Original Article

Endoscopic thoracic sympathectomy for primary hyperhidrosis: an over a decade-long follow-up on efficacy, impact, and patient satisfaction

Néstor J. Martínez-Hernández[1,2]^, Míriam Estors-Guerrero[2], José M. Galbis-Caravajal[2], David Hervás-Marín[3]^, Amparo Roig-Bataller[2]

[1]Department of Thoracic Surgery, Ascires Biomedical Hospital, València, Spain; [2]Department of Thoracic Surgery, University Hospital of la Ribera, Alzira, València, Spain; [3]Department of Applied Statistics and Operations Research and Quality, Universitat Politècnica de València, València, Spain

Contributions: (I) Conception and design: NJ Martínez-Hernández; (II) Administrative support: JM Galbis-Caravajal, M Estors-Guerrero, A Roig-Bataller; (III) Provision of study materials or patients: NJ Martínez-Hernández, M Estors-Guerrero, JM Galbis-Caravajal; (IV) Collection and assembly of data: NJ Martínez-Hernández; (V) Data analysis and interpretation: D Hervás-Marín, NJ Martínez-Hernández, A Roig-Bataller; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Néstor J. Martínez-Hernández, MD, PhD. Department of Thoracic Surgery, University Hospital of la Ribera, Alzira, Tres Cruces Avenue, València 46014, Spain; Department of Thoracic Surgery, Ascires Biomedical Hospital, València, Spain. Email: nessmartinez@gmail.com.

Background: Endoscopic thoracic sympathectomy is a well-known and effective treatment for palmar and axillary primary hyperhidrosis (PHH). Its most frequent drawback and the main complaint among patients who underwent surgery is the appearance of compensatory sweating (CS). To date, no long-term studies using internationally standardized tools have assessed the efficacy and impact of this surgery on patients. In this study we performed a very long-term follow-up of the patients using an internationally validated tool. The aim of this article is to assess the technique as a treatment for hyperhidrosis, focusing on its long-term efficacy, side effects (CS), and patient satisfaction with the procedure.

Methods: A closed cohort study was performed conducting a review of the clinical records to identify 100 consecutive patients who underwent bilateral endoscopic thoracic surgery with a minimum follow-up period of 2 years. Patients with diagnoses other than primary palmar or axillary hyperhidrosis or those for whom follow-up was impossible were excluded. A structured telephone survey, including the International Hyperhidrosis Society "Hyperhidrosis Disease Severity Scale" (HDSS) was conducted for all patients. Data were summarized using median (1st and 3rd quartiles) for quantitative variables and relative and absolute frequencies for qualitative variables. To study the likelihood of a patient recommending the surgery, a Bayesian logistic regression model was used reporting results as odds ratio (OR).

Results: A total of 91 patients were included in the follow-up. The median follow-up duration was 10.66 (5.68, 11.98) years. The most affected zone was the hands (29.67%), and the most common sympathectomy levels were R2 and R3 (68.13%). The overall surgical efficacy rate was of 94.50% and CS appeared in 36.26% of the patients, with 75.76% of these cases being mild and severe in only one patient. In total, 97.8% of patients improved their HDSS score after surgery. The OR of recommending the surgery for a lower HDSS index was 0.24 and 0.18 for the apparition of CS. Despite it, 91.21% of patients recommend the surgery, with an overall satisfaction rate of 93.95%.

Conclusions: Endoscopic thoracic sympathectomy is an effective and safe treatment for palmar and axillary PHH, with a relatively low rate of CS which, when present, is typically mild, making it a highly satisfactory treatment option for patients.

Keywords: Hyperhidrosis; sympathectomy; sweating; thoracic surgery

^ ORCID: Néstor J. Martínez-Hernández, 0000-0002-5529-9615; David Hervás-Marín, 0000-0003-0635-4961.

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Introduction

Hyperhidrosis, as defined by the Society of Thoracic Surgeons, is a pathologic condition characterized by excessive sweating that exceeds the physiological requirement for thermoregulation (1). It can be due to a defined cause, which is referred to as secondary hyperhidrosis. Although it can sometimes be localized, secondary hyperhidrosis usually presents as generalized sweating. Its underlying causes include a broad range of endocrine (thyroid, diabetic or corticoid pathology), infectious or even tumoral etiologies, along with several other systemic medical conditions (2).

Highlight box

Key findings

- Bilateral endoscopic thoracic sympathectomy (BETS) demonstrated a long-term efficacy rate of 94.5% in treating palmar and axillary primary hyperhidrosis, with a median follow-up of over a decade.
- Compensatory sweating (CS) occurred in 36.26% of patients, mostly mild, with only one case of severe CS reported.
- Patient satisfaction remained high, with 93.95% expressing satisfaction, and 91.21% recommending the surgery.

What is known and what is new?

- BETS is an effective treatment for primary hyperhidrosis, with CS being the most significant concern. Previous studies have shown high patient satisfaction but often lacked long-term follow-up with validated tools.
- This study provides one of the longest follow-ups using a validated diagnostic tool (International Hyperhidrosis Society "Hyperhidrosis Disease Severity Scale"), providing robust evidence of the sustained efficacy and patient satisfaction of BETS over more than a decade.

What is the implication, and what should change now?

- The study emphasizes the need for thorough patient education on CS and long-term outcomes. Given the high efficacy and satisfaction, BETS should remain a recommended option for suitable candidates, with a focus on informed consent highlighting CS risks.
- Surgeons should be fully aware of the long-term implications of sympathectomy, to provide comprehensive information to patients. Additionally, the use of validated tools in follow-up assessments should be standardized in clinical practice to ensure consistent and accurate evaluation of patient outcomes.

Conversely, primary hyperhidrosis (PHH) lacks a defined cause and typically presents as a localized problem, most commonly affecting palms, axillae or feet (3). While the treatment of secondary hyperhidrosis targets the underlying cause, with sweating being just a symptom which resolves with such treatment (4), PHH is thought to be associated with autonomic dysreflexia, being thus its indicated treatment targets the sympathetic nervous system (1).

PHH typically presents during adolescence or youth and it has a positive familiar history in 35% to 55% of patients (2). The exact prevalence of patients affected by PHH is not well known, but reported prevalences range from 1% to 4.8% (2,4,5). However, only 38% of patients seek medical consultations, leading to underreporting and underdiagnosing, which suggests that the true prevalence may be higher (2,4,6).

Although PHH is a major negative factor affecting quality of life (QOL), the low consultation rates clearly indicate that patients often find it an uncomfortable topic to discuss (6). Moreover, PHH increases the risk of cutaneous infections (7) and causes patients physical discomfort in 40% of affected individuals (2). Nevertheless, its primary impact is on patients' QOL and social interactions. Affected individuals often report an inability to shake hands, hold family members' hand or even write without soaking papers. Consequently, 75% of patients indicate that their sweating negatively affects their social life, emotional well-being and mental health (2). Additionally, over 80% of them have seen their work effectiveness impaired, and 41% indicate that PHH negatively affects their choice of hobbies (2).

PHH can be treated medically with topical therapies (aluminum chloride, glycopyrrolate or iontophoresis) and with oral anticholinergic medications (4). The latter has an efficacy rate of approximately 80% and its effects last only while the medication is taken. Its drawbacks include inherent adverse effects (dry mouth and urinary retention) and the need for continued use to maintain the effects, which cease upon discontinuation (8). Another option is treatment with injected botulinum toxin A (Botox™, Allergan Inc., Dublin, Ireland), with a 90% reported improvement of PHH (8). Its main side effects include pain from the procedure and finger muscle weakness. Furthermore, it is also temporary, with effects lasting

between 3 and 6 months, reappearing after that time the necessity to undergo another session. This makes it not only inconvenient but also economically inefficient due to the cumulative expense of ongoing procedures (9).

Regarding surgical treatment, bilateral endoscopic thoracic sympathectomy (BETS) is a minimally invasive technique requiring two small incisions of approximately 2 cm each in both axillae, rendering them virtually invisible. This procedure achieves success rates of over 90% (1,8). The effects are immediate after the surgery and permanent, eliminating the need for further treatments.

Given the near complete efficacy, the main concern regarding BETS and the main factor that diminishes satisfaction with its results is the occurrence of compensatory sweating (CS) in other areas (10). Therefore, to properly evaluate this treatment, it is essential not only study its efficacy, but also to assess its impact on each patient, particularly focusing on their satisfaction with the surgery and their post-operative QOL. Currently, few studies on patient satisfaction after BETS have been published, and most feature relatively short follow-up periods, ranging between 30 days and 1 year, with only one publication reporting a 5.5-year follow-up. Given that general QOL measures are not useful for this study, these papers have typically used self-developed, non-validated questionnaires (3,5,10,11).

The objective of our study is to present the satisfaction results from a very long-term follow-up of patients with PHH who underwent BETS and were assessed using the validated Hyperhidrosis Disease Severity Scale (HDSS) diagnostic tool of the International Hyperhidrosis Society (12,13). We present this article in accordance with the STROBE reporting checklist (available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-1407/rc).

Methods

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional ethics board of University Hospital of la Ribera (No. PI 010724) and individual consent for this retrospective analysis was waived. A closed cohort study was performed conducting retrospective review of clinical records to identify 100 consecutive patients who underwent BETS before 2022, ensuring a minimum follow-up period of at least 2 years at the time of the survey. Patients diagnosed with conditions other than palmar and axillary PHH or lost during follow-up were excluded.

Telephone interviews were conducted for all patients. The survey questions addressed the patients' degree of improvement in self-confidence and ability to perform activities with their hands. They were also queried about the efficacy of the procedure and overall satisfaction (responses were categorized as yes/no/partially, with corresponding scores of 100, 50, and 0 respectively, to calculate overall satisfaction) and whether they would recommend BETS to a family member, friend or colleague (yes/no) (Table S1).

Regarding CS, seeking the strictest definition, it was based solely on the patients' subjective experience of newly occurring excessive sweating in previously unaffected areas. The patients themselves defined their CS as mild, moderate, or severe, following the definitions provided by the Society of Thoracic Surgeons (Table S1) (1). Preoperatively, the International Hyperhidrosis Society HDSS scale was recorded and at the time of the survey, patients were asked to define their current HDSS status (12,13). A score of 3 or 4 indicates severe hyperhidrosis, whereas a score of 2 or 1 indicates respectively mild or moderate and not existing hyperhidrosis (Table S1). A post-treatment 1-point improvement is associated with a 50% reduction in sweating, while a 2-point improvement corresponds to an 80% reduction (13).

Besides, some authors have suggested that CS range may vary depending on climatic conditions (and therefore, the seasons of the year) (9,10). To avoid such potential bias, all surveys were conducted in June of 2024, a month during which our area has historically averaged a maximum daily temperature of 27.1 ℃ with peaks reaching 40 ℃ and an average relative humidity of 66% (14).

Surgical technique

All patients underwent surgery in the semi-Fowler position with 90° arms abduction. Under general anesthesia, patients' airway was managed with either a laryngeal mask, single-lumen or double-lumen intubation, based on the anesthesiologist's discretion, with a trend in recent years toward the use of the least invasive laryngeal mask. A single 2 cm incision was made in the third intercostal space along the mid-axillary line (just where axillar hair ends). Through blunt dissection, the thoracic cavity was accessed and a 11.5 cm trocar was placed. Using a 10 mm outer diameter, 0° direction view and 27 cm length optic with a working channel (Karl Storz, Tuttlingen, Germany), the sympathetic

Table 1 Patients' demographics and perioperative detail (n=91)

Variables	Value
Follow-up time (years)	10.66 (5.68, 11.98)
Age (years)	27.64 (20.38, 38.45)
Sex	
Women	58 (63.74)
Men	33 (36.26)
Body mass index (kg/m^2)	23 (20, 26)
Affected zone	
Hands	27 (29.67)
Hands and feet	23 (25.27)
Hands and axillae	18 (19.78)
Hands, axillae and feet	10 (10.99)
Axillae	13 (14.29)
Treated levels	
R2	13 (14.29)
R2 and R3	63 (69.23)
R2, R3 and R4	1 (1.1)
R3	1 (1.1)
R3 and R4	13 (14.29)

Data are presented as median (1st, 3rd quartiles) or n (%).

chain was identified. A monopolar hook was introduced through the working channel to cauterize the sympathetic chain at different levels between R2 and R4, based on the surgeon's decision. The procedure was repeated on the contralateral side.

Statistical analysis

Data were analyzed for individuals with complete information on all required variables. The data were summarized using median (1st and 3rd quartiles) for quantitative variables and relative and absolute frequencies for qualitative variables. To study the likelihood of a patient recommending the surgery, a Bayesian logistic regression model was used reporting results as odds ratio (OR) (15,16). All analyses were conducted using R software (version 4.4.1) employing the packages clickR (version 0.9.41), brms (version 2.21.0), and bayestestR (version 0.13.2).

Results

Five patients were excluded due to diagnoses other than PHH (3 with facial flushing and 2 with Raynaud syndromes), and follow-up was not possible for 4 patients. Thus, 91 patients were included in the follow-up and the information of all the variables was completed in all of them. The main characteristics of the patients are summarized in *Table 1*. The median follow-up duration was 10.66 (5.68, 11.98) years. The cohort consisted of 63.74% women (n=58) and 36.26% men (n=33) with a median age of 27.64 (20.38, 38.45) years and a median body mass index of 23 kg/m^2 (20, 26 kg/m^2) (*Table 1*).

All patients had a presurgical HDSS score of 4. The primary affected zones were the hands in 27 patients (29.67%) and both hands and feet in 23 patients (25.27%). The most frequently targeted cauterization levels were R2 and R3 (in 63 patients; 69.23%), followed by R2 alone (13 patients; 14.29%) and R3 and R4 (13 patients; 14.29%) (*Table 1*).

The overall surgical efficacy rate for palmar and axillary hyperhidrosis was 94.50% of the patients; complete (with a 100% score) in 91.21% and partial (50% score) in 6.59% of them. The efficacy for foot hyperhidrosis was scarce; only 5.49%. Regarding the surgical outcomes, 95.6% of patients reported an improvement in their ability to perform activities with their hands, whereas 94.51% reported an improvement in their self-confidence. CS occurred in 33 patients (36.26%), with most patients describing it as mild (75.76%). Only one patient in the entire series experienced severe CS (3.03%). A total of 97.8% of the patients improved their HDSS score after the surgery; 3.3% improved it by one point, 7.69% by two points, and 86.81% to its minimum, meaning thus that 94.5% of the patients experienced a sweating reduction of over 80% (*Table 2*).

In terms of patient overall satisfaction rate, it was of 93.95%; with 91.21% of the patients reporting being completely satisfied (100% score) and 5.49% being partially satisfied (50% score). Moreover, 91.21% of the patients stated that they would or had already recommended the surgery to family and friends (*Table 2*).

The degree of patient satisfaction was closely associated with surgical outcomes. Specifically, a lower post-surgical HDSS index was linked to higher satisfaction. The OR for a lower HDSS index postoperatively was 0.24, indicating that the odds of recommending surgery decrease approximately four-fold for each step up in the HDSS index

Table 2 Patients' survey results (n=91)

Variables	Value, n (%)
Activities with hands	
Better	87 (95.6)
Without changes	4 (4.4)
Self-confidence	
Better	86 (94.51)
Without changes	5 (5.49)
Feet sweating	
Decreased	5 (5.49)
Without changes	79 (86.81)
Increased	7 (7.69)
Surgery efficacy	
Yes	83 (91.21)
No	2 (2.2)
Partially	6 (6.59)
Compensatory sweating	
Yes	33 (36.26)
No	58 (63.74)
Compensatory sweating degree (n=33)	
Mild	25 (75.76)
Moderate	7 (21.21)
Severe	1 (3.03)
Patient satisfaction	
Yes	83 (91.21)
No	3 (3.3)
Partially	5 (5.49)
Surgery recommendation	
Yes	83 (91.21)
No	8 (8.79)
Post-surgical HDSS	
1	79 (86.81)
2	7 (7.69)
3	3 (3.3)
4	2 (2.2)

HDSS, Hyperhidrosis Disease Severity Scale.

(*Figure 1A*). Regarding CS, its OR was 0.18, indicating that its occurrence reduced the odds of recommending the surgery by approximately five-fold. The probability of these effects occurring was 99.8% and 93.3%, respectively (*Figure 1B*; *Table 3*).

Discussion

Among the available therapeutic options for PHH, the surgical strategy is the only one that provides a definitive and entirely effective outcome. However, significant concerns persist among patients and prescribers regarding BETS, primarily due to its notable drawback: the potential development of CS. Consistent with the findings of this study, previous research has demonstrated high patient satisfaction with BETS, despite this side effect (3). Nevertheless, there is a lack of studies that evaluate long-term efficacy and patient satisfaction using internationally validated diagnostic tools.

In fact, this is the main strength of this study: its extended follow-up period, with a median of 10.66 years (5.68, 11.98 years), allows us to assess the long-term acceptability of BETS, which is a critical consideration for patients considering the procedure. Moreover, while previous studies have relied on *ad hoc* surveys designed by the authors, our research employed a structured interview in conjunction with the validated assessment tool from the International Hyperhidrosis Society, to ensure maximum reproducibility and validity (12,13). One limitation of our study is the reliance on telephone interviews, which precluded the possibility of a physical examination. Consequently, patients self-reported the efficacy of the surgery, presence of CS, and its severity, without the possibility of objective verification.

The two elements that completely define the outcome of this type of surgery are its efficacy and the occurrence of its main side effect, CS. Consistent with previous studies, the efficacy of the surgery is reported to be over 90% (1,17), whereas the incidence of CS ranges from 3% to 98% of patients (6). This wide variability is due to the fact that, while efficacy is clearly depicted as the cessation of the excessive sweating in the hands and/or axillae which prompted the complaint, CS is not as clearly defined. Depending on where the threshold for CS is set, different responses will be obtained.

In this study, we aimed to allow patients to define

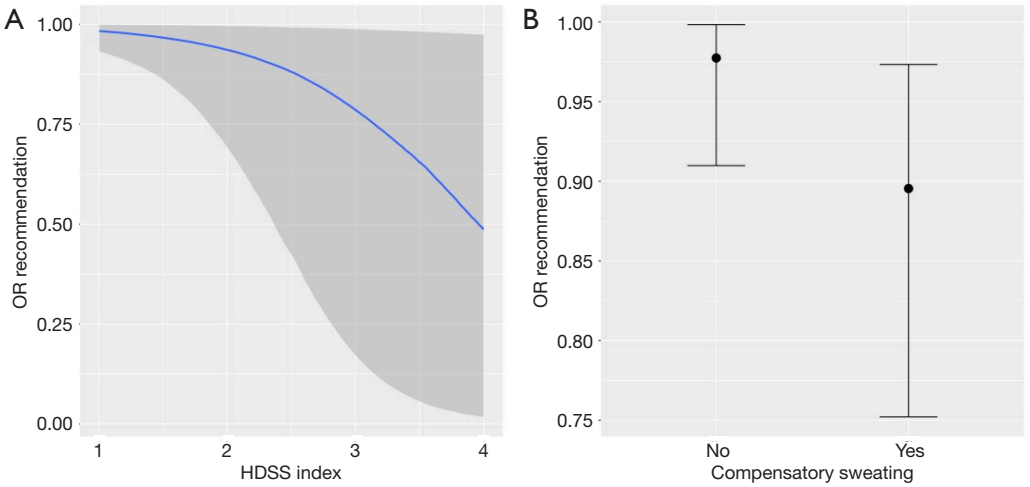

Figure 1 Marginal effects plot depicting the interaction between the OR for recommending bilateral endoscopic thoracic sympathectomy. (A) The postoperative HDSS index (blue line: OR-postoperative HDSS interaction; grey shadow: confidence interval), and (B) the occurrence of compensatory sweating. OR, odds ratio; HDSS, Hyperhidrosis Disease Severity Scale.

Table 3 Summary of the model "Would you recommend the surgery?"

Variables	Estimate	Standard error	OR	95% credible interval	Probability of the effect
Intercept	5.633	1.213	–	3.68–8.42	–
Post-surgical HDSS	–1.427	0.561	0.24	0.073–0.645	99.8%
Compensatory sweating	–1.704	1.256	0.182	0.012–1.735	93.3%

OR, odds ratio; HDSS, Hyperhidrosis Disease Severity Scale.

whether they considered themselves to have CS and to what degree (mild, moderate, or severe) (1). The interviews were conducted during the hottest season in the patients' region, thereby minimizing potential biases that could arise from the influence of ambient temperature on CS (9,10). Under these conditions, the incidence of CS in our sample was 36.26%, aligning with published studies such as that of Hemead *et al.* (36.5% incidence of CS) (11) and Qian *et al.* (46.72%) (18), and differing significantly from older studies reporting rates around 90% (1,19,20).

The vast majority of these CS cases (75.76%) were classified as mild, being dependent on temperature, exercise, or psychological stress, and did not cause any physical or psychological issues for the patient, with only 1 out of 91 cases reporting severe CS. Notably, 86.81% of patients described their current state as the lowest possible on the HDSS. It was observed that 94.5% of the patients experienced a reduction in sweating of over 80%, with a patient satisfaction rate of 93.95%. Thus, although the likelihood of recommending surgery decreases dramatically with the occurrence of CS—approximately five times if CS occurs and four times with each increase in the HDSS level—the recommendation rate still reached 91.21% of patients.

A significant consideration in our series is the inclusion of patients who underwent BETS many years ago, while resection of R2 was commonly performed. This procedure has been almost invariably associated with a higher CS rate (5,21). Notably, most of the patients in our series (84.62%) underwent surgery involving the R2 level, either as a standalone approach or in combination with other levels. From this, we can infer that despite the favorable outcomes in terms of patient satisfaction, there remains room for improvement with the more recent trends adopted by our group, which advocate for avoiding intervention at this R2 level (1).

Given that BETS is an elective procedure for a benign condition with potential drawbacks, it is essential that patients receive comprehensive information regarding the expected outcomes of this surgery. This includes clearly

communicating that the procedure is indicated for the treatment of palmar and axillary but not indicated for plantar hyperhidrosis and highlighting the likelihood and possible severity of developing CS. Patients should be informed about not only the short-term but also the long-term efficacy of the surgery, as well as its impact on their QOL, to ensure that they can make a well-informed and conscious decision.

Conclusions

BETS has demonstrated high efficacy, with 94.5% of patients experiencing an over 80% reduction in sweating in their hands and axillae. It is also a safe procedure, with the most common complication being CS, which occurs in just over one-third of patients. However, this side effect is typically mild and does not cause significant distress. As a result, patients generally found the treatment highly satisfactory, and nearly all patients were willing to recommend it to family and friends.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-1407/rc

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-24-1407/coif). N.J.M.H. serves as a member of the Editorial Board of Cirugía Española. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the institutional ethics board of University Hospital of la Ribera (No. PI 010724) and individual consent for this retrospective analysis was waived.

References

1. Cerfolio RJ, De Campos JR, Bryant AS, et al. The Society of Thoracic Surgeons expert consensus for the surgical treatment of hyperhidrosis. Ann Thorac Surg 2011;91:1642-8.
2. Lenefsky M, Rice ZP. Hyperhidrosis and its impact on those living with it. Am J Manag Care 2018;24:S491-5.
3. de Campos JR, Kauffman P, Werebe Ede C, et al. Quality of life, before and after thoracic sympathectomy: report on 378 operated patients. Ann Thorac Surg 2003;76:886-91.
4. McConaghy JR, Fosselman D. Hyperhidrosis: Management Options. Am Fam Physician 2018;97:729-34.
5. Cheng A, Johnsen H, Chang MY. Patient Satisfaction after Thoracoscopic Sympathectomy for Palmar Hyperhidrosis: Do Method and Level Matter? Perm J 2015;19:29-31.
6. Moraites E, Vaughn OA, Hill S. Incidence and prevalence of hyperhidrosis. Dermatol Clin 2014;32:457-65.
7. Henning MAS, Reguant R, Jørgensen IF, et al. The temporal association of hyperhidrosis and its comorbidities - a nationwide hospital-based cohort study. J Eur Acad Dermatol Venereol 2022;36:2504-11.
8. Chudry H. The treatment of palmar hyperhidrosis - a systematic review. Int J Dermatol 2022;61:1303-10.
9. Fujimoto T. Pathophysiology and Treatment of Hyperhidrosis. Curr Probl Dermatol 2016;51:86-93.
10. de Lima AG, Das-Neves-Pereira JC, de Campos JR, et al. Factors affecting long-term satisfaction after thoracic sympathectomy for palmar and plantar hyperhidrosis. Is the sudomotor reflex the only villain? Interact Cardiovasc

Thorac Surg 2011;12:554-7.
11. Hemead HM, Etman W, Hemead S, et al. Patients' satisfaction after bilateral thoracoscopic sympathicolysis. J Minim Access Surg 2023;19:478-81.
12. Gabes M, Jourdan C, Schramm K, et al. Hyperhidrosis Quality of Life Index (HidroQoL©): further validation and clinical application in patients with axillary hyperhidrosis using data from a phase III randomized controlled trial. Br J Dermatol 2021;184:473-81.
13. International Hyperhidrosis Society. International Hyperhidrosis Society | Official Site [Internet]. [cited 2024 Jun 3]. Available online: https://www.sweathelp.org/pdf/HDSS.pdf
14. Meteorología AE de. València: València - Agencia Estatal de Meteorología - AEMET. Gobierno de España [Internet]. [cited 2024 Jun 5]. Available online: https://www.aemet.es/es/serviciosclimaticos/datosclimatologicos/valoresclimatologicos
15. Bürkner PC, Vuorre M. Ordinal Regression Models in Psychology: A Tutorial. Advances in Methods and Practices in Psychological Science 2019;2:77-101.
16. Lin LI. A concordance correlation coefficient to evaluate reproducibility. Biometrics 1989;45:255-68.
17. Shabat S, Furman D, Kupietzky A, et al. Long-term Outcomes of Endoscopic Thoracoscopic Sympathectomy for Primary Focal Palmar Hyperhidrosis: High Patient Satisfaction Rates Despite Significant Compensatory Hyperhidrosis. Surg Laparosc Endosc Percutan Tech 2022;32:730-5.
18. Qian K, Feng YG, Zhou JH, et al. Anxiety after Sympathectomy in patients with primary palmar hyperhidrosis may prolong the duration of compensatory hyperhidrosis. J Cardiothorac Surg 2018;13:54.
19. Araújo CA, Azevedo IM, Ferreira MA, et al. Compensatory sweating after thoracoscopic sympathectomy: characteristics, prevalence and influence on patient satisfaction. J Bras Pneumol 2009;35:213-20.
20. Neumayer C, Zacherl J, Holak G, et al. Limited endoscopic thoracic sympathetic block for hyperhidrosis of the upper limb: reduction of compensatory sweating by clipping T4. Surg Endosc 2004;18:152-6.
21. Moon MH, Hyun K, Park JK, et al. Surgical treatment of compensatory hyperhidrosis: Retrospective observational study. Medicine (Baltimore) 2020;99:e22466.

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