Institutional report - Thoracic general

Minimally invasive thoracoscopic sympathectomy for palmar hyperhidrosis via a transaxillary single-port approach

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Received 17 October 2003; received in revised form 8 March 2004; accepted 10 March 2004

Abstract

The aim of this retrospective study was to evaluate the mid-term outcome (average follow-up 10 months, range 6–18 months) and value of transaxillary single-port thoracic sympathectomy using a thoracoscope with an operating channel for the treatment of hyperhidrosis. Between December 1992 and October 2002, 176 consecutive patients (94 men, 82 women, mean age 21 years) with hyperhidrosis underwent thoracoscopic sympathectomy via a 12-mm single-port approach. Data on postoperative morbidity and outcome were analyzed to validate the technique. Mean operative time per side was 9 min; there was no conversion to an open procedure. Ninety-five percent of the patients were discharged the next day. Thirty-day mortality was zero. Complications included unilateral transient Horner’s syndrome (n = 1), residual pneumothorax requiring chest drainage from the port entry (n = 4), and segmental atelectasis of the lung (n = 4) which was treated conservatively. Complete relief of symptoms was observed in all patients at the 6-month follow-up; 45% experienced compensatory hyperhidrosis. Single-port thoracoscopic sympathectomy produces excellent medical and cosmetic results in patients with hyperhidrosis, and is associated with a short hospital stay and a low risk of complications. Overall satisfaction is high. A few patients may experience compensatory symptoms.

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Keywords: Single-port sympathectomy; Video-assisted thoracoscopy; Thoracoscopy; Palmar hyperhidrosis

1. Introduction

Palmar hyperhidrosis is a distressing, often socially disabling, condition. Conservative treatment with topical or oral agents offers only minimal and temporary relief, and iontophoresis, which induces a nonspecific injury of the epidermis with abnormal keratinization and hyperkeratotic plugging of the orifices of the sweat gland, requires long-term maintenance therapy to prevent recurrence [1]. Open surgical procedures involving severance or resection of the upper thoracic sympathetic chain (T2 and T3, which are responsible for the sympathetic innervation of the palm) through a posterior, transaxillary or supracavicular approach were found to be very effective, but they were highly invasive and associated with a high rate of morbidity [2]. In the 1970s, however, sympathectomy for hyperhidrosis became considerably safer with the introduction of the minimally invasive thoracoscopic technique of Kux [2,3], and it can now be offered to nearly all patients with severe hyperhidrosis.

Several thoracoscopic methods have since been described, with different access sites and different operative approaches (resection of the chains or simple chain division over the ribs [4], or selective sympathectomy [5]). Video-assisted thorascopic (VATS) sympathectomy provides excellent anatomical exposure without the need for morbid incision [2]. It has been proven safe, reliable, and cost-effective, offering long-term relief of symptoms [6,7] and a significant reduction in the morbidity associated with open surgery, without affecting its success rate [8]. Efforts to use thoracoscopic techniques that minimize operative morbidity are appropriate for this benign condition.
2. Materials and methods

All patients who underwent thoracic VATS sympathectomy for palmar hyperhidrosis between December 1992 and October 2002 were included in the study. The medical files showed that all had experienced disabling hyperhidrosis of the palms since adolescence, and all had tried conservative treatment with numerous topical agents (antiperspirants, aluminum chloride hexahydrate) and alternative therapies, including iontophoresis, without effect. All complained that the hyperhidrosis severely interfered with their work or social activities.

Chest X-ray was performed prior to surgery to exclude pleural symphysis which could indicate the presence of adhesions. We attempted to detect adhesions only if there was an obstruction of the costophrenic angle.

2.1. Operative technique

The same manipulation technique was used in all cases. Surgery was performed under general anesthesia and one-lung ventilation using a double-lumen endotracheal tube. Patients were placed in the supine position with arms gently abducted. A small roll was placed transversely behind the scapulae to slightly elevate the axilla from the operating table. The neck, bilateral shoulders, axilla, chest and upper abdomen were prepped and draped. A fingertip pulse oximeter probe was used to record the changing pattern of the plethysmographic curve on the operated side. The surgeon stood at the side, facing the patient, and the videoscreen was positioned above the patient’s head. After exclusion of the lung, a single, 1-cm-long incision was made for insertion of a 12-mm trocar (Endopath, Ethicon Endo-Surgery, Inc., Cincinnati, OH, USA) into the pleural cavity at the third intercostal space in the midaxillary line. Because of the ‘closed’ insertion of the trocar, we took great caution in patients with a history of lung conditions or adhesions who were at increased risk of lung injury.

A straightforward, 0° operating thoracoscope (Karl Storz, Tuttlingen, Germany) was introduced (Fig. 1). The dorsal sympathetic chain (Fig. 2) was identified running along the neck of the ribs close to the costovertebral junctions. The first rib was always identified by direct vision or, in patients with adiposity, by palpation under visual control. The stellate ganglion (T1) was avoided. A diathermy hook (Jarit 600-305, Tuttlingen, Germany) inserted through the thoracoscope was used to completely divide the sympathetic trunk (Fig. 2) over the neck of the second and third ribs (T2–T3) including the rami communicanti and the accessory fibers of Kuntz [9], if present. At this level, the chain was divided with diathermy cautery after gentle anterior traction on the nerve; hook recoil after division was avoided to prevent vascular or lung injury. In order to destroy all the accessory sympathetic fibers, we dissected the pleura along the second rib up to approximately 5 cm lateral to the sympathetic chain.

Complete ablation of the ganglia was validated by the presence of peripheral vasodilatation, warm and dry hands, and an instant change in amplitude of the waveform patterns of the pulse oximeter, indicating an increase in circulation after sympathectomy. The lung was then inflated under direct vision, the trocar was removed, and the wound was closed with one cutaneous suture under a continuous positive airway pressure of 40 cmH₂O. This eliminated the need for a thoracic drain. The entire procedure was then repeated on the opposite side, without changing the position of the patient or the operative setting. A chest X-ray was performed in the recovery room immediately after surgery to ascertain complete lung expansion.

The postoperative state of palmar perspiration, complications and analgesic requirements were recorded. All patients were examined in the outpatient clinic until full surgical recovery. Follow-up data were obtained in all patients by telephone interview with a detailed standard questionnaire. Clinical examination was added only when the patient reported objective physical signs, such as the patient with Horner’s syndrome. Mean duration of follow-up was 10 months (range 6–18 months).

3. Results

One hundred and seventy-six consecutive patients (94 male, 82 female) of mean age 21 years (range 8–53 years) underwent 348 thoracoscopic sympathectomies, 344 bilateral and 4 unilateral (due to severe adhesions in 3 and azygos lobe in 1), during the study period (Table 1). Mean
operative time for each side was 9 min and for both sides, less than 20 min; there was no conversion to an open procedure. Ninety-five percent of the patients (167/176) were discharged from hospital the day after the procedure. Complications were observed in nine patients (5.1%), namely, unilateral transient Horner’s syndrome ($n = 1, 0.5\%$), residual pneumothorax requiring chest drainage from the port entry ($n = 4, 2.3\%$), and segmental atelectasis of the lung ($n = 4, 2.3\%$). The patient with unilateral Horner’s syndrome was discharged from hospital 10 days after surgery although he was aware of the risk of this complication, was so psychologically depressed, and had to be referred for psychiatric consultation. The clinical signs disappeared after 12 weeks. The patients with residual pneumothorax were discharged from hospital on the second day after surgery, following removal of the chest drainage tube and chest X-ray to ensure that there was no residual pneumothorax. Segmental atelectasis of the lung was treated with physiotherapy. The affected patients were hospitalized for 2 days. The 30-day mortality rate was zero (Table 2).

At the 6-month follow-up, complete relief of symptoms was observed in all patients, with uneventful wound healing and excellent cosmetic results. Shoulder girdle function was symmetric, and no patients complained of residual pain. Forty-five percent of the patients (79/176) experienced compensatory hyperhidrosis, usually affecting the back, trunk and thigh regions, but none were significantly distressed. Improvement in quality of life, defined as completely dry hands, was observed in 96%. Postoperative analgesics were necessary for less than 1 week in 92% of the patients.

### Table 1
Demographic and operative characteristics of the patients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (male/female)</td>
<td>94/82</td>
</tr>
<tr>
<td>Median age (years)</td>
<td>21</td>
</tr>
<tr>
<td>No. of procedures</td>
<td>348 (344 bilateral, 4 unilateral)</td>
</tr>
<tr>
<td>Mean operative time (min) each side</td>
<td>9</td>
</tr>
<tr>
<td>Mean postoperative hospital stay (days)</td>
<td>2.1</td>
</tr>
<tr>
<td>Symptom relief (%)</td>
<td>96</td>
</tr>
</tbody>
</table>

### Table 2
Complications of single-port thoracoscopic sympathectomy

<table>
<thead>
<tr>
<th>Complications</th>
<th>Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Horner’s syndrome</td>
<td>1 (0.5)</td>
</tr>
<tr>
<td>Indwelling chest tube</td>
<td>4 (2.3)</td>
</tr>
<tr>
<td>Segmental atelectasis</td>
<td>4 (2.3)</td>
</tr>
<tr>
<td>Compensatory sweating (back, trunk, thigh)</td>
<td>79 (45)</td>
</tr>
</tbody>
</table>

Fig. 2. Thoracic sympathetic chain. The pleura over the second rib (T2) was incised, starting from a point medial to the sympathetic chain and running laterally for approximately 5 cm to transect the nerve of Kuntz (if present).
4. Discussion

We report our experience in a consecutive series of 176 patients with hyperhidrosis treated by a video-assisted, minimally invasive technique with a single 12-mm port access and a straightforward 0° thoracoscope equipped with an instrumental channel. The patients were placed in the supine position with their arms gently abducted in order to allow for a bilateral approach in the same operative session, and we used a double-lumen endobronchial tube for anesthesia and a valveless trocar so that the lung on the operative side could be totally collapsed without CO₂ inflation. This provided ample space for thorascopic manipulation in the pleural cavity and eliminated the possibility of barotrauma (i.e. tension pneumothorax or air embolism). Because the blood-vessel tonus is balanced between both autonomous nervous systems, once the sympathetic chain is severed, there is a release in tonus, causing peripheral vasodilatation and, as a consequence, an increase in circulation [10]. Therefore, oxygen saturation was monitored by a pulse oximeter [10], which has long been accepted as a reliable method to detect an increase in circulation after sympathectomy [1].

The transaxillary single-port approach provided excellent visualization of the sympathetic chain up to the first rib. In earlier reports of endoscopic transaxillary access [11,12], several smaller ports were usually required, which could lead to greater patient discomfort and pain. In our series, clinical assessment 6 months after surgery revealed uneventful wound healing and excellent functional and cosmetic results in all patients, even with the use of a 12-mm trocar. There were no neuralgic sequelae, and none of the patients complained of pain. As there was no need for a chest tube (because the lung was inflated under direct vision), recovery was rapid, and the patients were ambulatory already a few hours after surgery.

Complications occurred in 5.1% of cases, a rate comparable to that in other reports [6,13]. However, no conversion to open surgery was required in our series. The development of residual pneumothorax (n = 4) is a well-known complication of endoscopic thoracic operations and is not specific to this procedure [2,13]. The risk of Horner’s syndrome was reduced with our method compared to open sympathectomy through the transaxillary or supraclavicular approach [14] thanks to excellent view of the ganglion and the adequate magnification which allowed for precise ablation. Horner’s syndrome was noted in only 1 of the 176 patients (0.5%) in our series, and the symptomatology was transient, disappearing completely after 12 weeks. Therefore, proper identification of the first rib is mandatory [6].

One of the major causes of failure of immediate symptomatic relief is improper identification of the target ganglion. Extensive resection distal to the T4 ganglion can lead to severe compensatory hyperhidrosis [15]. Compensatory truncal sweating has been reported in more than half the patients, sometimes to a significant degree [14]. This finding prompted us to avoid ablation of any ganglia lower than T3. A few authors [5] have reported the use of selective sympathectomy, wherein the sympathetic chain is preserved and only the rami communications are divided to reduce the rate of severe compensatory sweating. However, the slight improvement was obtained at the cost of a high rate of recurrence. Because VATS provides better visualization of the fibers of Kunz [9] and other accessory fibers parallel to the sympathetic chain, it can be expected to increase the safety of the division, especially for surgeons less experienced in the treatment of hyperhidrosis. The advantages of the video-assisted procedure for teaching residents are evident.

Other authors also reported excellent immediate results of thorascopic sympathectomy, 95% patient satisfaction with dramatic diminution of sweating of the palms [15]. These findings are consistent with ours.

In conclusion, our results suggest that single-port thorascopic sympathectomy for the treatment of hyperhidrosis offers excellent, cosmetic and functional results and avoids the chest wall sequelae sometimes seen after two- or three-port techniques. In addition, the smaller two-port instruments used in needlescopic thoracic sympathectomy [14] have several limitations (narrow field of vision, lower resolution, difficulty in maintaining fine control). We believe the larger 12 mm instruments allow the surgeon better control and make the operation easier to perform. Furthermore, the risk of injury to the lung is minimal and the upper lung collapses spontaneously once the trocar is inserted, without the need of CO₂ insufflation [14]. Simple port technique is safe, reliable, and quick way, and associated with low morbidity and a short hospital stay.

Acknowledgements

We thank Gloria Ginzach and Hanni Penn for their editorial and secretarial assistance.

References

Hyperhidrosis is an idiopathic condition characterized by excessive sweating occurring in up to 1% of the population. Hyperhidrosis most commonly occurs spontaneously, or in response to temperature and emotional changes, or as a result of increased sympathetic activity. Secondary causes include central nervous system conditions such as disorders of the hypothalamus or pituitary glands, or chronic diseases such as tuberculosis, lymphoma, diabetes, thyrotoxicosis, or pheochromocytomas.

The areas of the body commonly affected in hyperhidrosis in order of frequency include the palms, feet, axilla, head, or face [1].

The therapeutic options for the management of hyperhidrosis have traditionally been nonoperative. These include topical astringents, absorbing powders, and anticholinergic drugs. Other methods of treatment have included biofeedback, iontophoresis, botulinum toxin, and percutaneous phenol block. The anticholinergics commonly cause dry mouth and blurry vision, making their long-term use undesirable. Botulinum toxin type A is effective as treatment for axillary and palmar hyperhidrosis; however, the effects usually last only 3 to 4 months with repeated injections required [2]. Therefore, surgical sympathectomy is assuming a larger role as primary therapy.

Thoracic sympathectomy for hyperhidrosis was first described in the 1920s by Kotzareff [3]. Since that original report, multiple open surgical approaches have been developed. The approaches included the anterior supraclavicular, posterior paravertebral, posterior midline, anterior thoracic, axillary thoracic, and the axillary extrathoracic with first rib resection. Surgical sympathectomy was accompanied by a prolonged recovery period, postoperative pain, disability and significant morbidity including Horner’s syndrome [4].

Thoracoscopic sympathectomy was first reported in 1942 [5] and since then advances in endoscopic video technology have been successfully applied. The sympathetic trunk can be easily identified through the parietal pleura thoracoscopically and surgical division of the trunk can be safely performed with minimal associated morbidity. Methods described for performing sympathectomy include simple transection of the sympathetic ganglion, ablation with cautery or laser, or simple clipping of the sympathetic chain with titanium clips [1]. The incidence and severity of complications following treatment with VATS has been shown to decline, with reported incidences of Horner’s syndrome ranging from 0 to 1.9%. Other complications, including air leak requiring chest drainage, bleeding and compensatory sweating were relatively uncommon.

Catastrophic complications such as delayed recognition of tension pneumothorax from left sided CO2 insufflation, leading to fatal and disabling consequences was reported [2].

References