

# Extent of sympathectomy affects postoperative compensatory sweating and satisfaction in patients with palmar hyperhidrosis

Hiroshi Aoki · Tetsuya Sakai · Hiroaki Murata ·  
Koji Sumikawa

Received: 10 June 2013 / Accepted: 25 July 2013 / Published online: 8 August 2013  
© Japanese Society of Anesthesiologists 2013

## Abstract

**Purpose** Endoscopic thoracic sympathectomy (ETS) for the treatment of palmar hyperhidrosis is generally performed at one or two levels ranging between T2 and T4; however, compensatory sweating (CS) is an occasional bothersome side effect. The aim of our study was to evaluate the association between the extent of ETS and the degree of postoperative CS and palmar sweating, as well as patient satisfaction.

**Methods** The participants represented a consecutive series of 76 patients who underwent bilateral ETS for palmar hyperhidrosis at level T2 and/or T3. Patients were interviewed by postal questionnaires to assess their self-reported degree of postoperative palmar sweating and CS and their outcome satisfaction. Of the 53 patients who replied to the postal questionnaire, 25 underwent bilateral ETS at one level (group A), and 27 underwent bilateral ETS at two levels (group B). One patient who underwent asymmetrical sympathectomy was excluded.

**Results** The degree of postoperative palmar sweating was significantly lower in group B than in group A. The severity of CS was significantly higher in group B than in group A. The severity of CS was significantly inversely correlated with the degree of patient satisfaction. However, the degree of postoperative palmar sweating was not correlated with the degree of patient satisfaction.

**Conclusions** Compared to ETS at two levels, single-level ETS of T2 or T3 reduces postoperative palmar sweating to a milder degree, and causes CS to a less severe degree. The

severity of CS is inversely correlated with the degree of patient satisfaction.

**Keywords** Thoracic sympathectomy · Postoperative compensatory sweating and satisfaction

## Introduction

Endoscopic thoracic sympathectomy (ETS), generally performed at one or two levels ranging between T2 and T4, is an effective treatment approach for palmar hyperhidrosis; however, postoperative compensatory sweating is an occasional bothersome side effect [1–7]. To the best of our knowledge, few reports describe the correlation between the extent of thoracic sympathectomy and the degree of postoperative compensatory sweating. Here, we hypothesized that the extent of thoracic sympathectomy could determine the severity of postoperative compensatory sweating and the degree of postoperative palmar sweating and correlate with patient satisfaction. The aim of our study was to evaluate the association between the extent of thoracic sympathectomy and these postoperative outcomes.

## Methods

The participants in this study represented a consecutive series of 76 patients (53 females and 23 males; age range, 15–42 years) who underwent bilateral thoracoscopic sympathectomy for medically refractory palmar hyperhidrosis at Nagasaki University Hospital from September 1, 1997 to August 31, 2005. Institutional Review Board approval was obtained before all data collection and postal questionnaire.

H. Aoki · T. Sakai (✉) · H. Murata · K. Sumikawa  
Department of Anesthesiology, Nagasaki University School  
of Medicine, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan  
e-mail: tscat@fb3.so-net.ne.jp

Data including sex, age, and surgical technique (extent and level of sympathectomy) were obtained from clinical records.

Between August 2005 and 2008, patients were interviewed by postal questionnaires to assess postoperative outcomes after sympathectomy, such as their degree of palmar sweating, postoperative compensatory sweating, overall satisfaction, and complications. Written informed consent was obtained from each patient before completing the questionnaire. The self-reported degree of postoperative palmar sweating of both hands was assessed using a numerical rating scale that ranged from 0 to 10, whereby 0 indicated no sweating and 10 indicated the same degree of sweating as before the surgery. The postoperative palmar sweating score was calculated as the average of the degree on each hand. The patient's self-reported severity of postoperative compensatory sweating was graded on a scale ranging from 1 to 5 as follows: 1 = no compensatory sweating, 2 = occasionally noticed a little, 3 = always aware but not troublesome, 4 = troublesome but controlled by clothing, and 5 = severe dripping sweat leading to extreme burden and interference with daily activities. The degree of patient satisfaction was also graded on a scale ranging from 1 to 5 (1 = dissatisfied, 5 = very satisfied).

Fifty-three patients (69.7 %) replied to the postal questionnaire. Demographic data of the patients are listed in Table 1. Of these 53, 25 underwent bilateral sympathectomy at one level and were classified into group A and 27 underwent bilateral sympathectomy at two levels and were classified into group B. One patient who had undergone asymmetrical sympathectomy (right T2 and left T3) was excluded.

### Surgical procedure

The procedure was performed under general anesthesia in the supine position with arms extended; double-lumen endotracheal intubation was used to enable deflation of the lung on the operative side. Palmar cutaneous blood flow

monitors were applied bilaterally (PeriFlux 4001 Master™; PERIMED, Sweden). A port was made for the insertion of endoscopic instruments in the midpoint of the anterior axillary line and midclavicular line at the level of the fifth intercostal space. Another port was made in the midaxillary line at the level of the third intercostal space for the introduction of an electrical hook. The sympathetic chain was identified at the level of the crossing of the second and third costal heads. The parietal pleura was opened with an electrical hook. The sympathetic chain was transected completely at the level of the second (T2) and/or third (T3) rib bed, but the ganglion was left intact. Following sympathectomy, we confirmed the increase of palmar cutaneous blood flow in all patients. No conversion to open technique was necessary, and there was no operative mortality. No patients had pneumothorax requiring chest tube drainage postoperatively. In all patients, bilateral palmar sweating improved 1 month after the procedure.

### Statistical analysis

The Mann–Whitney *U* test was used to clarify the differences between the two groups. The Spearman rank correlation was used to analyze all correlations (compensatory sweating, palmar sweating, and patient satisfaction). Differences were considered significant at  $p < 0.05$ . Results are expressed as mean  $\pm$  SD.

### Results

The two groups were similar with regard to mean age and gender distribution but differed with regard to their follow-up period and the extent and level of sympathectomy. In group A, bilateral sympathectomy was performed at the level of T2 in 21 patients and at T3 in 4 patients. In group B, all patients underwent bilateral sympathectomy at both T2 and T3. The follow-up period was longer in group B because these patients underwent sympathectomy at an earlier date (1997–2001) compared to patients in group A (2001–2005).

Postoperative compensatory sweating occurred in all patients of both groups. There was no significant difference with regard to the incidence of each postoperative complication between the two groups.

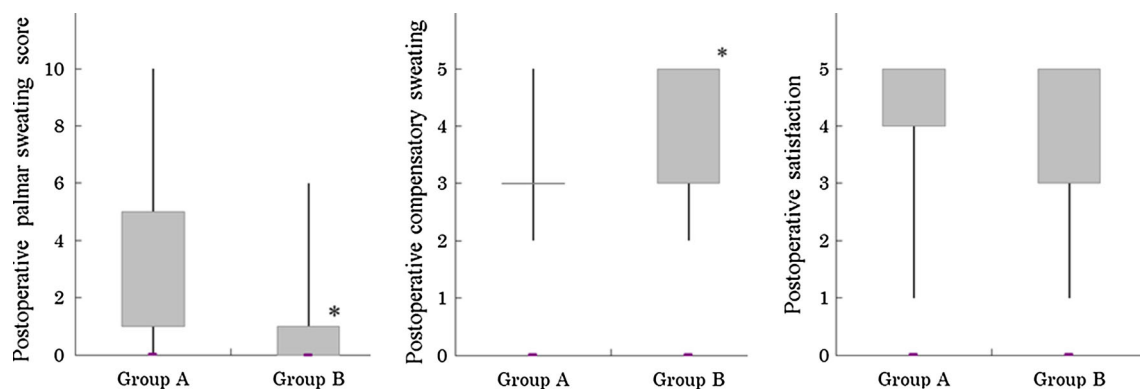
Postoperative outcomes are shown in Fig. 1. The postoperative palmar sweating score was significantly lower in group B ( $0.8 \pm 1.5$ ) compared to group A ( $3.2 \pm 2.5$ ). The severity of postoperative compensatory sweating was significantly higher in group B ( $4.0 \pm 1.0$ ) compared to group A ( $3.0 \pm 0.7$ ). There was no significant difference with regard to the degree of patient satisfaction between group A ( $3.8 \pm 1.2$ ) and group B ( $3.6 \pm 1.3$ ). The severity of

**Table 1** Demographic data of the patients

	Group A ( $n = 25$ )	Group B ( $n = 27$ )
Age (years)	$20.8 \pm 5.6$	$24.1 \pm 7.1$
Sex (M/F)	7/18	8/19
Follow-up period (months)	$20.3 \pm 6.4$	$55.3 \pm 11.0^*$
Level of sympathectomy		
Bilateral T2	21	–
Bilateral T3	4	–
Bilateral T2 and T3	–	27

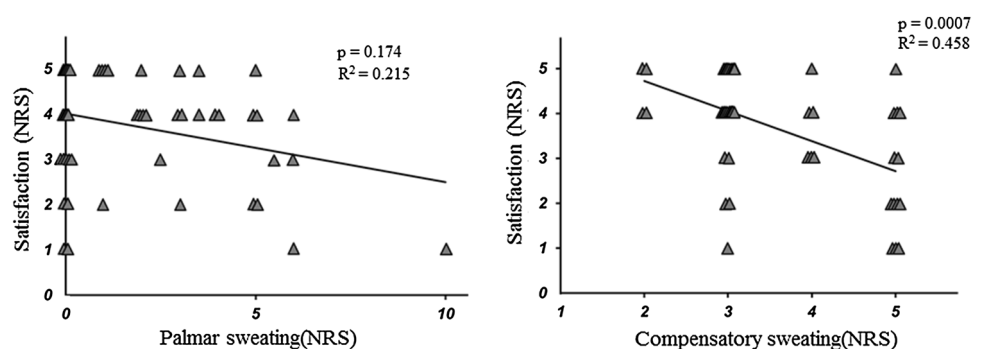
Values are mean  $\pm$  SD or  $n$

\*  $p < 0.01$  vs. group A



**Fig. 1** Postoperative outcomes. \* $p < 0.01$  versus group A

**Fig. 2** Correlation between postoperative satisfaction and effects. *NRS* numeric rating scale



postoperative compensatory sweating was significantly inversely correlated with the degree of patient satisfaction. However, the postoperative palmar sweating score was not correlated with the degree of patient satisfaction (Fig. 2).

## Discussion

The present results demonstrate that bilateral thoracic sympathectomy at two levels (T2 and T3) reduces postoperative palmar sweating to a significantly greater degree compared to sympathectomy at one level. However, the severity of compensatory sweating after bilateral sympathectomy at two levels was significantly greater compared to sympathectomy at one level.

Some studies have reported on the relationship between the extent of thoracic sympathectomy and the severity of postoperative compensatory sweating. Several authors have suggested that the limited extent of sympathectomy results in a lower incidence or severity of compensatory sweating [1–3, 5]. Conversely, other authors have reported that limited sympathectomy does not reduce the incidence or severity of compensatory sweating [6–8]. However, these studies did not include a group of patients who underwent single-level sympathectomy. The present results

demonstrate that the severity of compensatory sweating is reduced by sympathectomy performed at a single level compared to multiple levels.

In the present study, there was a significant inverse correlation between the severity of compensatory sweating and the degree of patient satisfaction. One of the most troublesome side effects of thoracic sympathectomy is compensatory sweating, which interferes with the patient's quality of life and causes patient dissatisfaction [9–11]. Chang et al. [12] demonstrated that the degree of patient satisfaction is significantly inversely related to the severity of compensatory sweating after sympathectomy, which supports our results.

Besides compensatory sweating, reoccurring postoperative palmar hyperhidrosis and excessive dry hands are other influential factors that influence the degree of postoperative patient satisfaction [9, 10]. It is natural for patients to feel dissatisfaction if palmar hyperhidrosis recurs. Excessively dry hands are also a cause for dissatisfaction because they are inconvenient in daily life activities. Liu et al. [13] claimed that it is important to maintain a slight degree of moisture in the hands because excessively dry hands decrease the degree of patient satisfaction. In the present study, some patients complained of excessively dry hands, which likely influenced our finding of no correlation between the

postoperative palmar sweating score and the degree of patient satisfaction.

Patient satisfaction may decrease with time because of postoperative recurrence of palmar hyperhidrosis or continuing severe compensatory hyperhidrosis [14]. Thus, the significant difference with regard to the follow-up period between group A and group B might have impacted patient satisfaction in the present study. For example, some patients who underwent sympathectomy at two levels complained of continuing severe postoperative compensatory sweating, which led to postoperative dissatisfaction and regret. On the basis of the findings of this study, we recommend sympathectomy at one level rather than at two levels for the treatment of refractory palmar hyperhidrosis.

In conclusion, thoracic sympathectomy at a single level of T2 or T3 reduces postoperative palmar sweating to a milder degree and causes compensatory sweating to a less severe degree compared to thoracic sympathectomy at two levels. The severity of compensatory sweating is inversely correlated with the degree of patient satisfaction.

## References

- Licht PB, Pilegaard HK. Severity of compensatory sweating after thoracoscopic sympathectomy. *Ann Thorac Surg.* 2004;78:427–31.
- Miller DL, Bryant AS, Force SD, Miller JI Jr. Effect of sympathectomy level on the incidence of compensatory hyperhidrosis after sympathectomy for palmar hyperhidrosis. *J Thorac Cardiovasc Surg.* 2009;138:581–5.
- Yano M, Kiriyama M, Fukai I, Sasaki H, Kobayashi Y, Mizuno K, Haneda H, Suzuki E, Endo K, Fujii Y. Endoscopic thoracic sympathectomy for palmar hyperhidrosis: efficacy of T2 and T3 ganglion resection. *Surgery (St. Louis).* 2005;138:40–5.
- Neumayer C, Zacherl J, Holak G, Függer R, Jakesz R, Herbst F, Bischof G. Limited endoscopic thoracic sympathetic block for hyperhidrosis of the upper limb: reduction of compensatory sweating by clipping T4. *Surg Endosc.* 2004;18:152–6.
- Li X, Tu YR, Lin M, Lai FC, Chen JF, Dai ZJ. Endoscopic thoracic sympathectomy for palmar hyperhidrosis: a randomized control trial comparing T3 and T2–4 ablation. *Ann Thorac Surg.* 2008;85:1747–51.
- Moya J, Ramos R, Morera R, Villalonga R, Perna V, Macia I, Ferrer G. Thoracic sympathectomy for primary hyperhidrosis: a review of 918 procedures. *Surg Endosc.* 2006;20:598–602.
- Rodríguez PM, Freixinet JL, Hussein M, Valencia JM, Gil RM, Herrero J, Caballero-Hidalgo A. Side effects, complications and outcome of thoracoscopic sympathectomy for palmar and axillary hyperhidrosis in 406 patients. *Eur J Cardiothorac Surg.* 2008;34:514–9.
- Lesèche G, Castier Y, Thabut G, Petit MD, Combes M, Cerceau O, Besnard M. Endoscopic transthoracic sympathectomy for upper limb hyperhidrosis: limited sympathectomy does not reduce postoperative compensatory sweating. *J Vasc Surg.* 2003;37:124–8.
- de Campos JR, Kauffman P, Werebe Ede C, Andrade Filho LO, Kusniek S, Wolosker N, Jatene FB. Quality of life, before and after thoracic sympathectomy: report on 378 operated patients. *Ann Thorac Surg.* 2003;76:886–91.
- Kopelman D, Hashmonai M. The correlation between the method of sympathetic ablation for palmar hyperhidrosis and the occurrence of compensatory hyperhidrosis: a review. *World J Surg.* 2008;32:2343–56.
- Bachmann K, Standl N, Kaifi J, Busch P, Winkler E, Mann O, Izbicki JR, Strate T. Thoracoscopic sympathectomy for palmar and axillary hyperhidrosis: for-year outcome and quality of life after bilateral 5-mm dual port approach. *Surg Endosc.* 2009;23:1587–93.
- Chang YT, Li HP, Lee JY, Lin PJ, Lin CC, Kao EL, Chou SH, Huang MF. Treatment of palmar hyperhidrosis: T4 level compared with T3 and T2. *Ann Surg.* 2007;246:330–6.
- Liu Y, Yang J, Liu J, Yang F, Jiang G, Li J, Huang Y, Wang J. Surgical treatment of primary palmar hyperhidrosis: a prospective randomized study comparing T3 and T4 sympathectomy. *Eur J Cardiothorac Surg.* 2009;35:398–402.
- Wallis T, Somuncuoglu G, Steger V, Veit S, Friedel G. Long-term efficiency of endoscopic thoracic sympathectomy: survey 10 years after surgery. *Interact Cardiovasc Thorac Surg.* 2009;8:54–7.