An assessment of plantar hyperhidrosis after endoscopic thoracic sympathicolysis

Anna Uren˜a, Ricard Ramos, Cristina Masuet, Ivan Macia, Francisco Rivas, Ignacio Escobar, Rosa Villalonga, Juan Moya

1. Introduction

Primary hyperhidrosis (PH) is a rare disorder of unknown etiology that is characterized by excessive sweating on the palms of the hands, the soles of the feet, and the armpits (axillary), in the groin area, and/or under the breasts [1]. It is different from secondary hyperhidrosis, which occurs as a consequence of another disorder.

Although the predominant symptom is palmar hyperhidrosis, patients present palmar hyperhidrosis with associated plantar hyperhidrosis or palmar-axillary-plantar hyperhidrosis in more than 70–80% of the cases [2,3].

Endoscopic thoracic bilateral sympathicolysis (ETBS) is currently the standard treatment for primary hyperhidrosis [4–6].

The clinical observation of over 700 patients with hyperhidrosis of the palms and/or soles, subjected to thoracoscopic sympathicolysis of ganglia T2 and T3, suggests that these ganglia present a more extensive dermatome than classically believed [7].

The purpose of this review of a prospectively gathered database was to investigate the effect of T2–T3 sympathicolysis on plantar hyperhidrosis.

2. Patients and methods

A review of a prospectively gathered database was carried out in our department. The sample included 198 patients with primary palmar, axillary, and/or facial hyperhidrosis who underwent ETBS. This study was approved by the ethics committee at our hospital. Information about the technique, results and side effects were provided to patients in a written format during the first consultation. An individual consent was obtained prior to the surgery.
3. Methods

All patients were subjected to a complete preoperative study, followed by completion of a specific questionnaire 8 weeks before surgery; recording the degree of perspiration in different body regions (thorax, abdomen, axilla, hand, back, popliteal region and foot), based on a visual analog scale (VAS) graded between 0 and 4.

Another questionnaire was completed 12 months after surgery; recording the degree of perspiration in the same body regions based on a VAS. All values were incorporated to a customized database for posterior analysis.

Areas without perspiration (i.e., presenting anhydrosis) were defined as those zones yielding a minimum score on the VAS, and were taken to be a direct indication of denervated areas after surgery.

4. Endoscopic thoracic sympathicolysis

The surgical protocol was carried out as following: (a) general anesthesia with double-lumen endotracheal intubation, placing the patient in a 25° sitting position with abduction of the upper extremities and semi-extension of the forearms; (b) lateralization of the table about 10° toward the opposite side of the hemithorax being operated on and creation of a single entry port for the 5 mm Wolf™ endoscope (5.5/3.5 mm 0; Richard Ellis Wolf, University of Leipzig) at the level of the III intercostal space, axillary midline; (c) the rib spaces and corresponding segment of the upper thoracic sympathetic chain were then visualized, located 0.5—1 cm laterally from the head of the rib and application of sympathicolysis to the T2—T3 ganglia in palmar hyperhidrosis patients, by means of electrocoagulation with monopolar forceps at 25 W in series of 5—10 applications cutting the chain at the level of the ribs; (d) collateral nervous trunks were coagulated (nerve of Kuntz); (e) hemostasia and evacuation of the pneumothorax by means of air aspiration through the endoscopic working channel, no drain left; and (f) discharge of patients 17 h after the intervention if X-rays were correct.

4.1. Statistical analysis

A descriptive analysis was made of the study parameters. Variable distribution was evaluated with the Kolmogorov—Smirnov test. The results obtained were paired data without a normal distribution; comparisons were thus made with the Wilcoxon signed rank test. The McNemar test was used to analyze the degree of anhydrosis before and after the operation, a value of 1 corresponded to the presence of perspiration, while a value of 0 being indicative of anhydrosis. To evaluate the degree of total anhydrosis, we adopted a score of 0 as the sole study variable, grouping the rest of scores as indicative of the presence of perspiration.

The surgical protocol was carried out as following: (a) general anesthesia with double-lumen endotracheal intubation, placing the patient in a 25° sitting position with abduction of the upper extremities and semi-extension of the forearms; (b) lateralization of the table about 10° toward the opposite side of the hemithorax being operated on and creation of a single entry port for the 5 mm Wolf™ endoscope (5.5/3.5 mm 0; Richard Ellis Wolf, University of Leipzig) at the level of the III intercostal space, axillary midline; (c) the rib spaces and corresponding segment of the upper thoracic sympathetic chain were then visualized, located 0.5—1 cm laterally from the head of the rib and application of sympathicolysis to the T2—T3 ganglia in palmar hyperhidrosis patients, by means of electrocoagulation with monopolar forceps at 25 W in series of 5—10 applications cutting the chain at the level of the ribs; (d) collateral nervous trunks were coagulated (nerve of Kuntz); (e) hemostasia and evacuation of the pneumothorax by means of air aspiration through the endoscopic working channel, no drain left; and (f) discharge of patients 17 h after the intervention if X-rays were correct.

5. Results

The study population comprised of 198 patients. The response rate for the questionnaire was 100%, of which there were 138 females (69.6%) and 60 males (30.3%), with an average age of 29.3 years (range, 16—53 years).

5.1. Perioperative and postoperative complications

No mortality or perioperative complications were recorded. The overall rate of complications was 2.8% (11/396 procedures) which included 1.5% (6/396) pneumothorax, which required drainage in 1% (4/396) of procedures, and 1.3% (5/396) isolated radiologic subcutaneous emphysema. One patient (1/396 procedures) had unilateral partial Horner syndrome (0.2%) and another patient (1/198) reported gustatory hyperhidrosis (0.5%). Gustatory hyperhidrosis appears on the face, thorax, and back and is associated with eating food.

5.2. Incidence of anhydrosis according to anatomical location

When the degree of sweating in different body regions was compared according to the preoperative and postoperative questionnaires, the body regions with significant changes in excessive sweating were the trunk and popliteal region (Fig. 1).

5.3. Compensatory hyperhidrosis according to anatomical region

When the degree of sweating in different body regions was compared according to the preoperative and postoperative questionnaires, the body regions with significant changes in excessive sweating were the trunk and popliteal region (Fig. 1).

6. Discussion

Plantar hyperhidrosis can lead to bromhidrosis, blistering, skin infections, and moisture-related rotting of socks and shoes, and therefore constitutes physical and emotional stress for most people concerned. Various therapy methods are available for the treatment of plantar hyperhidrosis.

Although ETBS over T2—T3 ganglia currently is the standard treatment for primary hyperhidrosis, there is still no consensus in the literature regarding the best resection level for palmar hyperhidrosis: resection at the T2 level, at the T2—T3 level of only T4 level. Some authors directly relate

<table>
<thead>
<tr>
<th>Anatomical region</th>
<th>Preoperative (n, %)</th>
<th>Postoperative (n, %)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axilla</td>
<td>16 (8.1)</td>
<td>182 (91.9)</td>
<td>0.01</td>
</tr>
<tr>
<td>Hand</td>
<td>2 (1.0)</td>
<td>196 (99.0)</td>
<td>0.001</td>
</tr>
<tr>
<td>Foot</td>
<td>7 (3.5)</td>
<td>191 (96.5)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

* McNemar test.

Table 1 Distribution of the anhidrotic areas before and after surgery.
Compensatory hyperhidrosis to the number of sympathetic ganglia eliminated or the surgical technique [6,8—10].

A lot of patients referred plantar hyperhidrosis associate to palmar hyperhidrosis. In our series, more than the half of the patients reported that anhidrosis or hypohidrosis plantar after ETBS.

From the anatomical perspective, the cutaneous sympathetic supply for the legs originates in cells of the intermediolateral column from the tenth dorsal to the third lumbar segment. The preganglionic fibers travel through from the 10th dorsal to the third lumbar anterior root, most of them passing caudal within the lumbar and sacral portions of the chain. The postganglionic fibers join the lumbarsacral plexus segmentally as gray rami. The typical lumbar sympathectomies consists in resection of the second, third and fourth lumbar ganglia [11,12].

Therefore, Rieger et al. [13] reported that the resection of the sympathetic trunk from the upper edge of the third lumbar vertebral body to the lower edge of the fourth lumbar vertebral body results in an interruption of the entire sympathetic reflux to the spinal nerves L4—S3, thereby causing anhydrosis of the feet. Theoretically, the transection of the sympathetic trunk below the lumbar ganglion L2 and/or caudal to the second lumbar vertebral body should be sufficient to accomplish anhydrosis of the feet because no further sympathetic outflow exists from the spinal cord to the sympathetic trunk caudal to L2.

Recently, Wolosker et al. [2], reported good initial improvement in plantar hyperhidrosis after thoracoscopic surgery that reduces to a lower level of improvement after one year. Neumayer et al. [14], on clipping ganglion T4, reported diminished perspiration of the palms, axillae and even soles, though this procedure was not as effective at palm level as T2 sympathicolysis, nevertheless, the majority of patients remained unchanged or nearly unchanged. In our series, 51% of soles were completely dry or important diminution after ETBS; similar to results of Hsu et al. who reported that 64% of patients with plantar hyperhidrosis were cured after T2 sympathectomy.

Following the surgical treatment, the level of anxiety and its influence on the daily life showed a statistically significant diminution, after the surgery, coinciding with other reports in the literature, we observed a clear and significant diminution of the anxiety state, which can be explained by the elimination of the capacity of the surroundings to generate and maintain anxiety [15]. Wolosker et al. [2], reported that after surgery there may a break in the negative feedback that might have been leading to plantar sweating.

Although this plantar anhidrosis or hypohidrosis cannot be explained by neuroanatomical or neurophysiologic knowledge, classically, two fundamental types of perspiration have been described according to the type of stimulus involved. Thus, environmental temperature induces diffuse perspiration of the face, back of the hands, neck, chest and back; with scant response on the part of the palm plantar eccrine glands. In turn, mental or emotional stimulation causes massive and profuse perspiration mainly of the palms, soles and/or axillae. The control of emotional perspiration is vehiculated by the promoter regions of the frontal brain cortex, while environmental perspiration is regulated by the hypothalamus [16].

Possibly, the anhidrosis or hypohidrosis of the hands and feet is more closely related to cortical control, and less to the surgical technique employed, though further studies are needed to confirm this.

In conclusion, the results obtained indicate that ETBS is followed by a clear and significant decrease in the zones regulated by mental or emotional stimuli, and an increase in the areas regulated by environmental stimuli, though we are unable to establish the etiology of this redistribution.

Although ETBS is the standard treatment for palmar primary hyperhidrosis and induced important plantar anhidrosis and hypohidrosis, it should not be indicated when there is only plantar hyperhidrosis. In this regard, we believe it would be interesting to study baseline sympathetic activity in patients affected by primary hyperhidrosis and the neuroanatomy of the sympathetic system.

References


