21 (91%) expressed postoperative

satisfaction with thoracic sympathectomy using ETS. The other two patients were the case with compensatory sweating resolving on the 12<sup>th</sup> month, and the case undergoing mini thoracotomy due to parenchymal laceration.

## DISCUSSION

The first sympathectomy in HH was reported by Kotzaref in 1920 (7). However, the size of the incision prevented the operation from being widely performed in subsequent years. The first endoscopic treatment of HH with the entry into surgical practice of closed surgical techniques was performed by Hughes in 1942 (8). Closed endoscopic procedures became more widely performed in the 1980s and gradually came to replace open surgery (9). ETS is a surgical technique of proven efficacy in cases of HH that fail to respond to medical treatment (10). Its efficacy for treating HH, its reliability, and the use of a small incision, have made the procedure a well-tolerated option for treating the (10,11). ETS was initially performed with two or three ports, but due to increasing experience, it has now become possible with only a single port. ETS surgery has been performed with a single port for the last decade in our clinic.

ETS is not only frequently employed for treating HH, but also in Reynaud's disease, reflex sympathetic dystrophy, and upper extremity ischemia. Selecting the endoscopic thoracoscopic approach in preference of top thoracotomy, or open surgery, provides greater patient comfort with both less muscle tissue damage and a smaller incision. This means the patient feels less pain in the postoperative period, increases patient satisfaction and contributes to a more rapid return to social life (12,13). Ninety-one percent of patient satisfaction was determined in thoracic sympathectomy operations performed with the ETS method and a single port in this study. We think that this high patient satisfaction rate can be attributed to patients experiencing less pain due to a smaller incision and lower tissue trauma with the single port ETS method, and to their early return to working and social life by being discharged on the same or the next day.

There are various operation application types in ETS. These differences derive from different thoracic entry sites or from the surgeon's use of different sympathetic nerve blocks (1,14). The thoracic sympathetic consists of 10-12 ganglia and extends beneath the parietal pleura on both sides of the spinal cord. ETS surgery is performed by interrupting the ganglia at predetermined levels and the branches between them (1,14). Although different methods with different names are employed, the essential aim is to interrupt the sympathetic chain. Removal by severing the sympathetic ganglion from above and below is

Age	25 (17-36)
Gender M/F	13/10
Operative time (min)	28
Length of hospitalization (days)	1 (0-8)
<b>Complications</b>	
Compensatory sweating	2
Parenchymal laceration	1
Rebound sweating	1
Follow-up duration (months)	12
M: Male, F: Female	

Indication	No	Levels
Hand sweating	10	T3-4
Axillary sweating	2	T4-5
Hand and axillary sweating	11	T3-5

defined as sympathectomy, damaging the sympathetic ganglion by using ultrasound or laser is defined as ablation, attaching a clip over the desired ganglion in the sympathetic trunk is known as clipping, and clipping the ganglion in the sympathetic trunk from above and below is defined as sympathetic blockage. In our clinic, we perform thoracic sympathectomy with the ETS method and a single port by interrupting the sympathetic ganglion using the ablation technique with an electrocautery hook. One previous study determined no significant difference in terms of operation-related risk and/or patient satisfaction between different techniques including ablation, cutting, and clipping (15).

While the optimal level for sympathetic chain resection is still unclear, the T3 or T3-4 ganglia are recommended in palmar HH, T4 in axillary HH, and T2 in facial HH (16). In this study, ablation was applied to the T3 and T4 ganglia for palmar HH, and to the T4-T5 ganglia for axillary HH. Family histories are present in 12.5-56.5% patients (14). Cerfolio et al. (2) described the best patient group for treatment as individuals with symptom onset before the age of 16, without sweating during sleep, and without bradycardia or other additional diseases. Adolescence has been described as the ideal age for surgery in patients with HH. However, studies have revealed no significant difference in terms of surgical outcomes between adolescence and patients over 40 or under 14 (17,18). The essential aim of HH surgery is to achieve a dry skin with as few complications as possible. The objective must be to perform blockage at the appropriate level to achieve this balance. However, results are not always at the desired level, and complications capable of causing the patient to regret having undergone surgery can even develop (19). Postoperative dissatisfaction was determined in two cases in this study, one in which parenchymal laceration developed, and one with compensatory sweating.

The reasons for surgical failure and recurrence of the disease include anatomical variations of the sympathetic nerve, pleural adhesions, inability to clearly visualize the nerve due to excess adipose tissue, and insufficiency of the sympathetic incision because of venous structures in the proximity of the sympathetic canal (20). The most common complication of ETS is compensatory sweating, the prevalence of which among all different surgical approaches ranges between 3% and 98% (2,21). In this complication, sweating increases abnormally in the lower part of the line passing between the nipples (22). Compensatory sweating is also the principal cause of postoperative regret. Of the two cases in which compensatory sweating developed in this study, the symptoms resolved spontaneously in one in the second postoperative month, while the other patient's

symptoms persisted for 12 months. Rebound sweating is a non-permanent complication that resolves within 30 days and that consists of slight moisture in the early postoperative period (Table 3). This should not be interpreted as a recurrence. It is thought to be associated with transient neurotransmitter release from the nerve end exposed to postganglionic degeneration (22). Rebound sweating developed in one patient in our series, but resolved entirely in the third week.

Another complication is excessively dry hands that can result in cracks in the palms, especially in cold weather. Dry hands are reported to be less common in patients in whom T4 is employed in preference to T3 in sweating of the hands (22). Another complication is Horner syndrome resulting from perioperative stellar ganglion damage in the C8-T1 junction. Although now not frequently seen, it was once one of the most frequent complications. The likelihood of development is higher in interventions at the T2 level or above in patients presenting with facial sweating. The prevalence is 0.7-5.6%. The effect may be transient in some patients, but can also produce permanent injury. However, the incidence has decreased as surgical interventions are increasingly performed to lower levels and to increased surgical experience (22). Horner syndrome was not encountered in any of our patients. Complications developing following thoracic sympathectomy are shown in Table 3. As with all interventional procedures, patients must be given comprehensive information and their consent must be obtained in terms of potential complications before ETS surgery (23).

Although tube thoracostomy is not currently required following thoracic sympathectomy using the ETS method, it is required in pneumothoraces, which develop at a rate of 4-6%. Pneumothorax is most frequently caused by parenchymal adhesions (22). Parenchymal adhesions were present in two cases in this study. Primary repair with axillary mini-thoracotomy associated with parenchymal laceration was required in one patient. In the other case, although bilateral sympathectomy was planned, no

<b>Table 3. Sympathectomy complications</b>	
<b>Postoperative complications</b>	<b>Perioperative complications</b>
Compensatory hyperhidrosis	Vascular bleeding
Gustatory sweating	Parenchymal laceration
Phantom sweating	Rhythm changes (bradycardia-tachycardia)
Recurrence	Plexus brachialis damage linked to surgical position
Rebound sweating	-
Horner syndrome	-
Hydro-hemo-pneumothorax	-

intervention was performed on the side with adhesion, while endoscopic sympathectomy was applied to the other side, and tube thoracostomy was not required.

## CONCLUSION

ETS has been increasingly applied for treating HH with satisfactory results and low complication rates recently. We believe that the advantage of the single port endoscopic sympathectomy we performed is that it allows the operation with a single small incision, less pain and less scarring, resulting in higher satisfaction in patients and their return to social life earlier.

### Ethics

**Ethics Committee Approval:** Approval for the study was granted by the Kahramanmaraş Sutcu Imam University Ethical Committee (session 2021/04, decision no: 15, dated: 25.01.2021).

**Informed Consent:** Informed consent form was obtained by signature.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: M.S., M.T., Concept: A.A., Design: A.A., M.T., Data Collection or Processing: A.A., M.S., Analysis or Interpretation: A.A., M.S., Literature Search: M.S., Writing: A.A.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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