Simultaneous bilateral transthoracic sympathectomy through posterior access in Lin-Telaranta modification for primary hyperhidrosis

Tomasz Stefaniak[1], Maria I. Pirski[2], Tomasz Osęka[1], Jarosław Kobiela[1], Monika Proczko-Markuszewska[1], Ryszard Horyd[2], Zbigniew Pawlicki[2], Henryk Aszkiełowicz[2], Marta Ćwigoń[3], Krzysztof Sworczak[4], Andrzej J. Łachiński[1], Zbigniew Śledziński[1]

[1]Department of General, Endocrine and Transplantation Surgery, Medical University of Gdańsk

[2]Department of Surgery, District Hospital, Kwidzyn

[3]Surgical Psychosomatics and Psychology Lab, Department of General, Endocrine and Transplantation Surgery, Medical University of Gdańsk

[4]Department of Endocrinology and Disturbances of Haemostasis, Medical University of Gdańsk

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Abstract

Introduction: *Primary hyperhidrosis (PHH) is a genetic disease resulting in excessive sweating of hands, armpits, feet and sometimes face under emotional and/or thermal stimulation. The disease most frequently starts in early childhood and poses a significant problem to the patients, mostly by causing social embarrassment with serious psychological consequences.*

Aim: *Thoracoscopic sympathectomy is one of the approved methods of treatment of PHH. The aim of this study is to make the first evaluation in Poland of results of simultaneous bilateral sympathectomy from a posterior approach with clipping as a method of sympathectomy.*

Material and methods: *There were 73 bilateral thoracoscopic sympathectomies of Th3, Th4 and Th5 ganglia performed between May 2006 and May 2008 in both participating centres. Data were collected prior to surgery, immediately after it and during a 3-month follow-up visit. The examination consisted of a questionnaire for subjective evaluation of symptoms and gravimetry for the measurement of sweat production over time. Fifty-seven patients (75%) were available for a follow-up visit.*

Results: *All procedures were completed with videoscopy. There was no mortality and no serious morbidity. Mean perspiration from the palmar region assessed gravimetrically reached 443.67 mg/min and dropped to 45.67 mg/min 3 months after the operation ($p < 0.05$). Mean intensity of disease-associated distress (measured on a visual scale from 1 to 10) was 9.46 prior to surgery and 1.03 during follow-up ($p < 0.05$).*

Conclusions: *Transthoracic, posterior access sympathectomy is a safe and effective procedure. The discussed technique allows for simultaneous bilateral surgery without the need for troublesome patient repositioning, while CO_2 insufflation and careful, active pleural deflation need no post-operative pleural drainage, with very limited risk of pneumothorax.*

Key words: *primary hyperhidrosis, compensation hyperhidrosis, thoracic sympathectomy, thoracoscopy.*

Address for correspondence

Tomasz Stefaniak, MD, PhD, Department of General, Endocrine and Transplantation Surgery, Medical University of Gdańsk, 7 Dębinki St, 80-211 Gdańsk, phone +48 58 349 38 05, fax +48 58 349 24 10, e-mail: wujstef@amg.gda.pl

Introduction

Primary hyperhidrosis (PHH) is a genetic disease with extreme perspiration of palms, armpits, feet and sometimes head in response to stress or temperature [1-3]. The disease usually starts in early childhood and creates a life-long serious issue of psychological, adaptational and social nature. Severe impairment of life quality, and not unusual social marginalization often lead to psychosocial abnormalities, depression in more severe cases or suicide [4, 5]. Neither exact genomic location of the mutation, nor pathomechanism of the disease is clear [6, 7]. There is excess responsiveness of sudoriferous glands to sympathetic stimulation, while morphology of the glands remains intact.

Conservative treatment of the disease with local application of aluminium chloride or formaldehyde does not bring any benefit but poses some risk of skin laceration. Botulinum injections are minimally invasive, but their effectiveness is transient and lasts no longer than 6 months. Complete resolution of symptoms can be only achieved with thoracic (or lumbar if hyperhidrosis of the feet is the problem) sympathectomy. Contemporarily, videoscopic transtho-racic sympathectomy is a standard access. A controversy remains concerning the extent of surgery – from excision or electrocauterisation of the sympathetic ganglia or excision of their communication tracks to clip-ligation of these trunks [3].

Aim

Assessment of efficacy and safety of posterior access simultaneous bilateral thoracic sympathectomy with clipping of the trunks.

Material and methods

Seventy-three patients operated on for axillary and palmar hyperhidrosis from May 2006 to May 2008 in the Department of General, Endocrine and Transplantation Surgery of the Medical University of Gdańsk and in the Department of Surgery of the District Hospital in Kwidzyn were included in the study. Mean patients' age was 30.1 ±9.73 years. Seventy-six per cent of the group were women. Symptoms were present from early childhood in 85% of patients, with positive family history in 52% of cases.

Qualification for the procedure was based on: (i) anamnesis (presence of symptoms since childhood or puberty, localized hyperhidrosis and not generalized in response to stress or temperature); (ii) consultation with endocrinologist, which excluded endocrine causes of hyperhidrosis; and (iii) gravimetry. Excretion of more than 100 mg of sweat per minute was considered a direct indication for surgery. If excretion was between 40 and 100 mg, pros and cons were carefully balanced and patients were advised to have either surgery or treatment with botulinum.

Patients were operated on in a prone position under general anaesthesia, and intubated with a single-lumen endotracheal tube (Figure 1). After skin incision 1 cm medially to the inferior angle of the scapula ventilation was interrupted and a Veres needle was introduced into the pleural cavity. The pleural cavity was insufflated with CO_2 until a final pressure of 4 or 8 mm Hg and 0.8 l of gas was blown into the cavity. The Veres needle was then removed and a 5 mm trocar was introduced blind during expiration. A CO_2 line was connected and insufflation pressures were adjusted as low as possible to secure proper visibility and lung retraction. Pressure gradation was started at 4 or 8 mm Hg (depending on initial pressure) with 2 mm Hg interval until a level of 12 mm Hg was reached. Then, with visual control a 10 mm port was placed in the posterior axillary line within the 3rd or 4th intercostal space. Via this trocar, a videoscopic hook was introduced. The sympathetic cord was identified, isolated and clipped with a 10 mm clip applier (Figure 2) in positions defined by localization of hyperhidrosis according to Lin-Telaranta classification [9]. Haemostasis was thoroughly assessed, Redon drainage was placed inside the pleura and suction was employed to deflate the pleura. Aspiration was maintained for 15 minutes and Redon drainage was removed. In the meantime, positive end-expiratory pressure (PEEP) of 8 cm H_2O was enforced. Then the whole surgical team moved to the contralateral side, where the whole procedure was repeated. Patients spent 6 hours in the postoperative ward, until X-ray of the chest was performed. If pneumothorax was not found, patients were transferred to the general ward.

Postoperative assessment was done 3 months following surgery. Careful anamnesis was taken,

focused on the primary complaints and compensatory hyperhidrosis. The study was completed with gravimetry. Statistical analysis was performed with the StatPlus:mac 2007 program. Parametric variables were analyzed with Student's *t* test. If distribution of the variable was other than normal, Mann-Whitney's U test was used. Value $p < 0.05$ was considered statistically significant.

Results

All surgeries were completed with thoracoscopy. Bilateral sympathectomy was performed in each case. Mean operation time was 70.9 ±5.2 minutes, including 10.2 ±2.5 minutes spent on preparatory procedures, i.e. intubation and positioning of the patient. None of the cases was complicated with Horner's triad. Unilateral pneumothorax was diagnosed in 3 patients. One patient required 12-hours suction pleural drainage for considerable pneumothorax. The procedure had no impact on duration of hospitalization. Two other patients had small pneumothoraces, with visceral pleura no more than 2 cm from the chest wall and only conservative treatment was implemented. Pneumothorax resolved within 24 hours in both cases. Subcutaneous emphysema, which receded spontaneously within 3-4 days, was seen in 5 patients. A dental implant was damaged on intubation in one patient. Most of the patients complained of chest pain caused by pressing intercostal nerve with trocar at the angle of scapula. These symptoms required oral non-steroid anti-inflammatory drug administration and resolved within 3 months (on average, after 1 month).

Median hospital stay was 2 days. Hospitalizations exceeding 48 hours were recommended in patients living more than 100 km from the centre which performed the surgery. Fifteen patients were discharged 24 hours following the procedure.

Control parameters at 3 months post surgery could be measured in 57 patients (78%). Mean values of disease-attributable distress measured with VAS scale before and 3 months after thoracoscopy are shown in Figure 3. Subjective assessment of symptoms' intensity in different locations is presented in Table I. Mean gravimetry results from the face, palms, armpits and abdomino-lumbar region before and 3 months after surgery are shown in Table II. None of the patients required clip removal within 3 months after surgery.

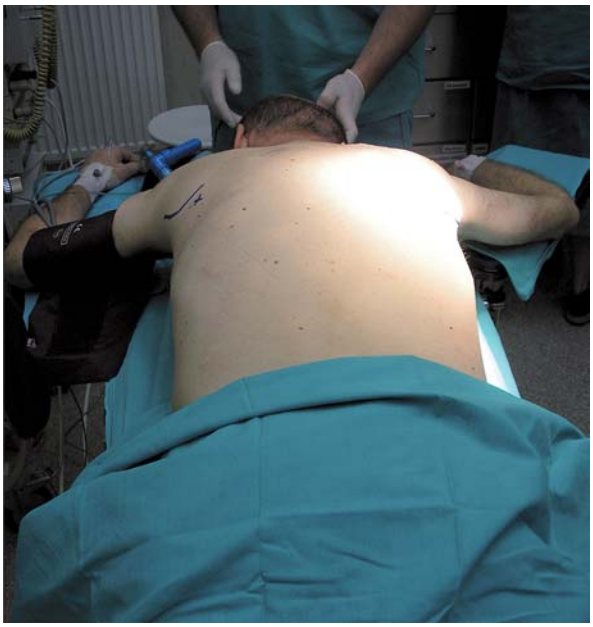

Figure 1. Positioning of the patient for posterior access simultaneous bilateral thoracoscopic sympathectomy

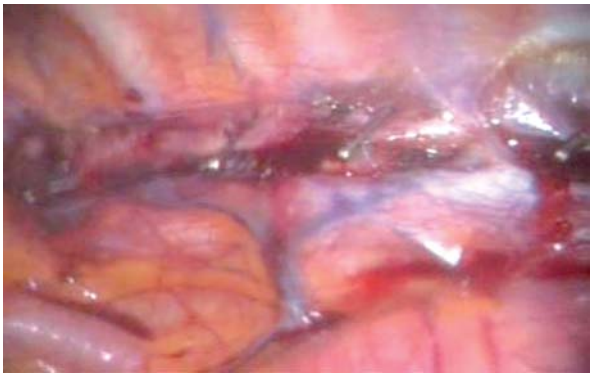

Figure 2. Intraoperative view after clip ligation of the left sympathetic trunk

In 7 patients (9.05%) some residual hyperhidrosis of palms was found (mean 51.87 ±6.21 mg/min), which needed no re-intervention. Although 2 further patients (2.37%) reduced their palmar perspiration by 29 and 54%, their residual values of, respectively, 114 and 106 mg/min slightly exceeded the cut-off for qualification for surgery (100 mg/min). In both cases the decision was made to extend the follow-up time until 12 months, and then re-evaluate the patients and discuss the need for reoperation.

Increased (compared to pre-operative) sweating of the abdomen and dorsum was seen in all patients. It can be considered a compensatory hyperhidrosis effect (100%), with 55 patients (75%) declaring a subjective sensation of excessive perspiration and only 36 (49%) having objective gravimetry results over 40 mg/min.

Discussion

Primary hyperhidrosis (*hyperhidrosis primaria*) is a genetically determined, dominant autosomal disease characterized by sympathetic overstimulation of the sudoriferous glands. Increased perspiration is particularly seen in the palms, armpits, face and feet. Stress is the most common stimulator, though sweating may also be provoked by thermal factors (hot day) or appear without any apparent reason. Remedies applied for conservative treatment, such as topical ion therapy or botulinum toxin, have only limited efficacy and rather high costs [1, 3]. An algorithm for PHH sequential therapy is presented in Table III.

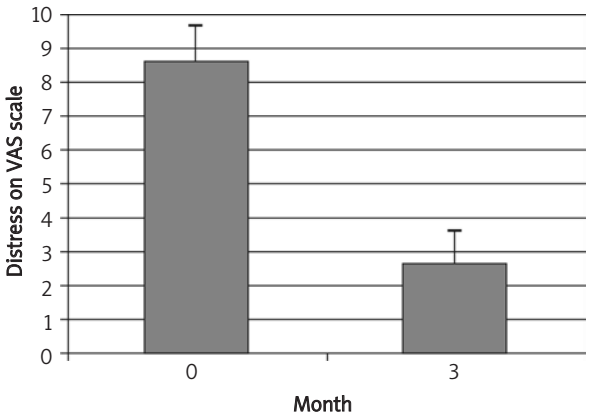

Figure 3. Mean values of disease-associated distress measured on visual analogue scale (VAS) before and 3 months following the procedure (results show as means and standard deviations). Student's *t* test, $p < 0.001$

Table I. Subjective sensation of symptoms intensity in different locations before and 3 months following surgery measured on VAS scale 0 – 10 (mean ± standard deviation)

Location	Before surgery	After surgery	*P*
Face	2.06 ±3.11	1.46 ±2.84	ns; 0.59*
Palms	9.46 ±1.80	1.03 ±1.26	< 0.01**
Axillae	8.20 ±2.90	2.53 ±2.34	< 0.01**
Abdomino-dorsal	2.73 ±3.26	3.93 ±2.67	ns; 0.30*
Feet	8.90 ±2.62	7.38 ±3.28	ns; 0.18**

**Mann-Whitney U test, **Student's t test*
ns – not significant

This paper presents early results of the surgical treatment of patients with PHH. Sympathectomy was performed with the clip-ligation method and both pleural cavities were explored at a single stage, without need for repositioning of the patient. As has been shown, the procedure is safe, has a low complication rate, needs no prolonged hospitalization and gives satisfactory therapeutic results. Efficacy of the treatment was confirmed with both patients' satisfaction (seen as distress attributable to the disease and subjective sensation of hyperhidrosis in different body areas) and objective gravimetric measurements. When inter-preting distress associated with the disease, one must remember that these patients still suffer from hyperhidrosis of the feet, which definitely affects their quality of life.

Since hyperhidrosis can occur due to other diseases or medication, consultation of an endocrinologist, who would exclude thyroid, pituitary and suprarenal pathology as much as carcinoid or paraneoplastic syndrome, is simply a must. Thorough analysis of co-morbidities and their therapy is also recommended. Young, otherwise healthy patients without any medication history prevailed in our study group. However, all factors that could contribute to hyperhidrosis ought to be analyzed before surgical treatment of the disease can be considered.

In the authors' opinion, gravimetry is particularly valuable in respect to possible consequences of the procedure [1]. Only patients with a perspiration rate exceeding 100 mg/min qualified for surgery, in spite of the fact that hyperhidrosis is diagnosed above 40 mg/min. This limitation was due to another important post-operative phenomenon: compensatory hyperhidrosis. This abnormality is associated with excessive sweating (sometimes extremely intensive) in the abdominal and dorsal regions. So far, there are no convincing data on pre-operative factors which could determine compensatory hyperhidrosis, its subjective

sensation and objective magnitude. Nor has any effective method of treatment of this ailment been described. Incidence of this complication in the literature is variable, and – as the authors state – depends very much on the definition of this condition [9, 10]. Lin *et al.* estimate the frequency of compensatory hyperhidrosis to be as high as 88% [11], while Panhofer *et al.* in 112 patients noted only 17% [12]. The significance of this side effect becomes even more important if one realizes that some patients ask for removal of the clips and reversal of the effects of the procedure due to the extreme compensatory sweating they suffer from. Such reversal is possible up to 3 months post clip-ligation of the sympathetic cords [10], although there are no data which would confirm the results of such a procedure. Nevertheless, patients treated with cross-section or excision of sympathetic nerves instead of clip-ligation do not have such an opportunity and are doomed to live with unmodifiable compensatory hyperhidrosis [11-14]. Clip ligation of the sympathetic trunk has similar long-term effectiveness as ablation or resection [10-14].

There are some reports on the topic in Polish literature based on small numbers of patients, mainly concerning technical matters, confirming the efficacy and safety of these procedures [15-18]. Still, they lack reliable data on patient qualification or long-term results. Besides, most of them focus on sympathectomies performed for vascular diseases, mainly for Raynaud's sign or Buerger's disease. The important therapeutic problem of hyperhidrosis as a chronic disease with serious psychosocial, not surgical, consequences is rarely discussed. Sympathectomies with clip ligation in Lin-Telaranta modification were neither analyzed nor, most likely, performed. This modification, leaving at least potential space for limiting severe adverse effects of sympathectomy, seems particularly convenient from the patient's point of view.

Table II. Primary and secondary hyperhidrosis in different locations before and 3 months after treatment with sympathectomy measured with gravimetry (shown as mean ± standard deviation)

Location	Before surgery	After surgery	*P*
Face	30.64 ±55.28	42.16 ±53.61	ns; 0.59*
Palms	443.67 ±53.69	45.67 ±21.59	0.01*
Axillae	175.67 ±178.40	49.25 ±68.23	0.03*
Abdomino-dorsal	41.53 ±70.19	93.33 ±156.61	ns; 0.26*
Feet	124.60 ±53.67	273.55 ±245.78	ns; 0.21*

**Student's t test*
ns – not significant

Conclusions

In summary, we want to emphasize that this study for the first time in Polish literature not only addresses simultaneous bilateral sympathectomy via posterior access, but also documents application of clipping technique in this procedure. Although the procedure itself is not complicated technically, issues of qualification and post-operative care of patients with primary hyperhidrosis, including sequential therapy and solving problems resultant from disease and treatment specificity, suggest that these procedures should be reserved for centres dedicated to the problem of PHH.

Table III. Algorithm for treatment of hyperhidrosis in various locations

Axillary	Palmar	Facial	Plantar
Deodorants with aluminium chloride	Aluminium chloride	Botox-A injections repeated every 6 months	Deodorants with aluminium chloride
Botox-A injections repeated every 6 months	Ionophoresis	Sympathectomy	Ionophoresis
Removal of axillary glandular tissue (retrodermal curettage with/without liposuction)	Botox-A injections repeated every 6 months		Botox-A injections repeated every 6 months
Sympathectomy	Sympathectomy		Sympathectomy

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