

Compensatory sweating after thoracoscopic sympathectomy: characteristics, prevalence and influence on patient satisfaction*, **

Hiperhidrose compensatória após simpatectomia toracoscópica: características, prevalência e influência na satisfação do paciente

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Abstract

Objective: This prospective study aimed at investigating predictive factors for compensatory sweating after thoracoscopic sympathectomy. **Methods:** From 2000 to 2002, 80 patients (53 females and 27 males) underwent thoracoscopic sympathectomy to treat hyperhidrosis. Patient ages ranged from 12 to 56 years, and the mean post-operative follow-up period was 42.51 ± 5.98 months. Patient satisfaction with the results was evaluated through the use of a rating scale. The procedure was performed bilaterally: at the T2 level for facial hyperhidrosis; at the T3-T4 level for axillary hyperhidrosis; and at the T3 level for palmar hyperhidrosis. **Results:** Post-operatively, 68 patients (85.0%) presented compensatory sweating, which was classified as mild in 23 (33.8%), moderate in 23 (33.8%) and severe in 22 (32.4%). Considering the final surgical results, 70 patients (87.5%) were satisfied with the outcome of the operation, whereas 10 patients (12.5%) were dissatisfied. The level of patient satisfaction varied according to gender, age, body mass index (BMI) and extent of denervation. The compensatory sweating was more severe on the abdomen and back than on the legs. **Conclusions:** Although compensatory sweating, which is a common adverse effect of sympathectomy, occurred in the majority of cases, the level of patient satisfaction was high. The best candidates for thoracoscopic sympathectomy are young adult women with a BMI ≤ 24.9 kg/m².

Keywords: Sympathectomy; Hyperhidrosis; Thoracoscopy; Postoperative complications; Thoracic surgery, video-assisted.

Resumo

Objetivo: Este estudo prospectivo visou investigar fatores preditivos para a hiperidrose compensatória após a simpatectomia toracoscópica. **Métodos:** De 2000 a 2002, 80 pacientes (53 mulheres e 27 homens), com idade entre 12 e 56 anos, foram submetidos à simpatectomia toracoscópica para o tratamento de hiperidrose e acompanhados em média por $42,51 \pm 5,98$ meses. A satisfação destes pacientes quanto aos resultados do procedimento foi aferida por meio de uma escala de avaliação. O procedimento foi executado bilateralmente: no nível de T2 para a hiperidrose facial; de T3 e T4 para a hiperidrose axilar; e de T3 para a hiperidrose palmar. **Resultados:** No período pós-operatório, 68 pacientes (85,0%) apresentaram hiperidrose compensatória, que foi classificada como leve em 23 (33,85%), moderada em 23 (33,8%) e grave em 22 (32,4%). Quanto aos resultados da cirurgia, na avaliação dos pacientes, 70 deles (87,5%) se consideraram satisfeitos, enquanto 10 pacientes (12,5%) disseram estar insatisfeitos. O grau de satisfação do paciente variou de acordo com o sexo, a idade, o índice de massa corpórea (IMC) e a extensão da operação. A hiperidrose compensatória foi mais intensa no abdome e dorso do que nas pernas. **Conclusões:** Embora a hiperidrose compensatória seja um efeito adverso frequente após a simpatectomia, o grau de satisfação dos pacientes foi elevado. Os melhores candidatos para simpatectomia toracoscópica são mulheres adultas jovens com IMC $\leq 24,9$ kg/m².

Descritores: Simpatectomia; Hiperidrose; Toracosopia; Complicações pós-operatórias; Cirurgia torácica vídeo-assistida.

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Introduction

Hyperhidrosis is an idiopathic condition characterized by excessive sweating. Symptoms generally begin in childhood or early adolescence and rarely improve with age. The excessive localized sweating generally occurs either spontaneously or in response to stressful or emotionally charged situations. Severe hyperhidrosis typically affects the palms and feet, with or without axillary involvement. In fact, palmar hyperhidrosis is the most common and most debilitating condition. In severely affected patients, hyperhidrosis can be socially, psychologically and professionally stigmatizing.^(1,2)

Thoracoscopic sympathectomy is a safe and effective method of treating hyperhidrosis, resulting in improved patient quality of life.⁽³⁻⁷⁾ Despite the effectiveness of the method, there can be post-operative complications, the most troublesome of which is compensatory sweating.^(4,5,7,8) In fact, compensatory sweating is the factor that most influences the post-operative quality of life of the patients, and it is said to be a marker of the quality of the sympathectomy.^(3,5) Pre-operative and post-operative patient perceptions regarding the sweating disorder play a major role in post-operative complaints and, consequently, in determining the level of patient satisfaction.⁽⁷⁻⁹⁾

To achieve a high level of patient satisfaction, it is useful to identify some predictive factors for compensatory sweating.⁽¹⁰⁾ Identifying the profile of the ideal candidate for thoracoscopic sympathectomy is of utmost importance and facilitates the appropriate selection of patients. The aim of this study was to investigate predictive factors for compensatory sweating after thoracoscopic sympathectomy, as well as their influence on the frequency, location and severity of compensatory sweating.

Methods

Between February of 2000 and April of 2002, 80 patients underwent video-assisted thoracoscopic sympathectomy for hyperhidrosis in the Thoracic Surgery Department of the Onofre Lopes University Hospital, located in the city of Natal, Brazil. After a mean follow-up period of 42.51 ± 5.98 months, data were available for all 80 patients. The study was approved by the institutional ethics committee and was performed

in accordance with the Helsinki Declaration. Written informed consent was obtained from each patient.

Demographic and pre-operative characteristics of the patients are shown in Table 1. Of the 80 patients included in the sample, 27 (33.7%) were male and 53 (66.3%) were female. The mean age at the time of surgery was 26.83 ± 10.17 years (range, 12-56 years). We collected data related to the duration of the problem, the area(s) affected, precipitating factors, body mass index (BMI) and surgical details, as well as post-operative complications and outcomes. Patient satisfaction with the results was evaluated through the use of a 10-point rating scale based on patient perception (Appendix 1).⁽¹¹⁾ The degree of sweating in the various areas affected (abdomen, back and legs) was scored pre-operatively and post-operatively. Patients completed the scale without any intervention or advice from the interviewer. Post-operative compensatory sweating was graded as follows: 1-4 = mild; 5-7 = moderate; and 8-10 = severe. A score of 10 was indicative of the most severely affected area, and the other scores were given accordingly. Finally, patients were asked whether they

Table 1 - Characteristics of the patient sample (n = 80).

Characteristic	n	%
Gender		
Male	27	33.7
Female	53	66.3
Average patient age		
Adolescent	17	21.3
Adult	56	70.0
Middle-aged	7	8.8
Duration of the problem		
< 1 year	3	3.75
1-5 years	5	6.25
5-10	10	12.5
> 10 years	62	77.5
Hyperhidrosis location		
Axillary	8	10.0
Multi-area	72	90.0
BMI		
< 19.9 kg/m ²	16	20.0
19.9-24.8 kg/m ²	49	61.3
24.9-29.9 kg/m ²	10	12.5
> 29.9 kg/m ²	5	6.3

BMI: body mass index.

were satisfied with the outcome of the procedure. Patients were evaluated and completed the scale on post-operative day 13, in the sixth post-operative month and at one year after the procedure.

Surgical technique

All patients underwent surgery in the supine position with both arms elevated at 45 degrees. The patients received general anesthesia and were submitted to endotracheal intubation using a single-lumen tube. Subsequently, two ports were placed. The first incision (20 mm) was made anteriorly. The endotracheal tube was briefly disconnected by the anesthesiologist in order to deflate the lung during entry into the pleural cavity, thereby avoiding damage to the lung parenchyma. A 10-mm blunt-tip trocar was introduced for the use of a 30-degree endoscope (Olympus Winter & Ibe, Hamburg, Germany), and pneumothorax was induced via CO₂ insufflation up to 10 mmHg. A 1-cm incision was made in the third intercostal space below the axilla, and an additional 5-mm trocar was placed for the introduction of a monopolar hook electrode for cautery. The sympathetic chain was identified at the level of the second, third, and fourth rib heads. The procedure was performed bilaterally: at the T2 level for facial hyperhidrosis; at the T3-T4 level for axillary hyperhidrosis; and at the T3 level for palmar hyperhidrosis. When

patients were treated for more than one area, multiple segments were incised, although the rest of the chain was left intact. The pneumothorax was aspirated using a chest tube, which was removed after total aspiration. A chest X-ray was performed after surgery to verify complete lung expansion. Patients were discharged on the first post-operative day.

Statistical analysis

Data were stored in a database and exported to the Statistical Package for the Social Science, version 14.0 (SPSS Inc., Chicago, IL, USA) for analysis. Pearson's chi-square test, Fisher's exact test, means and standard deviations were used as appropriate.

Results

There were no deaths or major peri-operative complications in our patient sample. The patients required an overnight hospital stay. The mean surgical time was 20 min (range, 10-30 min). Sixty-eight patients (85.0%) presented post-operative compensatory sweating, which was classified as mild/moderate or severe (Table 2).

We found that 70 patients (87.5%) were satisfied with the outcome of the operation, whereas 10 patients (12.5%) were dissatisfied. Women presented the highest level of satisfaction ($p = 0.026$), accounting for 71.4% of the satisfied

Table 2 - Severity of compensatory sweating on the abdomen and back according to gender, age, body mass index and number of ganglia denervated.

Variable	Abdomen					Back				
	Mild/Mod		Severe		p	Mild/Mod		Severe		p
	n	%	n	%		n	%	n	%	
Gender										
Male	11	45.8	13	54.2	0.001**	13	54.2	11	45.8	0.012**
Female	32	84.2	6	15.8		34	82.9	7	17.1	
Age bracket										
Adolescent	11	91.7	1	8.3	0.016*	11	84.6	2	15.4	0.133*
Adult	30	69.8	13	30.2		33	73.3	12	26.7	
Middle-aged	2	28.6	5	71.4		3	42.9	4	57.1	
BMI										
≤ 24.9 kg/m ²	36	73.5	13	26.5	0.172**	41	78.8	11	21.2	0.504**
> 24.9 kg/m ²	7	53.8	6	46.2		6	46.2	7	53.8	
Resected ganglia (n)										
1	10	90.9	1	9.1	0.217*	11	84.6	2	15.4	0.241*
2	20	66.7	10	33.3		24	75.0	8	25.0	
3	13	61.9	8	38.1		12	60.0	8	40.0	

BMI: body mass index; and Mod: moderate. *Fisher's exact test. **Pearson's chi-square test.

Table 3 – The degree of patient satisfaction according to gender, age range, body mass index and denervation site.

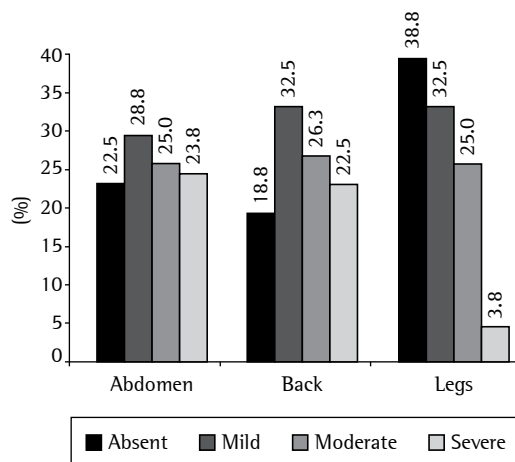
Variable	Satisfied		Dissatisfied		p*
	N	%	N	%	
Gender					
Male	20	74.1	7	25.9	0.026
Female	50	94.3	3	5.7	
Age bracket					
Adolescent	16	94.1	1	5.9	0.001
Adult	51	91.1	5	8.9	
Middle-aged	3	42.9	4	57.1	
BMI					
≤ 24.9 kg/m ²	62	95.4	3	4.6	<0.001
> 24.9 kg/m ²	8	53.3	7	46.7	
Resected ganglia (n)					
1	19	95.0	1	5.0	0.009
2	35	94.6	2	5.4	
3	16	69.6	7	30.4	

BMI: body mass index. *Fisher's exact test.

patients, whereas 70.0% of the dissatisfied patients were men (Table 3). Patient satisfaction also varied according to age, BMI and extent of denervation. Of the 7 middle-aged patients, 4 (57.1%) were dissatisfied ($p = 0.01$). Of the 65 patients with a BMI ≤ 24.9 kg/m², 62 (95.4%) were satisfied. In contrast, only 8 (53.3%) of the 15 patients with a BMI > 24.9 kg/m² were satisfied ($p = 0.001$). With respect to the incision of the sympathetic chain, patients who underwent denervation of 1 or 2 ganglia were significantly more likely to have a favorable opinion of the outcome, which was held by 95.0% and 94.6%, respectively, than were those undergoing denervation of 3 ganglia, only 69.6% of whom reported being satisfied ($p = 0.009$).

The severity of compensatory sweating depended on the area affected (abdomen, back or legs). Of the 80 patients evaluated, only 12 (15.0%) presented no compensatory sweating, 4 (5.0%) presented compensatory sweating at one site, and 64 (80.0%) presented compensatory sweating at two or more sites. Severe compensatory sweating occurred on the abdomen and the back, respectively, in 19 (23.8%) and 18 (22.5%) of the patients (Figure 1). However, only 7 (3.8%) presented compensatory sweating on the legs. The severity of compensatory sweating on the abdomen and back was analyzed according to gender, age, BMI and number of ganglia denervated (Table 2). Among the 11 adolescent patients who presented compensatory sweating,

abdominal sweating was severe in only 1 (8.3%), compared with 13 (30.2%) of the adult patients and 5 (71.4%) of the middle-aged patients ($p = 0.016$). In addition, the proportion of patients reporting compensatory sweating on the abdomen was greater among males than among females (54.2% vs. 15.8%; $p = 0.001$). Of the 7 patients with a BMI > 24.9 kg/m², 4 (53.8%) presented compensatory sweating on the back, a significantly higher proportion than that observed for the patients a BMI ≤ 24.9 kg/m² ($p = 0.018$). The proportion of patients reporting compensatory sweating on the back was also

**Figure 1** – Severity of compensatory sweating as a function of the affected area.

greater among males than among females (45.8% vs. 17.1%; $p = 0.012$).

Discussion

Although thoracoscopic sympathectomy is a well-established treatment for hyperhidrosis, it is empirical in nature, and compensatory sweating is a quite common adverse effect that plays a major role in determining the level of patient satisfaction.^(5,7-10,12) The reported incidence of post-operative compensatory sweating ranges from 30% to 84%.⁽¹²⁾ There have been discrepancies among studies in terms of the results and complication rates reported, due in part to the lack of clear-cut criteria for selecting surgical candidates, failed procedures, complications and side effects, as well as to differences in the collection of short- and long-term follow-up data.⁽⁵⁾ In the present study, 85% of the patients presented compensatory sweating. High rates of compensatory sweating are expected in countries with hot and humid climates, given that climate plays a major role in the occurrence of compensatory sweating, as demonstrated in two studies conducted in Taiwan,^(13,14) in which 98% of the patients evaluated complained of compensatory sweating. In a study conducted in Brazil, the reported rate of compensatory sweating was 63%.⁽⁵⁾

Although post-operative compensatory sweating is quite common, it rarely impairs patient quality of life,^(5,8,9,12) and the level of patient satisfaction with the surgical outcome is therefore quite high. In one study, it was reported that, although the rate of compensatory sweating was high (63%), 79.7% of the patients were completely satisfied with the outcome of the operation, having experienced immediate and permanent relief from the sweating or other symptoms.⁽⁵⁾ Our findings are in agreement with those of that report. Despite the fact that the compensatory sweating rate was 85%, 87.5% of the patients were satisfied with the outcome of the operation. The high degree of patient satisfaction might be attributable to the fact that the compensatory sweating caused neither social nor professional embarrassment. In fact, the compensatory sweating was severe in only 22 (32.4%) of the 68 patients affected.

Many factors might play a role in the occurrence of compensatory sweating. In a study involving 134 patients,⁽¹⁵⁾ the influence that

age, gender, family history and combined plantar hyperhidrosis have on the occurrence and severity of post-operative compensatory sweating was studied using multivariate analysis. The authors found that age was the sole variable associated with a statistically significant increase in the occurrence of compensatory sweating but not with that of severe compensatory sweating. This is in agreement with the age-related differences observed in our study sample, in which the satisfied group consisted mainly of adults and adolescents (72.8 and 22.8%, respectively). However, our findings differed in other aspects, such as the influence of gender, the level of satisfaction being significantly higher among the females evaluated in our study ($p = 0.026$).

Nutritional state is another important point to consider. One group of authors showed that higher BMI predisposes to more severe post-operative compensatory sweating, although this is not necessarily reflected in patient level of satisfaction.⁽⁸⁾ The authors suggested that patients with high BMI presented profuse sweating on the abdomen and back prior to surgery, and that the level of patient satisfaction was influenced not only by the result but also by expectations with regard to complications. They considered greater patient awareness of all possible side effects to play an important role in determining the level of satisfaction. This was not entirely the case for our results, in which BMI also affected the level of satisfaction. Although all of our patients were duly informed regarding the possible side effects, those with a BMI > 24.9 kg/m² were more likely to report dissatisfaction. In fact, the influence of BMI on the severity of compensatory sweating and on the level of patient satisfaction has not been widely investigated.

The extent of denervation has frequently been addressed in recent years.^(3,9,13,16,17) One study showed that patients submitted to one-port sympathectomy present better outcomes in terms of length of hospital stay, rate of post-operative pneumothorax, and the need for chest tube placement, although the number of ports was not found to correlate with the level of patient satisfaction.⁽¹⁶⁾ Another study analyzed the effectiveness of and complications following one- and two-ganglion resection in patients with palmar hyperhidrosis. The effectiveness of the one-ganglion resection was less than optimal due to a high rate of post-operative

compensatory sweating. It was concluded that two-ganglion (T2 and T3) resection is preferable because it improved satisfaction rates. In fact, the rate of compensatory sweating was lower among the patients submitted to two-ganglion resection, even if it may subsequently cause compensatory sweating of slightly greater severity.⁽¹³⁾ This remains the subject of debate. In another study, 24 patients underwent T2-T3 sympathectomy and 30 patients underwent selective T3 sympathectomy. It was found that one-ganglion thoracoscopic sympathectomy resulted in a fewer disturbing side effects than did the two-ganglion version of the procedure.⁽¹⁷⁾

The severity of compensatory sweating might be reduced by limiting the extent of the denervation. When denervation is restricted, compensatory sweating is expected to be mild.⁽¹²⁾ Selective T3 sympathectomy resulted in a lower rate of compensatory sweating rate (17%), compared with conventional T2 and T3 sympathectomy (46%).⁽¹⁷⁾ These results are consistent with our findings, since our patients who underwent more limited denervation, especially when the sympathectomy was performed at the lower levels, were more likely to have a favorable outcome.

The body area affected by compensatory sweating is another important point. In a recent study it was reported that the areas most often affected by compensatory sweating were the chest, back, legs, abdomen, thighs and groin.⁽¹⁾ In fact, the most common locations for compensatory sweating described in the literature, and corroborated in our study, are the abdomen, back, feet and buttocks.^(18,19) The present study also addressed the relationship between the severity of compensatory sweating and the affected area, as well as the roles played by age, gender and BMI. It was found that compensatory sweating on the chest was generally mild for adolescents and young adults, whereas it was generally severe for middle-aged patients. On the chest and on the back, compensatory sweating was generally mild or moderate in women. Patients with a BMI ≤ 24.9 kg/m² presented mild compensatory sweating on the back. It would be quite interesting to compare our findings with those of other studies. However, there is a paucity of data on this topic in the literature.

Sympathectomy is a safe and effective method of treating hyperhidrosis. However, the incidence of post-operative compensatory sweating is high. In most cases, it is tolerable and does not represent a social or occupational handicap. Patients are inconvenienced only when their symptoms are severe or when they do not receive adequate information prior to the procedure. Patients must always be advised of this potential complication before they decide to undergo surgery. In the present study, a number of factors were found to be related to the occurrence and severity of compensatory sweating. Based on our findings, we can conclude that the ideal candidate is a young adult female with a BMI < 25 kg/m². To prevent compensatory sweating, appropriate patient selection is required. In addition, limited denervation, especially when the sympathectomy is performed at the lower levels, is advisable. Our results are encouraging and should stimulate further comparative studies to investigate this important issue.

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Appendix 1 – Sweating scores.

Location	Score (0-10)	
	Before surgery	After surgery
Palms		
Armpits		
Face		
Feet		
Abdomen		
Back		
Legs		

Source: Andrews & Rennie.⁽¹¹⁾