

## Evaluation of Endoscopic Thoracic Sympathectomy at T2 and T3 Ganglion Level for Primary Hyperhidrosis

HODA A. YOUSSEF, M.D.; RASHA A. ABD ELGHANY, M.D. and MOHAMMED Sh. ZARAD, M.D.

The Department of General Surgery, Faculty of Medicine for Girls, Al Azhar University

### Abstract

**Background:** Primary hyperhidrosis is a benign and idiopathic sympathetic disorder characterized by excessive sweating with no apparent underlying cause and is aggravated during periods of stress and anxiety with a prevalence of 0.6-2.8% of population.

**Aim of Study:** To compare the effectiveness of thoracic endoscopic sympathectomy either at T2 and T3 regarding the patient's satisfaction, compensatory hyperhidrosis and post-operative complications.

**Patients and Methods:** Forty patients between 13 and 30 years old with primary hyperhidrosis undergoing endoscopic thoracic sympathectomy were divided into two equal groups, the group I: T2 (20 patients) endoscopic thoracic sympathectomy at T2 ganglion level and group II (20 patients) at T3 ganglion level.

**Results:** All patients in both groups had an immediate improvement after the operation with dry hands and 100% satisfaction. In group I with axillary hyperhidrosis only one patient (33.3%) had axillary dryness While in group II: Three patients (75%) had axillary dryness. In group I: Two patients (40%) had planter dryness while in group II: Three patients (75%) had planter dryness.

12 patients (60%) were complicated by compensatory sweating in group I, and eight patients (40%) in group II (in back, buttock and thigh), the difference was found statistically non-significant.

**Conclusion:** Sympathectomy at the T2 or T3 levels provided adequate long-term treatment for palmar hyperhidrosis in terms of initial surgery results, complications, and patient satisfaction. The most frequent complication was compensatory hyperhidrosis. Because of the lower severity of compensatory hyperhidrosis, we prefer the T3 level for treating palmar hyperhidrosis.

**Key Words:** Palmar hyperhidrosis – Sympathectomy – Compensatory hyperhidrosis.

### Introduction

**PRIMARY** Hyperhidrosis (PH) is a benign and idiopathic sympathetic disorder characterized by excessive sweating with no apparent underlying cause and is aggravated during periods of stress and anxiety with a prevalence of 0.6-2.8% of population [1-3]. It must be differentiated from secondary hyperhidrosis, which is due to a multiple of stimuli like: From infection, malignancy, medication, anxiety, neurological and endocrine disorders [4]. Although hand sweating has no significant impact on patients' health, and that has significant a negative effect on quality of life, work, educational activities, and social interaction, which will severely impair the patients' emotional wellness [5].

PH can present at any age, although it tends to affect adolescents and young adults predominantly. Most sweat glands are of the eccrine type, becoming active with puberty, which may explain why hyperhidrosis is rarely seen at an early age and generally becomes evident in the 2<sup>nd</sup> and 3<sup>rd</sup> decades of life [3].

Hyperhidrosis might also be generalized or localized and there are variants that might also have an effect on the axilla, palms, sole, trunk and face, with axillary HH being most common followed by palmar HH [1,6].

For many years, traditional conservative treatments like botulinum injections have been proven ineffective and have significant side effects [5].

Before the introduction of Endoscopic thoracic sympathectomy and the advances in video-endoscopic technology, thoracotomy was the standard surgical approach for hyperhidrosis. Endoscopic

thoracic sympathectomy had replaced open surgery to perform sympathectomy, determining a shorter hospital stay, reduced morbidity rates, less pain, and better cosmetic results for a non-life-risk disease [7].

Endoscopic thoracic sympathectomy is the treatment of choice for palmar hyperhidrosis, as it is a safe, effective, and minimally invasive method. Traditionally, it is used for palmar hyperhidrosis, but latest trials have established accurate clinical success rates for axillary hyperhidrosis as well especially with interruption of upper dorsal sympathetic chain T3 [4]. However, the symptoms may relapse in some patients, and most important side effect is Compensatory Sweating (CS) which can occur in different regions of the body [3].

The current study aimed to compare the effectiveness of thoracic endoscopic sympathectomy either at T2 and T3 regarding the patient's satisfaction, compensatory hyperhidrosis and post operative complications.

### Patients and Methods

A prospective randomized clinical study has been carried out between December 2017 and December 2019 at the Department of General Surgery, Al-Zahraa University Hospital.

Forty patients between 13 and 30 years old with primary hyperhidrosis suffering from excessive sweating in hands, axilla, and/or sole and scheduled for endoscopic thoracic sympathectomy were included in our study.

The exclusion criteria were patients who had secondary hyperhidrosis, pulmonary disease, previous thoracic surgery, or associated cardiac disease.

All included patients were informed about the surgical procedure. Informed consent was taken from all patients or her/his guardian to participate in this study that was bioethically approved by the Bioethics Committee of the faculty. Those patients were randomly allocated using a computerized random number generator into two equal groups, the group I: T2 (20 patients) endoscopic thoracic sympathectomy at T2 ganglion level and group II (20 patients) at T3 ganglion level.

All patients were clinically diagnosed and all data including age, sex, previous medication, and family history were obtained. All patients had routine blood investigations and chest X-ray.

### Operative technique:

All surgeries were done under general anesthesia with a double-lumen tube. Operations were done in the supine and semi setting position of the patient with the abduction of both arms to expose the axilla with table tilting. 10mm port was inserted at the second intercostal space in the midclavicular line with CO<sub>2</sub> insufflation and exposing the pleura cavity using 0 camera and identification of sympathetic chain along of the ribs. 5mm port was inserted in the midaxillary line at the fifth intercostal space for the diathermy hook. In group I: Cauterization and transection of sympathetic chain at T2 below the second rib while in group II cauterization and transection of sympathetic chain at T3 below the third rib Figs. (1,2). In both groups, cauterization of the Kuntz's nerve was done to achieve adequate denervation. Inflation of the lung under vision then the same procedure repeated on the other side. All patients had received analgesics and followed-up by a chest X-ray post-operatively and discharged after 24h except the complicated cases.



Fig. (1): Sympathetic chain along the side of the ribs.

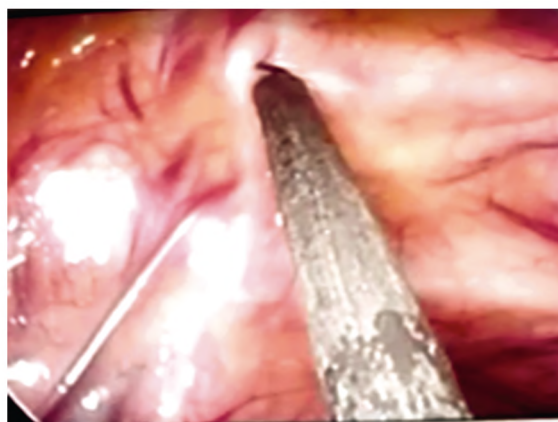


Fig. (2): Cauterization of the sympathetic chain with with L-shaped hook.

**Study endpoints:**

The primary outcomes were patient's satisfaction and compensatory hyperhidrosis.

The secondary outcomes were post-operative complications in the form of pneumothorax, hemothorax, and horner's syndrome.

**Statistical analysis:**

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± Standard Deviation (SD). Qualitative data were expressed as frequency and percentage.

*The following tests were done:*

- Independent-samples *t*-test of significance was used when comparing between two means.
- Chi-square ( $\chi^2$ ) test of significance was used in order to compare proportions between qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the *p*-value was considered significant as the following:
  - Probability (*p*-value).
  - *p*-value <0.05 was considered significant.
  - *p*-value <0.001 was considered as highly significant.
  - *p*-value >0.05 was considered insignificant.

**Results**

The present study included 40 patients with primary hyperhidrosis. Those patients were classified into two equal groups, group I (20 patients) endoscopic thoracic sympathectomy at T2 ganglion level and group II (20) patients endoscopic thoracic sympathectomy at T3 ganglion level.

Patients characteristics of the study groups are listed in (Table 1). In Group I (T2), the age of the patients ranged from 13 to 29 years with a mean of (21.10±4.59), they included 14 females (70%) and 6 males (30%) with positive family history in three patients (15%). In Group II (T3), the age of the patients ranged from 15 to 30 years with a mean of (21.95±4.32), 16 females (80%) and four males (20%) with positive family history in four patients (20%). Table (1) shows no statistically significant difference between groups according to demographic data.

Table (1): Comparison between group I: T2 and group II: T3 according to demographic data.

Demographic data	Group I: T2 (n=20)	Group II: T3 (n=20)	Total (n=40)	$\chi^2$ #	<i>p</i> -value
<b>Age (years):</b>					
Mean ± SD	21.10±4.59	21.95±4.32	21.53±4.42	0.364	0.550
Range	13-29	15-30	13-30		
<b>Gender:</b>					
Female	14 (70.0%)	16 (80.0%)	30 (75.0%)	0.533#	0.465
Male	6 (30.0%)	4 (20.0%)	10 (25.0%)		
<b>Family history:</b>					
Negative	17 (85.0%)	16 (80.0%)	33 (82.5%)	0.173#	0.677
Positive	3 (15.0%)	4 (20.0%)	7 (17.5%)		

*t*<sub>2</sub> : Independent Sample *t*-test.  
 # $\chi^2$  : Chi-square test *p*-value >0.05 NS.

**Pre-operative diagnosis:**

In Group I (T2), 13 patients (65%) had palmer hyperhidrosis only, two patients (10%) were presented with palmar + axillary hyperhidrosis, four patients were presented with Palmar & Plantar and one patient (5%) had palmer & axillary & planter hyperhidrosis. In Group II (T3), Palmer hyperhidrosis only was present in 12 patients (60%), palmar + axillary hyperhidrosis in four patients (20%), Palmar & Plantar in four patients and both palmer & axillary & planter in zero patients (0%). Table (2) show no statistically significant differences between both groups according to pre-operative variables.

Table (2): Comparison between group I: T2 and group II: T3 according to pre-operative diagnosis.

Pre-operative diagnosis	Group I: T2 (n=20)	Group II: T3 (n=20)	Total (n=40)	$\chi^2$	<i>p</i> -value
• Palmar	13 (65.0%)	12 (60.0%)	25 (62.5%)	1.707	0.635
• Palmar + Axillary	2 (10.0%)	4 (20.0%)	6 (15.0%)		
• Palmar + Plantar	4 (20.0%)	4 (20.0%)	8 (20.0%)		
• Palmar + Axillary + Plantar	1 (5.0%)	0 (0.0%)	1 (2.5%)		

$\chi^2$  : Chi-square test; *p*-value >0.05 NS.

**Post-operative complications:**

In group I: No intraoperative bleeding from intercostal veins occurred, while in group II occurred in one patient (5%), all were all controlled by diathermy. In group I: One patient (5%) had a unilateral pneumothorax after surgery and need insertion of chest tube and the tube removed after three days with no residual pneumothorax; while no patients in group II developed post-operative pneumothorax, however the difference was found to be statistically non-significant (Table 3). No

operative mortality neither conversion to open thoracotomy were recorded. There was no major haemothorax, chylothorax, atelectasis, or horner's syndrome in both groups.

Table (3): Comparison between group I: T2 and group II: T3 according to post-operative complications.

Post-operative complications	Group I: T2 (n=20)	Group II: T3 (n=20)	Total (n=40)	$\chi^2$	P-value
• Pneumothorax	1 (5.0%)	0 (0.0%)	1 (2.5%)	1.026	0.311
• Hemothorax	0 (0.0%)	1 (5.0%)	1 (2.5%)	1.026	0.311
• Chylothorax	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.000	1.000
• Atelectasis	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.000	1.000
• Horner's syndrome	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.000	1.000
• Mortality	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.000	1.000

$\chi^2$ : Chi-square test; *p*-value >0.05 NS.

#### Follow-up data:

All patients in both groups had an immediate improvement after the operation with dry hands and 100% satisfaction. In group I with axillary hyperhidrosis only one patient (33.3%) had axillary dryness while in group II: Three patients (75%) had axillary dryness. In group I: Two patients (40%) had planter dryness while in group II: Three patients (75%) had planter dryness.

12 patients (60%) were complicated by compensatory sweating in group I, and eight patients (40%) in group II (in back, buttock and thigh), the difference was found statistically non-significant (Table 4).

Complete follow-up information was obtained from 40 patients after one, 6, 12 months at outpatient clinic by clinical assessment or by telephone.

Table (4): Comparison between group I: T2 and group II: T3 according to outcome.

Outcome	Group I: T2 (n=20)	Group II: T3 (n=20)	Total (n=40)	$\chi^2$	P-value
• Satisfaction (palmar)	20 (100.0%)	20 (100.0%)	40 (100.0%)	0.000	1.000
• Satisfaction (axillary)	1 (33.3%)	3 (75%)	4 (57.1%)		
• Satisfaction (plantar)	2 (40%)	3 (75%)	5 (55.5%)		
• Compensatory hyperhidrosis	12 (60.0%)	8 (40.0%)	20 (50%)	0.229	0.633

$\chi^2$ : Chi-square test; *p*-value >0.05 NS.

Table (5): Compensatory hyperhidrosis follow-up.

Compensatory hyperhidrosis	1 month	6 months	1 year
Group I: T2 (n=20)	12 (60.0%)	8 (40%)	3 (15%)
Group II: T3 (n=20)	8 (40.0%)	4 (20%)	2 (10%)

## Discussion

Sweating is mediated by the sympathetic nervous system. The second thoracic ganglion is considered to be the key ganglion for sympathetic denervation of the upper extremity, and interruption of T2 or T3 are thus the main sympathetic procedure performed by many surgeons. The reported methodology for ETS is currently confusing, and ETS can be achieved by various methods, such as sympathectomy, sympathectomy, and ganglionectomy by cauterization, scissor resection, or clamping block [8].

Although there is no evidence for any difference in the prevalence of palmar hyperhidrosis between the sexes, women usually seek treatment more frequently and therefore end up undergoing sympathectomy more often and the patients were also young, with a mean age of  $23.4 \pm 5.3$  years (T2) and  $23.2 \pm 6.5$  years (T3) [9]. In this study in group I female (70%) and in group II (80%) and range of age was (13-29) in group I (15-30) group II respectively.

Ro et al., had found (65%) positive family history in their study [10]. In this study positive family history was found (15.0%) in group I and (20.0%) group II.

Horner's syndrome has become a rare complication because the advanced technique, and it occurred in cases of indirect lesion of the stellate ganglion (T1) due to heat diffusion or excessive traction of the chain. Yazbek et al., had recorded only one case of transient Horner's syndrome in a patient in the T3 group who presented adherent tissue that needed to be detached from one of the lungs [9]. In this study there were no cases of Horner's syndrome.

Bryant and Cerfolio, had observed a radiographic pneumothorax in 67% of the patients immediately postoperatively and only one patient required a chest tube [11].

In this study only one case of pneumothorax in group I and was treated with chest tube.

Ong et al., had reported overall satisfaction rate of (72.7%) and a higher rate of CH (91 %) than reported usual rate of around 60% [12].

Aoki et al., had reported post-operative compensatory sweating in all patients of both groups which decrease their patient satisfaction [13].

Sugimura et al., had reported 96% of patients with excellent satisfaction for palmar HH reporting

substantial improvement and ETS was also highly successful in controlling the symptoms of facial blushing/sweating and axillary HH with success rates of 89 and 94%, respectively [14].

Yazbek et al., had reported one month after the operation, compensatory hyperhidrosis in 26 patients in the T2 group (86.66%) and in 27 in the T3 group (90%). Six months after the operation, all patients in the T2 group had some degree of compensatory hyperhidrosis and only one patient in the T3 group did not present it (96.6%). Twenty months after the operation, all patients in both groups presented some degree of compensatory hyperhidrosis [9].

In our study all patient in both groups were satisfied for palmar hyperhidrosis while axillary and plantar hyperhidrosis satisfaction were (33.3%) (40%) in group I and (75%) (75%) in group II respectively.

In this study compensatory hyperhidrosis was (60.0%) in group I and (40.0%) in group II after one month post-operative and six months after the operation was (40%) in group I and (20%) in group II. One year follow-up only three (15%) cases in group I and two (10%) cases in group II of compensatory hyperhidrosis.

The sites of compensatory hyperhidrosis were different regions of the body, including the abdomen, back, gluteal region and thighs. The most frequent regions were between locations on the abdomen and back. The preferential location was similar between the groups.

### Conclusion:

Sympathectomy at the T2 or T3 levels provided adequate long-term treatment for palmar hyperhidrosis in terms of initial surgery results, complications, and patient satisfaction. The most frequent complication was compensatory hyperhidrosis. Because of the lower severity of compensatory hyperhidrosis, we prefer the T3 level for treating palmar hyperhidrosis.

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## تقييم قطع العصب السمبساوى بالمنظار فى علاج فرط التعرق الأولى عند الفقرة العصبية الثانية أو الثالثة

يعد فرط التعرق الأولى هو حالة مرضية فسيولوجية إجتماعية لها تأثير سلبى كبير على نوعية الحياة وعلى الرغم من أن تعرق اليدين ليس له تأثير كبير على صحة المرضى، إلا أنه يؤثر تأثيراً إجتماعياً سلبياً على حياة المرضى اليومية وعملهم وأنشطتهم التعليمية وتفاعلهم الإجتماعى، مما سيؤدى إلى الإضرار الشديد بصحة المرضى العاطفية.

قبل إدخال إستئصال العصب السمبساوى بالمنظار والتقدم فى تكنولوجيا المناظير، كانت عملية إستكشاف الصدر هو النهج الجراحى القياسى لفرط التعرق. فبعد إدخال المنظار أدى تحديد فترة بقاء أقصر فى المستشفى، وخفض معدلات الإصابة بالأمراض، وألم أقل، ونتائج تجميلية أفضل لمرض غير خطر على الحياة.

خطة الدراسة: دراسة إكلينيكية تمت فى مستشفى الزهراء الجامعى فى الفترة من ديسمبر ٢٠١٧ أى الفترة ديسمبر ٢٠١٩ لمرضى فرط التعرق الأولى.

ما تم إجراؤه: تم إشراك ٤٠ مريض من مرضى فرط التعرق الأولى وتم تقسيمهم إلى مجموعتين متساويتين.

المجموعة الأولى (٢٠) تم قطع العصب السمبساوى عند الفقرة العصبية الثانية عن طريق منظار التجويف الصدرى والمجموعة الثانية (٢٠) تم قطع العصب السمبساوى عند الفقرة العصبية الثالثة عن طريق منظار التجويف الصدرى.

المدخلات: المرضى بين (١٣-٣٠) عام والذين يعانون من فرط التعرق الأولى باليد أو الإبط أو القدم والتي تؤثر على حياتهم اليومية ويرغبون فى إجراء عملية قطع العصب السمبساوى.

وتم إستبعاد المرضى الذين يعانون من فرط التعرق الثانوى أو مرضى القلب أو الصدر. وبعد إجراء العملية تم سؤال المريض عن مدى رضاه عن نتيجة العملية أو حدوث تعرق تعويضى بأماكن أخرى بالجسم أو حدوث مضاعفات نتيجة العملية.