

Compensatory Sweating After Upper Thoracic Sympathectomy. Prospective Study of 123 Cases

J. Moya,^{a,b} R. Ramos,^{a,b} N. Vives,^c J. Pérez,^a R. Morera,^a V. Perna,^a R. Villalonga,^d and G. Ferrer^a

^aServicio de Cirugía Torácica, Hospital Universitari de Bellvitge, L'Hospitalet del Llobregat, Barcelona, Spain.

^bDepartament d'Anatomia Humana i Embriologia, Facultat de Medicina, Universitat de Barcelona, Barcelona, Spain.

^cServicio de Medicina Preventiva, Hospital Universitari de Bellvitge, L'Hospitalet del Llobregat, Barcelona, Spain.

^dDepartament d'Anestesiologia i Reanimació, Hospital Universitari de Bellvitge, L'Hospitalet del Llobregat, Barcelona, Spain.

OBJECTIVE: The most unpleasant consequence of upper thoracic sympathectomy is compensatory sweating (CS). Depending on the series, the incidence of CS ranges from 24% to 85%. The aim of this study was to determine the relation between CS and the following factors: distribution of hyperhidrosis, procedure performed (unilateral, synchronic bilateral, or sequential bilateral), and number of sympathetic ganglia eliminated. In addition, the degree of patient satisfaction was recorded as objectively as possible.

PATIENTS AND METHODS: Prospective study of 123 patients who underwent upper thoracic sympathectomy for palmar and/or axillary hyperhidrosis between 1 January, 1996 and 1 June, 2002 at our unit. All patients completed a questionnaire on symptoms 8 weeks before and after surgery to determine postoperative changes in distribution of the hyperhidrosis and the overall degree of satisfaction on a scale of 0 to 4.

RESULTS: The sensation of CS was reported by 86.1% of the patients. When asked to relate this sensation to changes in sweating intensity in specific parts of the body, 46.54% reported CS and 48.37% no change. The trunk was the only region where statistically significant increases in CS occurred; in the feet, a decrease in sweating was noted. No differences in CS were observed with respect to the type of surgery or the number of sympathetic ganglia eliminated. The overall results were considered very satisfactory or quite satisfactory by 84.55% of the patients, while 4.88% were very dissatisfied.

CONCLUSIONS: Although CS is a side effect of upper thoracic sympathectomy, not all patients are affected by it. Significant CS occurs mainly in the back, chest, and abdomen. Neither the type of intervention nor the number of ganglia eliminated has an effect on CS. This side effect notwithstanding, overall satisfaction with the treatment is very satisfactory given that the palmar hyperhidrosis is eliminated.

Key words: *Primary hyperhidrosis. Compensatory sweating. Social consequences. Extension of sympathectomy.*

Correspondence: Dr. J. Moya.
Servicio de Cirugía Torácica. Hospital Universitari de Bellvitge.
C/ Feixa Llarga, s/n. 08907 L'Hospitalet del Llobregat. Barcelona, España.
E-mail: jmoya@ub.edu

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Sudación compensatoria secundaria a la simpaticólisis torácica superior. Estudio prospectivo de 123 casos

OBJETIVO: La consecuencia más desagradable de la simpaticólisis torácica superior es la sudación compensatoria (SC), que oscila entre el 24 y el 85% según las series. El objetivo de este trabajo es determinar la relación de la SC en función de su distribución, del procedimiento realizado (unilateral, bilateral secuencial o sincrónica) y del número de ganglios simpáticos eliminados, así como registrar el grado de satisfacción obtenido, de la forma más objetiva.

PACIENTES Y MÉTODOS: Estudio prospectivo de 123 pacientes intervenidos de simpaticólisis torácica superior por hiperhidrosis palmar y/o axilar, entre el 1 de enero de 1996 y el 1 de junio de 2002, en nuestro servicio. Todos ellos completaron, 8 semanas antes de la intervención y 8 semanas después, un cuestionario epidemiológico donde se registraban la distribución de la hiperhidrosis respecto a cómo era antes de la intervención y el grado de satisfacción global tras la intervención mediante una escala del 0 al 4.

RESULTADOS: La sensación de SC se presentó en el 86,1% de los pacientes. Al relacionar esta sensación con la variación de intensidad de la sudación en las diferentes partes del cuerpo, el 46,54% reconoció sufrir SC, mientras que el 48,37% no presentó cambios. Sólo las regiones del tronco habían experimentado cambios en cuanto a la SC de una forma estadísticamente significativa, y en los pies se apreció una disminución del sudor. No se observaron diferencias en cuanto al tipo de intervención realizada ni al número de ganglios eliminados. El grado de satisfacción global fue muy aceptable en el 84,55% de los pacientes, mientras que un 4,88% no aceptaron el resultado de la intervención.

CONCLUSIONES: La SC es un efecto secundario de la simpaticólisis torácica superior que no se presenta en la totalidad de los pacientes intervenidos. Predomina en la espalda, el tórax y el abdomen de manera significativa. No se ve modificada por el tipo de intervención ni por el número de ganglios eliminados. A pesar de este efecto secundario, la satisfacción global de la intervención es muy aceptable dada la eliminación de la hiperhidrosis palmar.

Palabras clave: *Hiperhidrosis primaria. Sudación compensatoria. Repercusión social. Extensión de la simpaticólisis.*

Introduction

Palmar and axillary hyperhidrosis affects 1% of the population and cases in which excessive sweating presented in 30% to 50% of individuals in certain families have been described.^{1,2} Emotional stimulants can cause generalized sweating throughout the body, although this is more evident in areas with greater glandular density.^{3,4} Currently, the standard treatment for palmar and axillary hyperhidrosis is bilateral upper thoracic sympathectomy of the second and third thoracic ganglia (T2-T3) for palmar hyperhidrosis and T2-T4 for axillary hyperhidrosis. These ganglia, however, affect a wider area than just the palmar and axillary regions.⁵⁻¹¹ Typically, the average interval between emergence of symptoms and surgery is 11 years.^{12,13}

Surgical sympathectomy involves the thoracoscopic ablation of the aforementioned thoracic sympathetic ganglia. Findings from our series and most of those we consulted revealed a high degree of patient satisfaction due to anhidrosis (98% of cases) and hypohidrosis (1.5% of cases) in the target areas, with a complication rate under 2.5%.^{7,14}

The effects of bilateral upper thoracic sympathectomy are, by definition, irreversible; nonetheless, some authors have reported recurrence—even several years after surgery—in a few isolated cases. A common side effect of bilateral upper thoracic sympathectomy is compensatory sweating, the incidences of which in the 3 series we consulted were 24%, 40%, and 85%.^{12,15,16}

The objective of this study was to determine the proportion of overall compensatory sweating according to *a*) distribution; *b*) procedure performed (unilateral, sequential bilateral, or synchronic bilateral), and *c*) the number of sympathetic ganglia eliminated (T2-T3 or T2-T4). We also assessed the relation between postsurgical degree of overall satisfaction and the emergence or not of compensatory sweating.

Patients and Methods

This was a prospective study of patients with primary hyperhidrosis treated by upper thoracic sympathectomy at our unit between January 1996 and June 2002 after the therapeutic failure of other medical interventions.

A complete preoperative medical history was taken, with chest x-ray, simple spirometry, electrocardiogram, and standard laboratory workup including measurement of thyroid hormones. All patients completed a questionnaire on symptoms 8 weeks before and after surgery.

The surgical procedure for upper thoracic sympathectomy was as follows: *a*) general anesthesia with selective intubation; *b*) dorsal decubitus positioning with chest inclined 30° and the patient turned 15° laterally towards the nonintervention side; *c*) 8 mm thoracotomy at the third intercostal space and midaxillary line; *d*) complete ipsilateral lung collapse and identification of the sympathetic chain, located 0.5 cm to 1 cm laterally from the head of the rib; *e*) sympathectomy of the T2-T3 ganglia (palmar hyperhidrosis) or T2-T4 ganglia (axillary hyperhidrosis) by 30 W monopolar electrocoagulation (5 to 12 brief electric discharges), and *f*) after assuring complete lung

TABLE 1
Questions Related to Compensatory Sweating Included
in the Postoperative Questionnaire

- | |
|--|
| A. Have you noticed sweating in different areas of your body?
1. Yes
2. No |
| B. What is your sweating like on the specific parts of the body shown in the picture, in comparison to sweating in those regions before surgery?
0. Decrease in sweating
1. No change
2. Visible increase in sweating |
| C. How satisfied are you with the sweating that you currently have in the various parts of your body?
0. Very dissatisfied
1. Dissatisfied
2. Somewhat satisfied
3. Quite satisfied |

reexpansion, closure of the incision without a chest tube.

Surgery was unilateral in 5 cases (4.07%), sequential bilateral in 31 (25.20%), and synchronic bilateral in 87 (70.73%). In the sequential bilateral procedures, the average interval between operations was 6 months.

All patients were informed of the possible postoperative emergence of compensatory sweating—defined as “patient-reported sweating after surgery in body areas with no preoperative sweating or, alternatively, increased sweating in other areas, regardless of degree of satisfaction or anxiety caused by the sweating.”

The specific questions from the questionnaire used to measure postoperative changes in sweating are described in Table 1.

The SPSS 11.0 Statistical Software Package (SPSS; Chicago, IL, USA) was used for data analysis. The χ^2 test was used to analyze qualitative variables and the McNemar test to analyze the matched paired data before and after the intervention. A *P* value less than .05 was considered significant.

Results

One hundred twenty-three patients with a mean age of 28.9 years (range, 14-55) participated in the study. Of these, 75.6% (n=93) were women.

The question, “Have you had a sweating sensation in other areas of your body?” was answered affirmatively by 86.1% (n=106) of the patients. We considered an affirmative response to indicate the patient was aware of compensatory sweating.

When asked to associate this subjective sensation of generalized sweating to changes in sweating intensity in specific parts of the body, 48.37% of patients reported no change, 46.54% compensatory sweating, and 4.98% a decrease in sweating (Figure, Table 2).

Significant changes ($P<.05$) in sweating intensity in specific parts of the body before and after the intervention were found only in the trunk region; no significant changes were found in the lower extremities. Logically, changes occurring in the upper extremities are not included in this table.

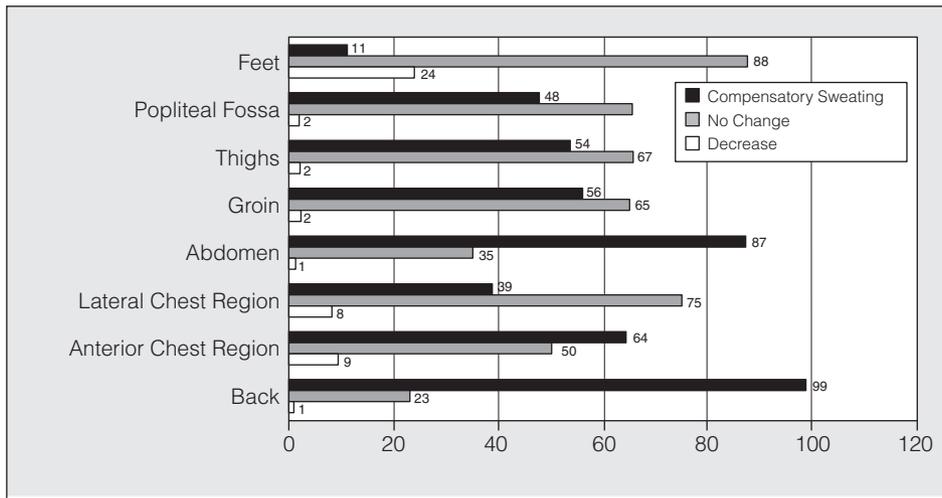


Figure. Anatomical distribution of sweating in 123 cases treated by upper thoracic sympathectomy. No change was reported by 48.37%, compensatory sweating by 46.54%, and a decrease in sweating by 4.98%.

Patient-reported degree of satisfaction after the intervention was as follows: 84.55% (n=104) were very or quite satisfied, 10.57% (n=13) dissatisfied, and 4.88% (n=6) very dissatisfied (Table 3).

The only significant difference ($P<.05$) observed between type of intervention and changes in sweating intensity in specific parts of the body was between unilateral and bilateral surgery in areas on the back.

When we analyzed the relation between changes in sweating intensity in specific parts of the body and the number of ganglia eliminated, the only significant difference observed was greater compensatory sweating in the anterior leg region with T2-T4 sympathectomy than with T2-T3 sympathectomy. No changes were found in other areas (Table 4).

Discussion

The results clearly show that compensatory sweating, with an incidence in our study of 46.54%, is a direct consequence of upper thoracic sympathectomy. A prospective study carried out by Andrews and Rennie¹³ showed a greater incidence of compensatory sweating (85% of cases), with a significant difference ($P<.001$) in the trunk region. In their study, compensatory sweating was severe in 23% of the cases, moderate in 39%, and slight in 23%. Perhaps the most obvious difference between our results and those of Andrews and Rennie was the method used to assess such sweating.

Compensatory sweating emerges shortly after surgery and is unrelated to the patient's level of anxiety or stress, but rather to changes in room temperature or physical effort.¹⁶

With respect to the distribution of compensatory sweating before and after surgery, we observed statistically significant changes in the back, anterior chest region, abdomen, and feet.

Upon analysis of the relation between compensatory sweating and the type of intervention performed, the only

TABLE 2
Distribution of Compensatory Sweating According to Anatomical Region

Anatomical Region	Sweating		
	Increase (%)	No Change (%)	Decrease (%)
Feet	8.94	71.54	19.51
Popliteal fossa	39.02	59.34	1.63
Thighs	43.90	54.47	1.63
Groin	45.53	52.84	1.63
Abdomen	70.73	28.45	0.81
Lateral chest region	31.70	60.97	6.5
Anterior chest region	52.03	40.65	7.32
Back	80.49	18.70	0.81
Mean	46.54	48.37	4.98

TABLE 3
Relation Between Changes in Sweating Intensity in Specific Parts of the Body and Degree of Satisfaction

Degree of Satisfaction	Percentage
Very satisfied	23.57
Quite satisfied	60.98
Dissatisfied	10.57
Very dissatisfied	3.25
Extremely dissatisfied	1.63

TABLE 4
Comparison of Degree of Compensatory Sweating (CS) and Number of Sympathetic Ganglia Eliminated

Anatomical Region	Type of Surgical Intervention			
	Palmar		Palmar-Axillary	
	Increase in CS, %	P	Increase in CS, %	P
Back	81.48	.009	83.38	.002
Anterior chest region	50	.710	64.51	1.000
Abdomen	68.75	.018	75.60	.000
Groin	39.13	.124	45.16	.486
Thigh	42.30	.690	48.14	.040
Popliteal fossa	39.39	1.000	43.75	.188

significant difference we observed was less sweating in the back after unilateral thoracic sympathectomy than with bilateral thoracic sympathectomy.

It is important to remember that these results do not measure a quantitative increase or decrease in sweating, but only a qualitative change. Nonetheless, we may conclude that, postoperatively, sweating increased in the back and abdomen and decreased (hypohidrosis) in the feet (trunk and lower extremity disassociation).

Differences in postoperative sweating between the back and feet occurred after both sequential bilateral and synchronic bilateral surgery; that is, both types of intervention produced the same result. The fact that no compensatory sweating was observed in the contralateral upper extremity in any of the cases treated by unilateral sympathectomy is difficult to interpret. However, in a previous study we reported finding fewer pathological lesions (accumulation of lipofuscin and chromatolysis) when resected ganglia from second interventions were examined and compared to ganglia from first interventions.¹⁷

Some authors believe that the frequency of compensatory sweating is directly related to the number of ganglia resected so that a frequency of 40% after T2 sympathectomy will increase by up to 24% more if the sympathectomy is extended to include the T2, T3, T4, T5, and T6 ganglia.¹⁵ In our series, the presence or not of excessive postoperative sweating was independent of the number of ganglia eliminated; resection of both the T2-T3 and T2-T4 ganglia resulted in a significant change in sweating intensity in the back, abdomen, anterior chest region, and feet. We have observed that exeresis of T2-T4 compared to T2-T3 produces significantly more compensatory sweating in the anterior leg region, which is not among the areas most affected by the phenomenon, as we have mentioned previously. Lai et al¹⁸ and Lesèche et al¹⁹ found no differences between the number of sympathetic ganglia resected (T2 compared to T2-T3) and the degree of compensatory sweating, results that coincide with our findings but differ from those reported by Hederman¹⁵ and Yoon et al.²⁰ As a result, the mechanism through which such sweating develops is still unclear.

Despite the degree of postoperative compensatory sweating, the percentage of patients who are very satisfied is much higher than those who are dissatisfied.

In conclusion, our study indicates that the emergence of compensatory sweating is a side effect of upper thoracic sympathectomy and that it occurs principally on the back, the anterior chest region, and abdomen, while much less occurs on the feet. Neither the number of sympathetic ganglia eliminated nor the type of intervention has an effect on compensatory sweating. Overall patient satisfaction is unaffected by the degree of such postoperative sweating because it arises mainly as a result of changes in room temperature rather than as an anticipatory response to stressful or important activities as happens with palmar hyperhidrosis. Given that not all

patients are affected by compensatory sweating, we believe it is worthwhile to study the basal sympathetic activity of these patients to try to identify distinct groups of primary hyperhidrosis patients.

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