The body mass index and level of resection
Predictive factors for compensatory sweating after sympathectomy

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Introduction
Video-assisted thoracic surgery (VATS) is the optimal surgical technique for performing a thoracic sympa-

thectomy (TS) in the treatment of primary hyperhidrosis since it is a safe, effective and minimally invasive method [1]. However, in addition to the complications of pneumothorax and hemothorax, which are totally reversible, the major adverse event which may result from

Abstract Objective Compensatory sweating (CS) is the most common adverse event and the main cause of dissatisfaction among patients undergoing a VATS sympathectomy for the treatment of primary hyperhidrosis. It has been described that obese individuals experience more sweating than thinner ones. The aim of this study is to identify the Body Mass Index (BMI) and the level of resection as predictive factors for CS and its relation to levels of patient satisfaction following the procedure. Methods From October 1998 to June 2003, 102 patients undergoing VATS sympathectomies (51 for palmar hyperhidrosis, PH, and 51 for axillary hyperhidrosis, AH) were prospectively surveyed. They were divided into three groups according to their BMI: Group I was composed of 19 patients with BMI < 20 (9 patients with PH and 10 with AH); and Group III was composed of 31 patients with BMI ≥ 25 (17 with PH and 14 with AH). Each procedure was simultaneously and bilaterally performed under general anesthesia using two 5.5 mm trocars and a 30° optic system. Results Patients treated for PH (resection of T2-T3) had more severe CS than those with AH (resection of T3-T4) (p = 0.007) and the greater the BMI, the greater the severity of the CS (p < 0.001). No statistically significant difference was found between the BMI bands in relation to the degree of satisfaction (p = 0.644), nor when we compared the degree of satisfaction to the degree of CS (p = 0.316). Conclusions The greater the BMI, the more severe the CS, but this did not correlate with the patients' level of satisfaction. Avoiding the resection of T2 sympathetic ganglia is also important in reducing the intensity of CS.

Key words body mass index · compensatory sweating · sympathectomy · quality of life · subjective rating scale
the operation in some cases is compensatory sweating (CS).
CS consists of an increase in the severity of sweating in locations that were previously normal. Because of its high frequency occurrence, it is the most feared adverse event following a VATS sympathectomy [1, 5, 7, 10, 12, 18]. When severe, CS is considered the main cause of patient dissatisfaction since it significantly affects the patient’s quality of life [3]. Thus, it would be useful to identify some predictive factors so that particularly susceptible patients could take preventive measures and thereby improve their quality of life.

It has been observed that obese individuals present more severe sweating than the general population [11]. The reason why they do so is unclear in the literature. It is probable that obese individuals, who have a thick layer of fat in the subcutaneous tissue, have greater difficulty in losing heat through convection and irradiation, and so evaporation becomes the natural compensatory mechanism. Thus, sweating is likely the chief means of regulating an increase in body temperature. A simple means of measuring an individual’s nutritional state is by calculating the Body Mass Index (BMI) [2, 6, 8, 9].

The objective of this study was to verify the relationship between an individual’s nutritional state as represented by BMI, the severity and degree of CS, the level of resection, and the level of satisfaction following a VATS sympathectomy for the treatment of primary hyperhidrosis.

Material and methods

This was a prospective, non-randomized, and uncontrolled study. From October 1998 to June 2003, data were collected from 102 patients with palmar hyperhidrosis (PH) who underwent thermoablation of the T2 and T3 ganglia or the T3 and T4 ganglia for primary palmar or axillary hyperhidrosis (AH) using VATS sympathectomy, respectively. The patients all underwent similar treatment, following the same protocol. The treatment was in accordance with the hospital’s ethical standards as set by the Ethics Committee for Analysis of Research Projects on Human Experimentation. The mean age was 27.6 ± 7.2 years, ranging from 15 to 45 years; 62 patients were female (60.8%). The complaints causing the greatest social interference in the group were PH in 51 patients and AH in the other 51.

All patients underwent a bilateral VATS sympathectomy. The patients with preferential PH were submitted to thermoablation of the T2 and T3 ganglia and those with AH to that of the T3 and T4 ganglia. The surgical techniques employed included two 5 mm incisions. The first incision was made in the fourth or fifth submammary intercostal space in order to introduce the camera (30°), and the second was midaxillary, for the surgical instruments. Ablation using an electrical or harmonic scalpel was the chosen technique in all cases.

No mortality or conversion to open surgery occurred in our series. All of the patients showed uneventful postoperative progress and were discharged on the day after the surgery. Only two patients had temporary Horner’s syndrome, with regression to normal in 30 days. As part of routine follow-up, clinical examinations were provided in the first, third, and sixth month, and at six month intervals thereafter. The patients were followed for periods from 1 to 38 months (an average of 12.8 months and a median of 10.2 months).

All of the patients underwent at least three evaluations for the purpose of this study: immediately prior to and after surgery and at the final clinical evaluation. At the first visit, patients were given a thorough clinical evaluation. After measuring their BMI and identifying the symptoms causing the greatest social interference, either palmar or axillary hyperhidrosis, they were treated. We considered the last evaluation from all data collected. To calculate each patient’s BMI, the patient’s weight (kg) was divided by the square of his or her height (m²).

The patients were divided into three groups according to their BMI as it stood immediately before surgery: less than 20; between 20 and 25; and greater than 25. The patient distribution according to their BMI and hyperhidrosis site is presented in Table 1. No statistically significant difference was found between the hyperhidrosis location and the patients’ BMI (p = 0.690).

Patients who did not notice any difference in the location or intensity of their sweating were considered to be unaffected by CS. Slight compensatory sweating was considered to exist when patients referred to minor modifications in the locations and intensity of sweating, such as a blot on a shirt, but without expressing significant concern as a result. Moderate compensatory sweating was considered to exist when patients referred to embarrassing or disabling situations caused by CS. Finally, severe compensatory sweating was considered to exist when patients referred to interference in their social and professional activities, such as successive changing of clothes, due to sweating of the same intensity but at other primary locations.

For the postoperative evaluation, patients filled out a subjective rating scale (multiple test) at every visit, without any intervention or advice from the interviewer, based on their own estimates. The following parameters were studied: recurrent hyperhidrosis and CS. If the latter was present, its severity was recorded as slight, moderate, or severe, according to the patient’s subjective perception, as described above. Finally, the patient satisfaction with regard to the procedure’s final results (including both the treatment and any complications) was subjectively evaluated by means of a multiple choice subjective rating scale (four options) in which the patients could place themselves on a satisfaction scale as follows: 1- deficient, 2- regular, 3- very good, 4- excellent.

At first, the result from the VATS sympathectomy was analyzed in relation to the success of the treatment for each hyperhidrosis location. Next, we analyzed the relationship of the BMI with the presence and degree of CS and also with the patients’ level of satisfaction. The relationship between the degree of CS and patient satisfaction was also studied.

The statistical tests utilized were the chi-squared test and a multivariate analysis in which a discriminatory analysis technique was applied using the “stepwise” method for the selection of variables. Variables associated with p < 0.05 on univariate analysis were included in multivariate analysis. This was to verify whether the variables that were significant in the univariate analysis continued to be significant when in association. In both tests we considered a significance level (p value) of 0.05.

Table 1: Patient distribution according to BMI and hyperhidrosis location

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Hyperhidrosis location</th>
<th>Total sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Palmar hyperhidrosis n (%)</td>
<td>Axillary hyperhidrosis n (%)</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>9 (17.6)</td>
<td>10 (19.6)</td>
</tr>
<tr>
<td>between 20 and 25</td>
<td>25 (49.0)</td>
<td>27 (52.9)</td>
</tr>
<tr>
<td>&gt; 25</td>
<td>17 (33.3)</td>
<td>14 (27.5)</td>
</tr>
<tr>
<td>Total</td>
<td>51 (100.0)</td>
<td>51 (100.0)</td>
</tr>
</tbody>
</table>

Chi-squared test: p = 0.690