Video assisted thoracoscopic re-sympathetic surgery in the treatment of re-sweating hyperhidrosis

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Abstract

Objective: The characteristics and causes of re-sweating after sympathetic surgery in hyperhidrosis patients have yet to be clearly documented due primarily to low incidence of re-sympathetic surgery. The purpose of this study is to identify the causes of re-sweating following sympathetic surgery, and to assess the outcomes of re-sympathetic surgery. Methods: From February 1997 to July 2003, 36 patients underwent re-sympathetic surgery in order to treat re-sweating. Patients originally underwent sympathetic surgery due to facial (14 cases), palmar (21 cases), and axillary (1 case) hyperhidrosis. Results: Sympathectomy was performed as a primary surgical intervention in 7 cases (19.4%), sympathicotomy in 12 cases (33.3%), and sympathetic clipping in 17 cases (47.3%). Thirteen patients complained of re-sweating on both sides, and 23 patients exhibited unilateral re-sweating. The onset of re-sweating occurred after an average of 3.1 months (range, 1–12 months) after the operation. The causes of re-sweating after sympathetic surgery included an intact sympathetic chain in 4 cases (11.1%), incomplete resection in 6 cases (16.7%), partial reattachment in 6 cases (16.7%), improper ganglion location in 4 cases (11.1%), clip slipping out in 11 cases (30.5%), and unknown in 5 cases (13.9%). Twenty-seven patients (75.0%) exhibited re-sweating within 3 months, and 9 patients (25.0%) experienced re-sweating after 6 months. During the second operation, sympathicotomy was performed in 20 cases (55.6%) and sympathetic clipping in 16 cases (44.4%) in which 32 patients (88.9%) reported decreased sweating. Conclusions: Surgical errors during the initial operation constituted the main cause of re-sweating following sympathetic surgery. Re-sympathetic surgery was necessary in order to treat re-sweating, and was associated with favorable outcomes.

Keywords: Hyperhidrosis; Sympathectomy; Re-sympathectomy; Re-sweating

1. Introduction

Thoracoscopic sympathetic surgery is currently the best treatment for hyperhidrosis, and the success rate is quite high, although 1–15% patients experience re-sweating after surgery which is the most common cause of dissatisfaction after sympathetic surgery [1–4].

The characteristics and causes of re-sweating after sympathetic surgery have yet to be clearly documented, owing mainly to low incidence of re-sympathetic surgery, and not much is known regarding re-sweating after sympathetic clipping. The purpose of this study is to identify the causes of re-sweating following sympathetic surgery, and to evaluate the outcomes of re-sympathetic surgery.

2. Patients and methods

From February 1997 to July 2003, we operated on 36 patients who had previously undergone video-assisted thoracoscopic sympathetic surgery. In the same period, 757 patients underwent sympathetic surgery and 10 of re-operation patients (27.8%) had been referred from other hospitals. We retrospectively analyzed the method of initial operation, recurrence sites, onset time of re-sweating, causes of re-sweating, the method of second operations, and the results of the second operation.

Pleural adhesion was graded as absent, mild, moderate, or severe, and the cause of recurrence was classified into six groups based on thoracoscopic findings as intact, incomplete resection, partial reattachment, clip slip out, improper location of sympathetic trunk, and unknown cause.

The operation was performed in a semi-fowler’s position under the general anesthesia using a single lumen endotracheal tube. One port was made in the anterior axillary line and the 6th intercostal space for insertion of a telescope (Olympus Winter & Ibe, Germany). A 5 mm thoracoscope was used in most cases except in patients with severe...
pleural adhesion where 10 mm thoroscope was used. 1500-1700 ml of CO₂ gas was insufflated into the thoracic cavity to gradually deflate the lung rendering a better surgical view. After inspecting the pleural space, another port was made on the mid-axillary line and 3rd or 4th intercostal space for an endoscopic instrument depending on the presence of pleural adhesion in that area.

After adhesiolysis of pleura, sympathetic trunks which had been previously operated on were inspected and dissected in order to determine the cause of recurrence prior to undertaking re-sympathetic surgery. We defined sympathetic trunk as 'intact' if no scar could be observed on the sympathetic trunk; 'incomplete resection' if the sympathetic trunk showed partial continuity between the ganglions; nerve regeneration implies continuity of the sympathetic trunk between ganglions; nerve regeneration implies continuity of the sympathetic trunk; 'improper location' refers to cases in which wrong sympathetic ganglion was selected during the first operation; 'clip slip out' was defined as a clip located near the sympathetic trunk or partially clipped on the sympathetic trunk. After classifying the cause of re-sweating, either sympathectomy by ablating the chain with electric diathermy, or sympathetic clipping by clipping the chain with an endoclip (Liga clip, Ethicon Co.) on the upper border of rib was done.

3. Results

The patients' demographics, type of hyperhidrosis, method of first operation, and the site of re-sweating are listed in Table 1. Twenty-three patients (63.9%) experienced re-sweating within 1 month, and the mean onset from the first operation to re-sweating was 3.1 ± 3.4 months (range, 1-12 months), with no re-sweatings between 3 and 6 months. Pleural adhesion was absent in 8 cases (22.2%), mild in 18 cases (50%), moderate in 8 cases (22.2%), and severe in 2 cases (5.6%) although all adhesion were resolved without conversion to thoracotomy.

The cause of re-sweating after sympathetic surgery included an intact sympathetic chain in 4 cases (11.1%), incomplete resection in 6 cases (16.7%), partial re-attachment in 6 cases (16.7%), improper surgical location in 4 cases (11.1%), clip slipping out in 11 cases (30.5%), and unknown cause in 5 cases (13.9%).

Sympathectomy was performed as a second operation in 20 cases (55.6%) and sympathetic clipping in 16 cases (44.4%) with the mean operation time of 85.1 ± 37.3 min (range, 30-189 min). There was no operative mortality, and complications such as bleeding more than 250 ml (4 cases) and prolonged air leak (3 cases) occurred in 7 patients (19.4%). There was no re-operation due to postoperative bleeding. The mean duration of hospital stay was 4.9 ± 1.5 days (range, 3-7 days) and mean follow-up duration was 3.0 ± 3.3 months (range, 1-12 months).

Thirty-two patients (88.9%) experienced decreased sweating following the second operation, and the success rate of re-sympathetic surgery and clipping were 95.0% (19/20) and 81.3% (13/16), respectively, although there was no statistically significant difference between the two groups (P = 0.192) (Table 2).

4. Discussion

Re-sweating after sympathetic surgery for hyperhidrosis is an embarrassing complication and classified into two types. One is persistent sweating due to improper operation or an alternate pathway of the sympathetic nerve. The other is delayed re-sweating due to regeneration of the sympathetic nerve. Drott et al. [5] reported persistent sweating in 1.9% and delayed re-sweating in 2% of patients during a mean follow-up period of 31 months following sympathectomy.

The principal cause of persistent sweating was improper operation, including 'clip slip out', incomplete resection of the sympathetic trunk (other site operation, partial resection), and improper location of sympathetic ganglion, and Hsu et al. [6] reported that the main cause of failure following sympathectomy was due to improper operation.

Sympathetic clipping has some advantages over sympathectomy, and has gained an increasing amount of acceptance, and Lin et al. [7] first described sympathetic clipping in 1998, and has reported that five of 326 patients who underwent T2 sympathetic clipping had to undergo reoperation because of intolerable compensatory sweating, and four patients recovered by removing the clip. By clipping the sympathetic trunk, it is theoretically possible to check proper placement of clip by intraoperative chest X-ray.

<table>
<thead>
<tr>
<th>Method of second operation</th>
<th>Number of cases (Success Rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sympathectomy</td>
<td>20 cases (55.6%)</td>
</tr>
<tr>
<td>Sympathetic clipping</td>
<td>16 cases (44.4%)</td>
</tr>
<tr>
<td>Mean operation time (range)</td>
<td>85.1 ± 37.3 min (30-189 min)</td>
</tr>
<tr>
<td>Complications</td>
<td>7 cases (19.4%)</td>
</tr>
<tr>
<td>Bleeding</td>
<td>4 cases</td>
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<tr>
<td>Prolonged air leak</td>
<td>3 cases</td>
</tr>
<tr>
<td>Mean hospital stay (range)</td>
<td>4.9 ± 1.5 days (3-7 days)</td>
</tr>
<tr>
<td>Mean follow up duration</td>
<td>3.0 ± 3.3 months (1-12 months)</td>
</tr>
<tr>
<td>Operation success</td>
<td>32/36 (88.9%)</td>
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</tbody>
</table>

Table 2: Surgical results of re-sympathetic surgery
and it can be removed if necessary in patients with excessive compensatory sweating to regain to preoperative status.

In our study, the most common cause of improper operation was ‘clip slip out’. We experienced 17 cases of re-sweating after clipping, and except for 5 cases of unknown origin and 1 case of improper location, 11 cases were most likely due to clip slip out. Partial clipping was responsible for 7 of these cases (64%), and no clip was observed on the sympathetic trunk in 4 cases. The possible causes of slip out may be due to inadequate dissection of sympathetic trunk, loose clipping, or an unusually thin sympathetic trunk.

The second most common cause of improper operation was incomplete resection which may have occurred as a result of variations in the pathway of sympathetic trunk or due to the presence of large vessels in the vicinity of sympathetic trunk. Wang et al. [8] reported variations of distribution of T-2 and T-3 sympathetic trunks along the horizontal axis of the rib, and Lin et al. [9] reported 5.1% chance of encountering an unusual findings which include upper sympathetic trunk obscured by adipose tissue, medially located sympathetic trunk, great vessels overriding the sympathetic trunk, or presence of aberrant vessels.

Confirming the level of sympathetic ganglion is not easy, and using the sympathetic ganglion as a landmark during surgery may decrease the possibility of improper localization. The second rib is usually the most upper rib visible from the thoracic cavity and hence most commonly used landmark in identifying the level of sympathetic ganglion [10]. It is necessary to palpate first rib with the instrument in order to confirm its location. Highest superior intercostal artery which consistently runs parallel and lateral to sympathetic chain at an average distance of 10 mm is another useful landmark [11].

Anatomical variations of ganglion may be another cause of improper localization. Cadaveric dissections revealed that the sympathetic ganglion was most frequently located in the intercostal space (50%), but it was not possible to identify them in 7.6% [12]. However, for optimal results, it is imperative to adequately dissect sympathetic nerves, and confirm the level of the sympathetic ganglion.

The sympathetic trunk is also associated with a complex alternate pathway via rami-communicantes, and this may be the principal cause of unknown origin of re-sweating. Kirgis et al. [13] reported that the incidence of bilateral and unilateral intercostal rami arising from T-2 nerve connected to T-1 nerve was 59 and 31.8%, respectively, and the incidence of those arising from T-3 nerve and connected to T-2 nerve was reported as 34.1 and 40.9%, respectively.

Distance of Kuntz fiber from the sympathetic trunk was 7.3 mm in average [12], and technically, pleural resection of at least 1.5 cm laterally from the sympathetic trunk is required in order to avoid bypassing the Kuntz fiber thus decreasing a chance of re-sweating. Sym pathetic surgery without resection of rami communicantes cannot block all the sympathetic stimuli, and lateral ablation tends to reduce the incidence of re-sweating.

The main cause of delayed re-sweating is nerve regeneration [6,14]. Clinical evidence suggests that the rate of recurrence increases as time goes on, and by increasing the length of resected sympathetic nerve, the recurrence rate decreased [15]. Following the nerve damage, a rapid Schwann cell proliferation takes place, forming solid cellular columns, which serve as a guide to sprouting axons. Axons grow 1-2.5 mm per day, and reconnect the effect organ. Return of sympathetic activity parallels the extent of the regenerative process, and the fibers eventually reestablishes functional pathways. However, most regenerative fibers only have functional connection and only a few fibers exhibit sympathetic activity. Most recurred sweatings developed unilaterally, although the same procedure was performed on both sides [16].

Most patients who has had undergone re-sympathectomy experiences decreased sweating [6,17]. The success rate associated with sympathicotomy is higher than that associated with sympathetic clipping, although this is not a statistically significant trend. This implies that more complete resection is necessary during re-sympathetic surgery in order to achieve favorable surgical results. It is also imperative to separate interrupted sympathetic trunks by 2-3 mm in order to reduce the chance of nerve regeneration [15].

In conclusion, surgical errors during the initial operation constituted the principal cause of re-sweating following sympathetic surgery. Re-sympathetic surgery was necessary to treat re-sweating and was associated with favorable outcomes.

References


