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Comparison of only T3 and T3–T4 sympathectomy for axillary hyperhidrosis regarding treatment effect and compensatory sweating

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Abstract

OBJECTIVES: Patients diagnosed with axillary hyperhidrosis can face psychosocial issues that can ultimately hinder their quality of life both privately and socially. The routine treatment for axillary hyperhidrosis is T3–T4 sympathectomy, but compensatory sweating is a serious side effect that is commonly seen with this approach. This study was designed to evaluate whether a T3 sympathectomy was effective for the treatment of axillary hyperhidrosis and whether this treatment led to less compensatory sweating than T3–T4 sympathectomies among our 60-patient population.

METHODS: One hundred and twenty endoscopic thoracic sympathectomies were performed on 60 patients who had axillary hyperhidrosis. The sympathectomies were accomplished by means of a single-lumen endotracheal tube and a single port. The axillary hyperhidrosis patients were randomly divided into two groups with 17 patients in Group 1 undergoing T3–T4 sympathectomies and 43 in Group 2 undergoing only T3 sympathectomies. We analysed the data associated with the resolution of axillary hyperhidrosis, the degree of patient satisfaction with the surgical outcome and the quality of life in parallel with compensatory sweating after the procedure as reported by the patient and confirmed by the examiner. Moreover, the results were compared statistically.

RESULTS: No statistically significant difference was observed between the groups based on age ($P = 0.56$), gender ($P = 0.81$), duration of the surgery ($P = 0.35$) or postoperative satisfaction levels ($P = 0.45$). However, the incidence and degree of compensatory sweating were lower in the T3 group than the T3–T4 group at the 1-year follow-up ($P = 0.008$).

CONCLUSIONS: T3 sympathectomy was as effective as T3–T4 sympathectomy for the treatment of axillary hyperhidrosis based on the patients' reported postoperative satisfaction, and the T3 group demonstrated lower compensatory sweating at the 1-year follow-up.

Keywords: Axillary hyperhidrosis • T3 sympathectomy • T3–T4 sympathectomy • Compensatory sweating

INTRODUCTION

Axillary hyperhidrosis is an important disease that affects ∼1.4% of the population and can cause serious emotional and work-related problems [1]. Various medical treatment options for the treatment of axillary hyperhidrosis are available, including topical and systemic therapies, iontophoresis, regional nerve block and botulinum toxin injections. Medical management is often frustrating, and the response to treatment is generally transient [1, 2]. Thoracoscopic sympathetic surgery where the T3 and T4 sympathetic ganglia are resected through one or two ports is currently the most effective treatment for axillary hyperhidrosis. Patients are usually satisfied with the surgical outcome during the early postoperative period, but often suffer the recurrence of symptoms or compensatory sweating (CS) during the late postoperative period. In fact, CS is the factor that has the most influence on the postoperative quality of life of the patients and is considered a marker of the quality of the sympathectomy [3]. Researchers have reported that cutting at lower levels leads to less CS in axillary hyperhidrosis [2].

Endoscopic thoracic sympathectomy (ETS) is usually used to treat palmar hyperhidrosis in our clinic, but not axillary hyperhidrosis or facial flushing. Palmar hyperhidrosis and axillary hyperhidrosis are frequently seen together, and we observed that axillary hyperhidrosis resolved in patients with palmar hyperhidrosis who were treated with a T3 sympathectomy; moreover, these patients had less CS during the follow-up period. We did not find any studies in the literature on the results from a T3 sympathectomy for the treatment of axillary hyperhidrosis. We, therefore, compared the axillary hyperhidrosis treatment results and any associated CS following treatment with T3 sympathectomy vs that of treatment with T3–T4 sympathectomy. More specifically, we compared the results, degree of satisfaction and CS of patients who underwent thoracic sympathectomy at only the T3 level vs the T3 and T4 levels for axillary hyperhidrosis.

MATERIALS AND METHODS

This two-cohort, observational, single-centre study included patients undergoing bilateral ETS for the treatment of axillary hyperhidrosis by the Pamukkale University Faculty of Medicine in the Department of Thoracic Surgery. Sixty patients who had axillary hyperhidrosis and may or may not have had palmar hyperhidrosis underwent ETS between May 2008 and December 2010; the patients were monitored for 1 year and only the results of the treatment for axillary hyperhidrosis were evaluated. The exclusion criteria were as follows: history of previous thoracic surgery or associated diseases that could increase surgical risks (e.g. cardiac diseases, pulmonary infections, neoplasias or diseases of the pleura or lungs), a body mass index >25 and isolated Grade 1 axillary hyperhidrosis [4]. All participating patients stated that their symptoms had become more evident during puberty and increased when they were under stress. The preoperative sweating levels of the patients were rated using 4 grades according to the Hyperhidrosis Disorder Severity Scale (HDSS) [5] (Table 1).

The sympathetic chain was treated with electrocautery at the R3 level for the T3 sympathectomy and the R3–R4 level for the T3–T4 sympathectomy. Axillary hyperhidrosis patients were randomly divided into two groups using a randomization table with the intent of performing two times more T3 procedures than T3–T4 procedures; i.e. 17 patients were assigned to Group 1 and underwent T3–T4 sympathectomy, whereas 43 patients were assigned to Group 2 and underwent T3 sympathectomy. Both surgeries focused on the rami communicanti. All patients scheduled for sympathectomy were informed that CS may develop after surgery. Patients in both groups were outpatients with axillary hyperhidrosis that was rated Grade 2 or more according to the HDSS. In addition, all patients with Grade 1 axillary hyperhidrosis accompanied by palmar hyperhidrosis were included in the T3 group (i.e. Group 2).

All sympathectomies were done by the same surgical team using a standardized technique. All patients were monitored and asked to complete a postoperative questionnaire survey one year after surgery. A chest X-ray was performed following the operation in order to assess lung expansion. We analysed the data related to the resolution of the symptoms associated with axillary hyperhidrosis according to the HDSS [5], CS (i.e. occurrence and quantification), degree of patient satisfaction with the surgical outcome and the quality of life associated with CS in the early postoperative period (i.e. first day after the procedure) and in the late postoperative period (i.e. 12 months after the procedure) as reported by the patient and confirmed by the examiner. Each patient's quality of life was assessed based on the patient's statements regarding the degree of CS that they experienced over time.

Patient satisfaction and quality-of-life measures included both the treatment and side effects, particularly CS, and were subjectively graded by the participants for scores between 1 and 4 with 1 referring to dissatisfied, 2 referring to fair, 3 referring to very good and 4 referring to excellent for axillary hyperhidrosis.

Table 1: Preoperative sweating levels according to the hyperhidrosis disorder severity scoring (HDSS)

HDSS		
Grade 1	Minimal	No visible sweating
Grade 2	Mild	Visible sweating
Grade 3	Moderate	Visible and embarrassing sweating
Grade 4	Maximal	At least two clothing changes caused by sweating of the same intensity as the previous axillary hyperhidrosis

Operative technique

All patients underwent general anaesthesia and orotracheal intubation with a simple cannula during surgery. All patients were positioned in a semi-sitting position with their arms raised during the operation. Essentially, to perform the sympathectomy, we used a rigid thoracoscope (0° telescope, Karl Storz, Germany) *via* a 10-mm trocar with an obturator and a cannula. A separate channel was available inside the thoracoscope for the use of the forceps or the aspirator. A 1-cm incision was made in each hemithorax at the third or fourth intercostal space on the mid-axillary line, and then a 10-mm diameter thoracoscope was inserted into the thoracic cavity to identify the T3 and T4 sympathetic ganglion *via* inspection. In order to identify anatomical landmarks, pneumothorax was induced in all patients *via* temporary apnea [6]. An electrocautery hook was inserted to isolate and cut the sympathetic chain at the T3 level or the T3 and T4 levels in Group 2 or Group 1, respectively. After the sympathectomy, the lung was re-expanded under direct viewing, and the air was simultaneously aspirated from the pleural space using a small catheter (i.e. 16 Fr). The same procedure was carried out on the contralateral chain. The catheter was removed, and the incisions were closed using an absorbable suture. The use of a chest drain was not routine.

Statistical analysis

The data were stored in a database and exported to the Statistical Package for Social Sciences, version 14.0 (SPSS Inc., Chicago, IL, USA) for analysis. For categorical variables, the χ^2 test was used. The associations between age, degree of satisfaction and ganglion resection level (i.e. T3–T4 or T3) were investigated using the Kruskal–Wallis one-way analysis of variance (i.e. a non-parametric test), and a *P*-value that was <0.05 was accepted as significant. Significance for all tests was defined at 5%.

RESULTS

Of the 60 patients, 29 were females and 31 were males. The mean age was 25 ± 10.2 years, with a range of 14–42 years. Table 2 presents the distribution of the axillary hyperhidrosis cases according to HDSS and the patients' demographic characteristics according to the HDSS results. Only 2 had axillary hyperhidrosis without palmar hyperhidrosis.

No statistically significant differences were observed between Group 1 and Group 2 for age ($P = 0.56$), gender ($P = 0.81$), duration of surgery ($P = 0.35$), and postoperative satisfaction level ($P = 0.45$), but the incidence and degree of CS were significantly lower in Group 2 than Group 1 at the 1-year follow-up ($P = 0.008$) (Table 3).

The symptoms disappeared completely after the operation in all patients, and the therapeutic success rate was considered to be 100%. No recurrence of axillary hyperhidrosis was reported at the 12-month follow-up in either group. All patients from both groups rated their postoperative satisfaction level for relief from axillary hyperhidrosis at Grades 3 and 4.

The incidence of CS was lower in Group 2 than Group 1 at the 12 month follow-up. More specifically, all (i.e. 100%) Group 1 patients and 34 (i.e. 79%) Group 2 patients experienced CS. Moreover, a statistically significant difference was observed between the postoperative CS grades of the two groups ($P = 0.008$). CS affected more than two regions in 5 patients within Group 1 (i.e. 29%) but only 1 patient within Group 2 (i.e. 2%). The most common site of CS was the back (i.e. for 27 patients in total), followed by the abdominal region (i.e. for 16 patients in total). The incidence and severity of CS for both Groups 1 and 2 are presented in Table 4.

Most patients in both groups were discharged 8–24 h after the surgery. However, 1 patient from Group 1 and 1 from Group 2 experienced a postoperative partial pneumothorax, and 1 patient from Group 1 experienced a haemothorax that did not require a thoracotomy case; these patients were discharged 72 h after the surgery because they required the placement of a chest tube. No postoperative mortality occurred in either group. Pain was transiently experienced by the patients only on the first day and was ameliorated by analgesics in the early postoperative stage for patients in both groups.

Table 2: HDSS and demographic distribution of the patients for axillary hyperhidrosis

	HDSS+1	HDSS+2	HDSS+3	HDSS+4
Number of patient's (*n*)	9	12	16	23
Group 1	–	3	6	8
Group 2	9	9	10	15
Mean age (years)	24.00 ± 8.2	20.33 ± 7.8	23.75 ± 5.9	25.00 ± 6.8
F/M ratio	5/4	5/7	8/8	10/13
General F/M ratio	29/31			
General mean age (years)	25 ± 10.2 (14–42)			

DISCUSSION

Axillary hyperhidrosis is a disease characterized by the excessive production of sweat. This condition commonly affects youth and can create significant psychological and social issues for the patient. Hyperhidrosis is defined as a complex dysfunction of the autonomic nervous system that includes excessive sympathetic activity and compensatory parasympathetic activity. The typical treatment approach focuses on decreasing sympathetic activity and promoting parasympathetic activity *via* a sympathectomy [7–10]. First-line non-surgical therapies involving topical antiperspirants, such as aluminium chloride, are often short-acting, require frequent reapplication, are ineffective in reducing sweat production, and can cause irritant dermatitis [11]. Seven patients (i.e. 12%) in the present study population had been treated for 3 months with topical agents, through which a temporary remission was obtained. Botox injections were recommended when the symptoms reoccurred, and the patients who did not want to pursue this procedure presented at our clinic. The other patients had not received any other treatment for hyperhidrosis. Although injections of botulinum toxin type A are a safe, rapid, relatively durable and effective way to treat symptomatic axillary hyperhidrosis, the subjects in our patient group rejected this treatment approach and preferred to treat hyperhidrosis permanently through surgery.

Sweating can occur for thermoregulatory purposes or be associated with an emotional response. Most sweat glands are of the eccrine type and are usually seen in the axillae, palms and plantar regions. All these glands become active with puberty. This may explain why hyperhidrosis is rarely seen at an early age and generally becomes evident in the second and third decades of life, which is true for our patient population [11, 12] ETS is an effective treatment for axillary hyperhidrosis, i.e. with a success rate of 89%, and a well-established procedure [6, 10, 13]. The operative scars are very small compared with open thoracotomy, which is very important, particularly to young people [3, 10]. We used ETS to accomplish the sympathectomy on account of the aforementioned advantages. Our results were similar to those reported from other studies.

The best ganglia level for sympathectomy and the optimal technique used to interrupt the sympathetic chain remain the subject of debate. Most authors agree on the use of T3–T4 sympathectomy to treat axillary hyperhidrosis [7–9]. Indeed, the results from T3–T4 sympathectomies for the treatment of axillary hyperhidrosis and the subsequent CS have been reported in

Table 3: Demographic characteristics, operation durations, patient satisfaction levels, and compensatory sweating and complication incidences of the patients in Group 1 and Group 2

	Group 1	Group 2	*P*-values
Mean age (years)	25.52 ± 8.63 (16–42)	24.09 ± 8.30 (14–35)	0.56
F/M ratio	8/9	21/22	0.81
Operation time (min)	25 ± 3.3 (18–30)	16 ± 1.5 (13–22)	0.35
Postoperative satisfaction level	*n* = 11 (excellent) (65%) *n* = 6 (very good) (35%)	*n* = 38 (excellent) (88%) *n* = 5 (very good) (12%)	0.45
Compensatory sweating	*n* = 17 (100%)	*n* = 34 (79%)	0.008
Complication	One haemothorax (28-Fr tube), one pneumothorax (small calibre chest tube)	One pneumothorax (small calibre chest tube), one subcutaneous emphysema	

Table 4: Postoperative compensatory sweating incidence, localization and degree in Group 1 and Group 2

Compensatory sweating	Group 1, *n* (%)	Group 2, *n* (%)	*P*-values
Absence	0 (0)	9 (21)	
Presence	17 (100)	34 (79)	0.008
Compensatory sweating location			
Back	8 (47)	19 (45)	
Leg	4 (23)	4 (9)	
Only abdomen	– (0)	10 (23)	
Abdomen with two regions	5 (30)	1 (2)	
Degree			
Back			
1+	–	5 (12)	
2+	1 (6)	7 (16)	
3+	3 (17)	7 (16)	
4+	4 (23)	– (0)	
Leg			
1+	– (0)	2 (5)	
2+	– (0)	2 (5)	
3+	2 (12)	– (0)	
4+	2 (12)	– (0)	
Only abdomen			
1+	– (0)	2 (4)	
2+	– (0)	5 (12)	
3+	– (0)	3 (7)	
4+	– (0)	– (0)	
Abdomen with two regions			
1+	– (0)	– (0)	
2+	2 (12)	– (0)	
3+	– (0)	1 (2)	
4+	3 (18)	– (0)	
Total	17 (100)	34 (79)	

many studies [8, 9]. Munia *et al.* observed that both T3–T4 and T4 sympathectomies were effective in all cases for the treatment of axillary hyperhidrosis at both 1 month and 6 months after the procedure, but CS was seen less commonly following the T4 sympathectomy [10]. Munia and Decampos also reported that cutting fewer levels leads to less reflex sweating in patients with axillary hyperhidrosis, but did not evaluate the effect of the T3 sympathectomy alone. Our aim in this study was to compare the effects of the T3 sympathectomy alone to that of the T3–T4 sympathectomy as used in the treatment of axillary hyperhidrosis patients regarding the treatment effectiveness and degree of postoperative CS. Moreover, since axillary and palmar hyperhidrosis are frequently seen together, another aim of this study was to determine whether both areas could be treated with a single-level incision. However, our study was limited due to the low number of patients who participated in the investigation, particularly in the T3–T4 group. However, the effects of the T3–T4 sympathectomy on axillary hyperhidrosis and CS are well known from previous studies. Therefore, our focus was not to establish the effects of the T3–T4 sympathectomy; rather, we intended to investigate the effectiveness of the T3 sympathectomy in comparison with that of the T3–T4 sympathectomy for the treatment of axillary hyperhidrosis. Furthermore, we demonstrated that a lower CS incidence was observed when the lower incision level was used.

The complication rate associated with thoracoscopic sympathectomy for the treatment of palmar and axillary hyperhidrosis can reach 10% [11, 14]. We encountered early complications in 2 patients in Group 2 and 2 in Group 1. Our total surgical complication rate was 6.6%, which is lower than that of other studies [11, 14]. The most troublesome postoperative side effect reported by patients is CS; yet, the nature of CS after sympathectomy is unknown [12–14]. CS has been reported as less common in patients who underwent denervation of 1 or 2 ganglia when compared with those undergoing denervation of three ganglia [3, 12, 15]. We, therefore, used the T3 sympathectomy to treat axillary hyperhidrosis in patients in Group 2, and we found that CS was less common according to the HDSS in Group 2 than Group 1. In fact, 21% ($n = 9$) of Group 2 reported no CS, while no one in Group 1 patients reported no CS. Severe CS occurred on the back and the abdomen in our series of patients, which is similar to the findings of other studies [3, 10]. CS in more than two regions was present in 1 patient in Group 2 and given a grade of 3, whereas CS in more than two regions was present in 5 patients in Group 1 and rated as a grade of 4. We found that axillary sweating had resolved in the postoperative period in all patients in Group 2 and Group 1.

Another limitation of our study is the fact that the satisfaction expressed by the patients after surgery was subjective. Nevertheless, even if we had incorporated an objective sweating test, these results would have only reflected the findings at one given time under a given emotional state at that time. Unfortunately, no methods have been developed to measure hyperhidrosis over the course of an entire day. However, the main factors contributing to patient satisfaction in the treatment of axillary hyperhidrosis are the resolution of current symptoms with no CS [10, 13]. Axillary hyperhidrosis symptoms resolved after ETS in both groups in our study, and no patients reported recurring symptoms at the end of a year. The lowest satisfaction score was 3 (i.e. very good), and these patients reported some CS symptoms. We observed that resolved axillary hyperhidrosis symptoms with no recurrence for an extended time after surgery satisfied the patients and increased their quality of life even when CS was present.

In conclusion, we found that T3 sympathectomy was as effective as T3–T4 sympathectomy for the treatment of axillary hyperhidrosis in terms of satisfaction level and resulted in a lower CS rate in this study. CS, usually considered a serious side effect of surgical treatment of hyperhidrosis, is cosmetically bothersome and unwanted; therefore, we conclude that T3 sympathectomy is preferable to T3–T4 sympathectomy for the treatment of axillary hyperhidrosis, and another aim of this study was to determine whether both areas (palmar and axillary) could be treated with T3 sympathectomy.

Conflict of interest: none declared.

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