

# Video-assisted thoracoscopic sympathectomy for thoracic three versus thoracic four for the treatment of primary hyperhidrosis (single-center study)

Sameh E. Elimam, Nehal Farouk

Department of Vascular Surgery, Al-Zahraa University Hospital, Azhar Faculty of Medicine for Girls, Al-Zahraa, Egypt

Correspondence to Sameh E. Elimam, MD, AFMG. Postal Code: 11835. Tel: 02 25619474; fax: 26855880; e-mail: samehelemam1982@gmail.com

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## Background

Hyperhidrosis is a pathologic disease of excessive sweating in amounts greater than the physiologically necessary thermoregulation. Although hand sweating does not have a significant effect on the health of patients, it can be uncomfortable to shake hands, complicate the writing, and cause humiliation and psychological distress. The primary treatment for patients with the disease is video-assisted thoracic sympathectomy (VATS) to be done with accuracy, with improved health care and good outcomes.

## Aim

The aim was to assess the effect VATS on patient's quality of life according to the level of sympathectomy performed, as well as the presence of postoperative complications.

## Patients and methods

This is a comparative randomized study that was conducted at Al-Zahraa University Hospital. A total of 126 patients with palmar hydrosis were involved in this study. The authors included patients from 16 to 40 years, in whom the sweating had a negative effect on their work. The authors have classified patients into two groups, those who underwent VATS on T3 and those who on T4 level, randomly. The authors followed patients at 1, 6, 12, and 24 months.

## Results

The study was conducted on 126 patients, comprising 27.7% males and 72.3% females, with mean age of 25.8±5.8 and 25.2±4.4 in T3 and T4 groups, respectively. The incidence of compensatory hyperhidrosis was significantly lower in T4 group at 6 and 12 months, and also it was lower at long-term follow-up of 24 months, but with no significance statistically. We have noticed high rates of satisfaction of different degrees in both groups. T4 group showed better efficacy in limiting compensatory hyperhidrosis compared with T3 group.

## Conclusion

Thoracoscopic T4, T3 sympathectomy provides very good results, with very low incidence of compensatory hyperhidrosis. T4 appears to be the best segment for treatment of primary hyperhidrosis.

## Keywords:

compensatory hyperhidrosis, primary hyperhidrosis, satisfaction, sweating, thoracoscopic sympathectomy

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## Introduction

Hyperhidrosis is a pathological condition of excessive sweating in amounts greater than the thermoregulation physiologically required. It may develop secondary to a variety of medical disorders, or may be primary.

Primary hyperhidrosis (PH) is a condition with predominant signs of prolonged sweating in the hands and pedals that are not owing to metabolic disorder or other systemic disease, caused by sympathetic hyperactivity, which greatly affects patients' quality of life [1]. The sympathetic nerve that controls the sweat glands within the hand is derived from the second thoracic ganglion (T2) – the fourth thoracic ganglion (T5), and most power

comes from the T2. The preganglionic fibers of the arm derive mainly from the third to sixth segments of the spine [2].

PH treatment methods include a diversity of topical or systemic drugs, psychotherapy, and surgical or nonsurgical procedures [3]. Recently, minimally invasive surgery, video-assisted thoracoscopic sympathectomy (VATS), has been shown to be a safe and effective procedure [4].

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At T2 [5], early thoracic sympathectomy is completed. However, particularly compensatory hyperhidrosis has dramatically increased postoperative complications [6]. VATS at level T3 or T4 is widely used to treat PH with a greater efficacy and safety profile than at level T2 [7]. We performed a systematic analysis of VATS T3 and T4 to treat sweating by hand, in which 126 patients underwent thoracoscopic bilateral sympathectomy from February 2017 to March 2019.

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### Aim of the study

The aim was to assess the effect of video-assisted thoracic sympathectomy (VATS) on patient's quality of life according to the level of sympathectomy performed, as well as the presence of postoperative complications.

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### Patients and methods

This is a comparative randomized study that was conducted at Al-Zahraa University Hospital. Written informed consent was obtained from the patients. The study was approved by the Department of surgery, Faculty of Medicine, Alzahraa University Hospital and ethical committee of Alzahraa University Hospital. A total of 126 patients with palmar hidrosis were involved in this study.

Patient inclusion criteria were as follows: first, 16–40 years of age; second, extreme sweating symptoms that have a major negative effect on the patient's work and everyday life; and third, long-term pH and inadequate response to drug therapy.

The exclusion criteria were patients whose sweating was caused by metabolic disorders and patients under the age of 16 years and above 40 years. Patients were divided according to the intervened level randomly into two groups: first, high thoracic ganglion (T3 level=63) and second, low thoracic ganglion (T4 level=63).

### Procedures

All patients had preoperative examinations, such as X-rays in the chest, ECG, and all routine analyses [complete blood count, coagulation profile, liver function tests (LFTS), kidney function tests (KFTs), urine analysis, and red blood cells].

### Anesthesia

The patients usually undergo double-lumen endotracheal general anesthesia to stop patients'

ventilation and collapse of the lung on the side that will undergo surgery. Position:

The patient was placed in 30–45° position, half seated, with a 90° arm extension.

### Incision

Two 5-mm mini incisions were made in each hemithorax, one in the endoscope insertion axilla and the other in the middle or posterior axillary line at the level of the nipple for diathermy insertion. Then, a 30°, a small camera, and low-voltage electrocautery on a scope is placed through the incisions to show the surgeon the sympathetic nerve chain cuts and seals the nerve chain where it best relieves the patients' hyperhidrosis. A suture of the incisions followed. The first day after surgery, chest radiographs were done to exclude early complications.

Our cases were followed by frequent visits at 1, 6, 12, and 24 months after operation. The follow-up content were [3] time and degree to regulate postoperative sweating; time, duration, and place of hyperhidrosis compensation; and satisfaction of patients.

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### Results

#### Statistic data analysis

Using IBM SPSS software package version 20.0, data were fed to the computer and analyzed (IBM Corp., Armonk, New York, USA). The Kolmogorov–Smirnov test was used to verify the regularity of variables distribution.  $\chi^2$  test (Fisher exact test) has been used to assess differences among groups for categorical variables. Student *t*-test was used to compare two classes for quantitative variables, which are usually distributed. The importance of the findings obtained was calculated at the point of 5%.

No significant difference was found in the age, the rate of dry hands, and pedal sweating between the two categories. See Table 1 for details.

The success rate in the VATS for two categories was 100%. and Sweating changed qualitatively following surgery in all cases. There were no major preoperative or postoperative complications. Compensatory hyperhidrosis (CH) was the main nonsevere postoperative complication for determining the effectiveness of the procedure.

Regarding T3 group, the incidence rate of CH at 1, 6, 12, and 24 months after surgery was 66.6, 58.7, 47.6, and 23.8%, respectively, whereas in T4 group, it was 47.6, 31.7, 28.6, and 14.2%, respectively.

**Table 1 Patients' characteristics and follow-up duration**

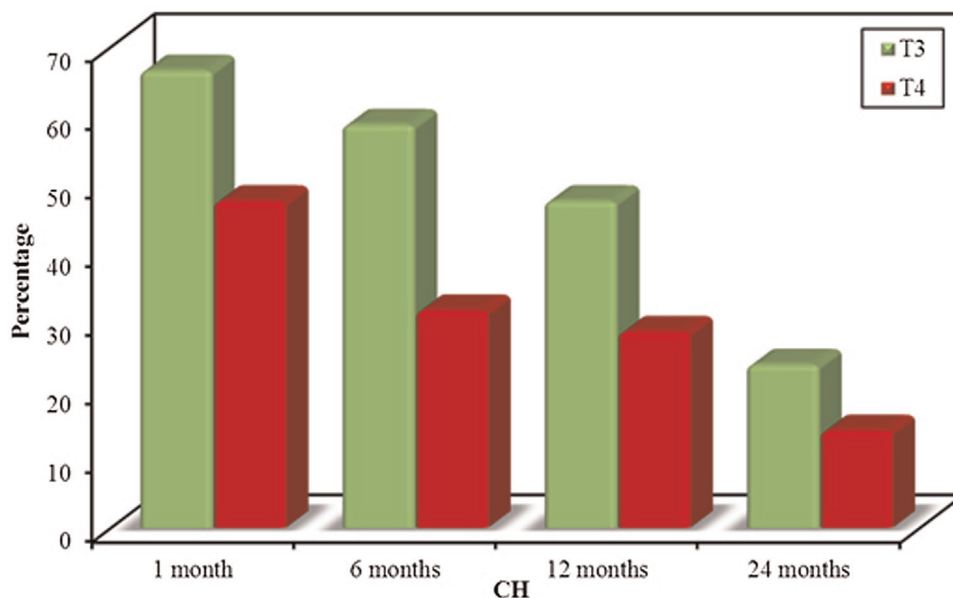
Groups	T3	T4	Test of significance	P value
Number of patients	63	63		
Male/female	15/48	20/43	$\chi^2=0.989$	0.320
Age (years) (mean $\pm$ SD)	25.8 $\pm$ 5.8	25.2 $\pm$ 4.4	$t=0.671$	0.503
Armpit sweating	12	21	$\chi^2=3.326$	0.068
Pedal sweating	30	37	$\chi^2=1.562$	0.211
The severity of hand sweating				
Mild	0	0	–	–
Moderate	44	45	$\chi^2=0.038$	0.845
Severe	19	18	$\chi^2=0.038$	0.845

P, P value for comparing between the studied groups.

**Table 2 Incidence and severity of CH**

Group	T3 [n (%)]	T4 [n (%)]	$\chi^2$	P value
CH				
1 month	(42/63) (66.6)	30/63 (47.6)	4.667*	0.031*
6 months	(37/63) (58.7)	20/63 (31.7)	9.259*	0.002*
12 months	30/63 (47.6)	18/63 (28.6)	4.846*	0.028*
24 months	15/63 (23.8)	9/63 (14.2)	1.853	0.173
Severity of sweating	n=42	n=30		
Mild	20 (47.6)	19 (63.3)	1.741	0.187
Moderate	12 (28.6)	6 (20)	0.686	0.408
Severe	10 (23.8)	5 (16.7)	0.541	0.462

CH, compensatory hyperhidrosis. P, P value for comparing between the studied groups. \*Statistically significant at  $P \leq 0.05$ .

**Figure 1**

Comparison between the two studied groups according to incidence and severity of compensatory hyperhidrosis.

The rate of CH in these two categories was equivalent at 1 and 6 months, and the 12-month incidence rate was substantially lower in the T4 group than in the T3 group ( $P < 0.05$ ). Moreover, there was no statistically significant difference between the two classes regarding the decrease at 24 months. Details are given in Table 2.

Hyperhidrosis can range in severity from mild dampness to severe dripping that can impair the quality of life as well as patients' mental and emotional health. The proportion of patients with mild, moderate, and severe CH showed no statistically significant difference between these two groups. Details are given in Fig. 1.

**Table 3 Patients' satisfaction and quality of life**

Group	T3 [n (%)]	T4 [n (%)]	$\chi^2$	P value
Very satisfied	19.1 (30)	30 (47.6)	4.041*	0.044*
Satisfied	35 (55.5)	20 (31.7)	7.260*	0.007*
Not satisfied	9 (14.2)	13 (20.6)	0.881	0.348
Palm dryness	40 (63.4)	33 (52.3)	1.596	0.207
Palm moisture	12 (19)	9 (14.3)	0.514	0.473
Armpit sweating improved	7/12 (58.3)	13/21 (61.9)	0.041	<sup>FE</sup> P=1.000
pedal sweating improved	6/30 ((20)	15/37 (40.5)	3.248	0.072

FE, Fisher exact test; P, P value for comparing between the studied groups. \*Statistically significant at  $P \leq 0.05$ .

As shown by chest radiography, two patients developed a moderate bilateral pneumothorax, and five patients developed unilateral pneumothorax, and the approach was a cautious procedure. Regarding patient satisfaction, the category T4 was slightly higher than the category T3 ( $P < 0.05$ ).

Although there was a higher incidence rate of palm dryness in the T3 category (63.4%) than T4 (52.3%), it was not statistically significant ( $P = 0.27$ ).

The T4 group had a non-significant higher moist axis incidence than those in the T3 group ( $P > 0.05$ ).

The T4 category had a significantly higher incidence of improved pedal sweating than anyone in the T3 category ( $P > 0.05$ ). Details are given in Table 3.

## Discussion

PH can be defined as a somatic disorder characterized by excessive sweating in the palmer region caused by abnormal hyperactivity of the sympathetic nervous system, which controls the sweating glands in the hands, and it generally gets more serious when the patient is excited. Although hand sweating does not have a direct effect on patients' well-being, it has an effect on patients' everyday lives and jobs, which can significantly affect patients' emotional well-being. There has also been a growing desire to establish successful care for patients with the disease.

Endoscopic thoracic sympathectomy has acquired an important position in treatment of the disease, and it minimizes its complications such as CH [8].

VATS has been applied to various segments T2–T4; the T2 ganglion was regarded as the first pathway for the hands but had high incidence of severe CH, affecting quality of life [9].

For the treatment of PH, we compared the efficacy and protection of this study for VATS with different rates of cuts (T3 and T4).

The success rate in both types of surgery (T3 and T4) was 100%, and the effects of sweating decreased in both regions. No significant complications occurred during or after surgery. The cycle of CH following VATS is still unclear today [10].

Several studies have shown that the decrease in the cutting level in the sympathetic chain will minimize incidence of compensatory hyperhidrosis, which concurs with our analysis here that the incidence of CH between two groups was statistically important at 6 and 12 months, but occurrence levels in the T4 group were slightly lower than in the T3 group with a follow-up duration of 2 years (Fig. 1).

For the severity of CH sweating, in T4, there was a lower incidence in mild form than in T3 group. In T3 group, moderate and extreme type of CH is higher than in T4 group; this suggests that the frequency of compensatory hyperhidrosis could be decreased when the sympathetic cutting plane is lowered. To explain this phenomenon, the autonomic nervous system functions through positive and negative feedback mechanisms. Nervous impulses from the target organs (e.g. sweat glands) are transmitted as afferent negative feedback signals to the central control center (hypothalamus), from where the efferent positive feedback signals return to the target organ. T3 ganglionic interruption disrupts fewer afferent negative feedback signals, so that efferent positive feedback signals are weaker, and reflex sweating is less severe. T4 interruption causes the least or almost no reflex sweating, because most of the afferent negative feedback signals are preserved. Therefore, the changing pattern of excessive sweating is not really a compensation but a reflex response, so the higher the level of ganglionic blockade (e.g. T2 or T3), the greater the incidence of severe compensatory symptoms [11].

Marco Anthony and colleagues stated another important statistical difference was that in the T3–T4 community, moderate to severe compensatory hyperhidrosis accounted for 34.4% of the population, whereas in the T4 community, just 6.7% of patients had moderate

compensatory hyperhidrosis and no serious cases occurred, leading them to believe that T3 thermoablation is unnecessary [12]. The findings also showed that the remission rates of armpit sweating in the T4 group were higher in these two groups than in the T3 category, indicating a preferable T4 sympathectomy for patients with axillary sweating. To explain this, the incidence of palmar moisture had higher incidence in the T3 group than in the T4. The preganglionic fibers that innervate the sweat glands of the hand mostly from the third and fourth are considered to be mainly responsible for PH. The aim of TS should be to transect a certain percentage of sympathetic nerve fibers but not all, with the T4 level achieving this aim than T3 [13]. Therefore, we will suggest T4 sympathetic chain cutting to reduce the occurrence of palm moisture and to increase treatment outcomes.

### Conclusion

Sympathectomy at T3 or T4 level is a safe and effective method of treating PH. VATS of high segments increases the incidence and severity of postoperative CH. T4 sympathectomy seems to be the best segment for VATS of PH to decrease the incidence of postoperative CH.

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### Conflicts of interest

There are no conflicts of interest.

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