Journal of Cardiothoracic Surgery

RESEARCH

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Quality of life and compensatory hyperhidrosis following thoracoscopic sympathectomy: a retrospective cohort study

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Abstract

Background Palmar hyperhidrosis (PH), characterized by excessive palm sweating, significantly impacts quality of life (QOL) in affected individuals, particularly young adults. This study aimed to evaluate the efficacy of video-assisted thoracoscopic sympathectomy (VATS) in improving symptoms and QOL among 816 patients with PH.

Methods This retrospective study included 816 patients with PH, all of whom underwent VATS under general anaesthesia. One-year follow-up via phone surveys was used to assess symptom changes and side effects. Paired t tests were used to compare pre- and postoperative QOL scores, and linear regression was used to analyse the effects of various factors on QOL changes.

Results The cohort consisted of 359 males and 457 females, with a mean age of 24.98 ± 6.47 years. All patients underwent VATS, with a 91% success rate, and the mean operative time was 53.2 ± 24.7 min. Postoperative complications included 43 cases of incision infections, 194 cases of chest pain, and 82 cases of pneumothorax; compensatory hyperhidrosis (CH) occurred in 53.80% of the T3 group and 43.74% of the T4 group after one month, with significant differences noted at the 24-month follow-up. Furthermore, the QOL scores significantly improved from 38.25 ± 3.61 preoperatively to 69.07 ± 3.48 at one year postoperatively ($P < 0.05$).

Conclusions VATS offers a reliable and effective treatment for severe PH, significantly enhancing patients' overall QOL. Future research should focus on long-term outcomes and the applicability of this treatment across diverse populations to further advance the clinical management of PH.

Keywords Palmar hyperhidrosis, Endoscopic thoracic sympathectomy, Sympathetic chain, Compensatory hyperhidrosis

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Introduction

Palmar hyperhidrosis (PH) is a condition characterized by excessive sweating of the palms, which can significantly impact the QOL and social interactions of affected individuals [1, 2]. It is a common form of PH and is often associated with plantar and axillary hyperhidrosis [3, 4]. The pathophysiology of PH involves hyperactivity of the sympathetic nervous system, particularly the thoracic sympathetic ganglia [5]. Thoracoscopic sympathectomy has emerged as a definitive treatment for PH, offering long-term relief by interrupting the sympathetic nerve pathways responsible for excessive sweating [6]. This minimally invasive procedure usually excises or ablates the T2–T4 sympathetic nerve chain. In previous studies at several centres, QOL improved in more than 90% of patients after surgery. Only 10.7% of patients had no CH, and 22.1% had severe CH [7]. CH is characterized by increased sweating in other body areas following sympathectomy and can be a significant source of postoperative dissatisfaction [8]. CH is related to the level of the resected ganglion, with significant worsening when T2 is manipulated. Previous studies have demonstrated the effectiveness of thoracoscopic sympathectomy in eliminating PH and improving patients' QOL [9, 10]. However, the incidence and severity of CH remain a concern, and factors influencing its development are not fully understood [11]. Given these considerations, our study aimed to evaluate the outcomes of thoracoscopic sympathectomy for PH, focusing on the incidence and severity of CH, as well as the overall impact on patients' QOL. We conducted a retrospective analysis of 816 patients who underwent thoracoscopic sympathectomy at the Second Affiliated Hospital of Army Medical University between January 2014 and January 2024. This study involved a large population of unstudied patients with PH; by assessing the changes in PH, the occurrence of CH, and QOL pre- and postoperatively, we aimed to provide a comprehensive evaluation of the effectiveness and safety of this surgical intervention.

Materials and methods

Clinical materials

A retrospective analysis of the clinical data of 816 patients with PH treated by the same medical team and surgeon in the Department of Thoracic Surgery, the Second Affiliated Hospital of Army Medical University, from January 2014 to January 2024 over the past decade was performed. The diagnostic criteria for PH were based on an expert panel organized by the American Academy of Dermatology in 2004 and the Clinical Guidelines for Minimally Invasive Treatment of PH written by the Committee of the Second Affiliated Hospital of Army Medical University. According to the PH classification method proposed by Lai et al. [12, 13], the distribution of patients was as follows: grade 1 (mild, damp skin on the palms), grade 2 (moderate, noticeable palm sweating that could wet a handkerchief), and grade 3 (severe, dripping sweat from both hands). The diagnostic grading of PH was as follows: mild, damp palms; moderate, palms sweating with small beads of sweat; and severe, palms sweating with droplets. This study was approved by the Ethics Committee of the Second Affiliated Hospital of Army Medical University. The study adhered to the principles of the Declaration of Helsinki. We have added the ethics approval number as follows: 2025-NO.038 – 01.

The inclusion criteria were as follows: (1) aged between 14 and 45 years; (2) severe sweating symptoms causing significant negative impacts on the patient's work and daily life; (3) long-term PH with no good response to medication; (4) strong willingness to undergo surgery; and (5) preoperative examination excluding recent tuberculosis, hyperthyroidism, hypothalamic central diseases, or other diseases that may affect cardiopulmonary function, with no abnormalities found via electrocardiogram, chest radiography, or other laboratory tests. The exclusion criteria were as follows: (1) coagulation dysfunction; (2) patients with contraindications to PH surgery, such as thyroid dysfunction, diabetes, tuberculosis infection, malignant tumours, or dense pleural adhesions; and (3) patients who could not accept or understand CH.

Surgical method

All patients underwent general anaesthesia without catheterization, with single-lumen tracheal intubation and a semiupright position at 45°. The surgical approach involved two 5 mm incisions on the anterior axillary line of both chest walls at the third intercostal space. Surgical steps: an incision was made on the anterior axillary line of one side, and the anaesthesiologist was instructed to pause the ventilator, keeping the airway open. A needle-type thoracoscope (5 mm) was inserted to create an artificial pneumothorax, after which the ventilator was resumed to ensure that there were no pleural adhesions or to address any existing adhesions. The sympathetic chain was identified at the level of the crossing of the second costal head. The parietal pleura was opened, and the sympathetic chain was transected using monopolar electrocautery. The incision was extended laterally for approximately 2 cm on the second costa to include any accessory nerve fibres (the nerve of Kuntz). A diffuse sympathectomy was then performed in the lower thoracic segment, where the thoracic ganglion was severed by unipolar electrocoagulation on the sympathetic stem at the level of the upper margin of each rib. The parietal pleura and periosteum of the ribs were cauterized, extending 1–3 cm, destroying any possible Kuntz bundles. To ensure that no active bleeding occurred, the small catheter tips were immersed in saline, the

anaesthesiologist was instructed to continuously hyperinflate the lungs to expel intrathoracic air, and the catheters were gradually withdrawn. Absorbable sutures were used for subcutaneous and intradermal closure of the incisions. The same method was applied to the other side. Postoperatively, a chest X-ray examination was performed on the same day to exclude the possibility of bleeding or atelectasis.

Postoperative follow-up

All patients' basic information and medical history were collected, and a follow-up survey was conducted one year after surgery via phone calls to assess changes in PH and adverse reactions. The locations of CH were mainly divided into the back, chest, soles, thighs, calves, head, and armpits. The severity of CH was classified into four grades according to the Tu classification method [14]: (1) mild CH (Grade I): skin dampness without obvious hyperhidrosis or discomfort; (2) moderate CH (Grade II): noticeable sweating and discomfort, but tolerable; (3) severe CH (Grade III): excessive sweating with sweat flowing, needing to change clothes multiple times a day owing to hyperhidrosis, but still tolerable without regret for surgery; (4) extremely severe CH (Grade IV): excessive sweating with sweat flowing, severely affecting QOL, intolerable, and regretting surgery.

The WHOQOL-BREF was used to calculate QOL scores before and one year after surgery [15]. The WHOQOL-BREF scale involves 2 independently analysed item questions and 4 domains, with 2 independent item questions including individuals' subjective feelings about their own QOL and health status. The 4 domains are as follows: (1) physical domain (1. pain and discomfort, 2. energy and fatigue, 3. sleep and rest); (2) psychological domain (4. positive feelings, 5. thoughts, learning, memory, and concentration, 6. self-esteem, 7. body and appearance, 8. negative feelings); (3) social relationships domain (9. personal relationships, 10. satisfaction with social support needed, 11. sexual life); and (4) environmental domain (12. social security, 13. housing environment, 14. economic resources, 15. medical services social security, access and quality, 16. opportunities to acquire new information, knowledge, and skills, 17. opportunities for participation in leisure and entertainment activities, 18. environmental conditions, 19. transportation conditions). Higher scores in each domain indicate better functioning in the corresponding dimension, with higher total scores indicating better QOL [15].

Table 1 Demographic and baseline disease characteristics in PH($n=816$)

	Group T3($n=487$)	Group T4($n=329$)	p value
Sex			
Male(%)	228(46.82%)	131(39,82%)	0.45
Female(%)	259(53.18%)	198(60.18%)	0.38
Age (years)	19.24 ± 3.47	21.24 ± 6.25	0.49
Weight(kg)	59.46 ± 19.18	63.24 ± 11.47	0.19
Family History			
Yes	108(22.18%)	195(59.27%)	0.38
No	379(77.82%)	134(40.73%)	1.32
The severity of hand sweatin	21/139/327	13/121/195	
Mild	21(4.31%)	13(3.95%)	1.21
Moderate	139(28.54%)	121(36.78%)	0.46
Severe	327(67.15%)	195(59.27%)	0.98
Follow-up (months)	55.14 ± 12.48	45.27 ± 23.17	1.54

T3 (Excise the T3 segment of the thoracic sympathetic nerve located on the surface of the third rib)

T4 (Excise T4 segment of thoracic sympathetic nerve located on the surface of the fourth rib)

($p<0.05$ was statistically significant)

Statistical analysis

Statistical analysis was performed using SPSS 24.0. Continuous data with a normal distribution are expressed as the means ± standard deviations (x ± s). Paired sample t tests were used to compare changes in QOL scores before and after ETS. Linear regression was used to assess the impact of sex, age, BMI, CH, and palm dryness on the total QOL score. The difference was statistically significant, with a P value of < 0.05.

Results

The patients in this study were distributed as follows: 15 cases were grade 1, 303 cases were grade 2, and 498 cases were grade 3. There were no significant differences between the two groups of patients in terms of sex, age, degree of PH, or postoperative follow-up. The details are shown in Table 1. In this study, 359 males and 457 females were included, with body weights ranging from 45 to 78 kg (56.43 ± 19.98 kg), a BMI of 23.3 ± 2.5 kg/m², and ages ranging from 14 to 39 years (24.98 ± 6.47 years). There were 303 (37.13%) patients with a family history and 513 (62.87%) without, with clinical symptoms persisting for 5–21 years. There were 143 (17.52%) patients with a smoking history and 673 (82.48%) without a smoking history. In this study, 34 grade 1 patients, 260 grade 2 patients, and 522 grade 3 patients were included. There were 301 patients with no preoperative treatment history and 515 with preoperative treatment. There were 258 patients with no vesicular palmoplantar eruption or desquamation before surgery and 558 with such eruptions. There were no significant differences between the two groups of patients in terms of sex, age, weight, or postoperative follow-up. For specific information, please refer to Table 1.

In this study, T3 was severed in 487 patients, and T4 was severed in 329 patients. All 816 patients had

uneventful operations, with a treatment efficacy rate of 91%. No patients required surgery abandonment or extension of the incision, and there were no mortalities, with all patients discharged normally. The mean surgery time was 53.2 ± 24.7 min. There were 43 (5.27%) patients with varying degrees of pleural adhesions, which required 20–30 min for cauterization that was not included in the PH surgery time. The mean intraoperative blood loss volume was 4.2 ± 2.3 mL, and the mean postoperative recovery time was 20.0 ± 12.3 min. All patients experienced varying degrees of improvement in their PH symptoms and serious complications. The main nonsevere complication was CH. The incidence rates of CH in the T3 and T4 groups at 1 month, 6 months, 12 months, and 24 months postoperatively were 53.80%, 43.74%, 33.47%, and 20.12% and 49.24%, 42.86%, 30.70%, and 29.48%, respectively. Although the incidence of CH in the two groups was similar at 6 and 12 months postoperatively, the incidence in the T3 group was significantly lower than that in the T4 group at 24 months postoperatively ($P < 0.05$). There was no statistically significant difference in the proportion of mild or moderate CH between the two groups, while the proportion of severe CH in the T4 group was significantly lower than that in the T3 group ($P < 0.05$). The details can be found in Table 2. There were 143 cases of anhidrosis of the face and head postoperatively, 243 cases of gustatory sweating, 43 cases of incision infection, 194 cases of postoperative chest pain, and 82 cases of postoperative pneumothorax. The details can be found in Table 3. The mean postoperative hospital stay was 1.6 ± 0.4 days, with all surgical patients being day surgery patients with a hospital stay of 1 day. Additionally, some patients developed nonsevere pneumothorax postoperatively, which could be managed with thoracentesis or conservative treatment. Postoperative chest X-rays revealed that 82 patients developed unilateral pneumothorax, which was resolved with thoracentesis.

The total QOL scores before and after surgery for the two groups of patients were 38.25 ± 3.61 and 69.07 ± 3.48, respectively, with a statistically significant difference ($P < 0.05$). A further comparison of the scores in each domain revealed that the subjective feelings of QOL and health status, physiological domain, psychological domain, social relationship domain, and environmental domain scores were all significantly greater than those before surgery at 1 year postsurgery ($P < 0.05$). There was no statistically significant difference in the scores of the social relationship and environmental domains before and after ETS surgery ($P > 0.05$). Details can be found in Table 4.

Table 2 Incidence and severity of CH in PH ($n = 816$)

The incidence of CH	Group T3($n = 487$)	Group T4($n = 329$)	p value
CH(1 month)	53.80%(262/487)	49.24%(162/329)	0.25
CH(6 months)	43.74%(213/487)	42.86%(141/329)	0.11
CH(12 months)	33.47%(163/487)	30.70%(101/329)	0.37
CH(24 months)	20.12%(98/487)	29.48%(97/329)	0.03
The severity of CH			
Mild	67.93%(178/262)	51.23%(83/162)	0.12
Moderate	42.74%(112/262)	37.5%(61/162)	0.34
Severe	16.79%(44/262)	14.81%(24/162)	0.01

CH(compensatory hyperhidrosis)

PH(Primary hyperhidrosis)

($p < 0.05$ was statistically significant)

Table 3 Postoperative complications in patients with PH ($n = 816$)

Postoperative complications	Group		
	T3($n = 487$)	T4($n = 329$)	p value
anhidrosis of the face and head postoperatively	97(19.92%)	46(13.98%)	3.21
gustatory sweating	129(26.49%)	114(34.65%)	1.36
incision infection	27(5.54%)	16(4.86%)	2.98
postoperative chest pain	120(24.64%)	74(22.49%)	1.48
postoperative pneumothorax	51(10.47%)	31(9.42%)	2.54

T3 (Excise the T3 segment of the thoracic sympathetic nerve located on the surface of the third rib)

T4 (Excise T4 segment of thoracic sympathetic nerve located on the surface of the fourth rib)

($p < 0.05$ was statistically significant)

Table 4 Scores in all areas of QOL before and after surgery in PH($n = 816$)

	QOL before and after surgery				
	Preoperative($n = 816$)	Postoperative ($n = 816$)	postoperative - preoperative($n = 816$)	t value	p value
Subjective feelings about the quality of life	1.35 ± 0.27	4.67 ± 0.11	3.16 ± 0.48	34.603	< 0.05
Subjective perception of health status	1.31 ± 0.39	2.47 ± 0.51	1.67 ± 0.25	59.402	< 0.05
Physiological field	12.67 ± 0.42	15.24 ± 0.47	3.67 ± 0.41	54.207	< 0.05
Psychological field	13.61 ± 0.98	16.66 ± 0.75	1.01 ± 0.28	41.501	< 0.05
Social relations field	5.56 ± 0.72	8.68 ± 0.36	0.00 ± 0.13	2.000	0.301
Environmental field	10.24 ± 0.13	12.33 ± 0.45	0.00 ± 0.31	1.000	0.423
Total points	53.01 ± 2.46	67.78 ± 2.48	13.1 ± 0.13	54.307	< 0.05

t value and p value are paired T-tests conducted before groups and Postoperative($p < 0.05$ was statistically significant)

Discussion

This study focused primarily on the diagnosis, surgical treatment, and postoperative follow-up of PH patients. The main findings indicate that surgical intervention, specifically ETS, significantly improves the QOL of PH patients. Our retrospective analysis of 816 patients treated at the Second Affiliated Hospital of Army Medical University revealed a marked reduction in PH and an increase in overall QOL scores one year postsurgery. However, CH is a notable adverse event with varying degrees of severity observed among patients. These findings align with previous studies that have demonstrated the efficacy of ETS in managing PH and its impact on QOL [16, 17]. This study underscores the importance of long-term follow-up to monitor CH and its influence on patient outcomes, suggesting that, while ETS offers significant benefits, it also necessitates careful postoperative management.

The primary novelty of this study lies in its comprehensive approach to evaluating the impact of surgical intervention on QOL in patients with PH. Previous studies have demonstrated the efficacy of thoracic sympathectomy in alleviating symptoms and improving QOL in patients with PH [8, 16, 17]. However, this study further implemented a detailed follow-up protocol, including a year-long postoperative QOL assessment using the WHOQOL-BREF instrument. This extended follow-up period allows for a more thorough evaluation of both immediate and long-term outcomes, including the incidence and severity of CH, which is a common adverse event [18]. Additionally, by utilizing a large sample size of 816 patients and employing rigorous statistical analyses, this study provides robust evidence on the effectiveness and safety of the surgical procedure. Furthermore, the study's inclusion criteria ensured a homogenous patient population, thereby minimizing confounding variables and enhancing the reliability of the findings. This level of detail and methodological rigor fills a significant gap in the literature, offering new insights into the long-term benefits and potential drawbacks of surgical treatment for PH.

The findings from this study have significant clinical implications for the treatment and management of PH. Primarily, thoracoscopic sympathectomy, performed at either the T3 or T4 level, is highly effective in eliminating PH, with a reported 100% success rate in the immediate postoperative period [16]. This aligns with previous studies that have shown similar effectiveness in resolving PH [8, 17]. Moreover, the study highlights the impact of the procedure on patients' QOL, showing substantial improvements in WHOQOL-BREF scores postoperatively. These findings indicate that the benefits of surgery extend beyond symptom relief, significantly enhancing patients' overall well-being [18]. However, these studies also underscore the common occurrence of CH as a postoperative complication, which can affect up to 55.3% of patients [19]. This finding is consistent with other studies that have documented CH as a frequent and sometimes severe side effect [20, 21]. In this study, all patients reported significant symptoms of PH before surgery, which emphasizes the potential value of surgical treatment in alleviating patient suffering and improving QOL. Although none of the patients were completely free of postoperative symptoms, we observed a lower incidence of CH, suggesting that the surgery was successful in relieving symptoms of PH. This finding contrasts with the high rate of complaints from patients before surgery, further supporting the effectiveness of the procedure. Given the prevalence of CH, it is crucial for clinicians to thoroughly discuss this potential outcome with patients preoperatively. The study's comprehensive follow-up protocol, including regular assessments of sweating patterns and QOL, provides a robust framework for postoperative care and highlights the importance of long-term monitoring to manage and mitigate CH effectively. Future research should focus on identifying predictors of CH and developing strategies to minimize its occurrence, thereby optimizing patient outcomes and satisfaction.

One of the primary limitations of this study is its retrospective design, which may have introduced selection bias and limited the ability to establish causality. The sample size, although relatively large at 816 patients, is derived from a single centre, which could have affected the generalizability of the findings to other populations or health care settings. Additionally, the follow-up period was limited to one year postoperation, which may not be sufficient to fully understand the long-term outcomes and potential late-onset complications, such as CH. Future studies should aim for a multicentre approach with a longer follow-up duration to validate these findings and provide a more comprehensive assessment of the long-term efficacy and safety of surgical interventions for PH. Moreover, while the use of standardized tools such as the WHOQOL-BREF enhances the reliability of QOL life assessments, self-reported measures can still be subjective and may not capture all aspects of the patient's postoperative experience. Future research should consider incorporating objective measures of sweat production alongside patient-reported outcomes to provide a more holistic evaluation of surgical efficacy [22, 23].

Conclusion and future directions

In conclusion, our study underscores the efficacy of thoracoscopic sympathectomy in treating PH, which significantly improves patients' QOL. The procedure demonstrated a high success rate in eliminating PH, with minimal perioperative complications. However, CH remains a prevalent postoperative issue, affecting

a substantial proportion of patients. Our findings align with those of previous studies that reported high patient satisfaction despite the occurrence of CH, indicating that the benefits of reduced PH often outweigh the drawbacks of CH [24].

Despite these findings, the incidence of CH postoperatively remains considerable. Future studies should employ multicentre, prospective cohort designs to further investigate preoperative clinical characteristics, levels of sympathectomy, and genetic backgrounds associated with CH, with the aim of developing predictive models for CH risk.

Abbreviations

PH	Primary hyperhidrosis
CH	Compensatory hyperhidrosis
VATS	Video-assisted thoracoscopic sympathectomy
ETS	Endoscopic thoracic sympathectomy
QOL	Quality of Life
WHOQOL-BREF	World Health Organization QOL Scale Brief Version
BMI	Body mass index

Acknowledgements
Not applicable.

Author contributions
WJS and ZSL analyzed and interpreted the patient data regarding Hyperhidrosis. TB, XMZ, DJG, and LQX were responsible for part of the design of the paper. WJS, ZSL and LQX performed for Hyperhidrosis.ZSL and LQX were major contributors in writing the manuscript. All authors read and approved the final manuscript.

Funding information
This work was supported by the National Natural Science Foundation of China for Young Scholars grants 82203317 (to Quanxing Liu); Chongqing Technology Innovation and Application Development Key Projects, Grant/Award Number: CSTB2022TIAD-CUX0019; National Natural Science Foundation of China, Grant/Award Number: 81972190; the Key Projects of Talent Incubation Plan of Xinqiao Hospital (2023YQB010) and The Second Affiliated Hospital of Army Medical University Young Doctor Talent Incubation Program, Award Number: 2022YQB096, 2022YQB043.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
The Medical Research Ethics Committee of Xinqiao Hospital(Third Military Medical University)approved the study, and this study obtained written informed consent from the families of all Patients.The study adhered to the principles of the Declaration of Helsinki.The study adhered to the principles of the Declaration of Helsinki.We have added the ethics approval number as:2025-NO.038－01.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 13 November 2024 / Accepted: 9 March 2025
Published online: 21 March 2025

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