

Expanded level of sympathetic chain removal does not increase the incidence or severity of compensatory hyperhidrosis after endoscopic thoracic sympathectomy

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Objective: Compensatory hyperhidrosis is a common devastating adverse effect after endoscopic thoracic sympathectomy for patients undergoing surgical treatment of primary hyperhidrosis. We sought to determine whether a correlation existed in our patient population between the level and extent of sympathetic chain resection and the subsequent development of compensatory hyperhidrosis.

Methods: All patients undergoing endoscopic thoracic sympathectomy in the T2-T3, T2-T4, T2-T5, or T2-T6 levels for palmar or axillary hyperhidrosis at the University of Iowa Hospital and Clinics (n = 97) from January 2004 to January 2013 were retrospectively reviewed.

Results: Differences in the preoperative patient characteristics were not statistically significant among the patients receiving T2-T3, T2-T4, T2-T5, or T2-T6 level resections. Of the 97 included patients, 28 (29%) experienced transient compensatory hyperhidrosis and 4 (4%) complained of severe compensatory hyperhidrosis and required additional treatment. No operative mortalities occurred, and the morbidity was similar among the groups.

Conclusions: Most patients had successful outcomes after undergoing extensive resection without changes in the incidence of compensatory hyperhidrosis. Therefore, we recommend performing complete and adequate resection for relief of symptoms in patients with primary hyperhidrosis. (*J Thorac Cardiovasc Surg* 2014;148:2673-6)

Primary focal hyperhidrosis affects 1% to 3% of the population and is characterized by increased perspiration out of proportion to what is physiologically needed for thermoregulation.¹ Primary focal hyperhidrosis is a chronic idiopathic condition defined as focal, visible, and excessive sweating of ≥ 6 months' duration accompanied by 2 of the following characteristics: bilateral and symmetric symptoms, onset before age 25 years, impairment of daily activities, ≥ 1 episode per week, focal sweating that ceases during sleep, and/or a family history of hyperhidrosis.² It most commonly affects the palms, axillae, and plantar surfaces.² The pathophysiology behind primary hyperhidrosis is not well understood. It has been postulated that an abnormal or exaggerated response to emotional stressors by the

hypothalamus or cerebral cortex causes increased autonomic signaling to the eccrine sweat glands.³ Although benign in nature, hyperhidrosis can cause soaking of papers, clothes, and shoes, can lead to avoidance of social situations and limitations in professional and physical activities, and can result in emotional and psychological distress.

When topical and medical treatments have failed to resolve excessive sweating, endoscopic thoracic sympathectomy (ETS) is an effective surgical treatment of severe primary palmar hyperhidrosis, with high patient satisfaction rates. The most common devastating adverse effect after ETS is compensatory hyperhidrosis (CH), defined as subjectively increased sweating at parts of the body not anatomically affected by the sympathectomy chain. CH is thought to be a thermoregulatory response by which the body compensates for the lack of perspiration at surgically denervated regions by increasing perspiration in unaffected areas, including the trunk, lumbar, groin, thigh, and popliteal regions.⁴ Widespread hyperhidrosis before surgery, older age, greater body mass index, high ambient temperature, and a family history of primary hyperhidrosis are risk factors for development of CH.^{5,6} The rates of CH cited in published studies has ranged from 3% to 98%, depending on how CH has been assessed.⁵ In attempts to decrease the incidence of CH, many have suggested that limiting the magnitude of resection of the sympathetic chain will decrease the incidence of postoperative CH. However,

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Disclosures: Authors have nothing to disclose with regard to commercial support. Received for publication Dec 20, 2013; revisions received March 3, 2014; accepted for publication June 12, 2014; available ahead of print Aug 15, 2014.

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0022-5223/\$36.00

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<http://dx.doi.org/10.1016/j.jtcvs.2014.06.080>

Abbreviations and Acronyms

CH = compensatory hyperhidrosis

ETS = endoscopic thoracic sympathectomy

controversy remains regarding the appropriate level and number of ganglia to be removed for the best outcome. Our aim was to review the series of ETS cases performed at our institution to determine whether the level of resection influences the long-term results or overall outcomes of the procedure.

METHODS

From January 2004 to January 2013, all patients undergoing ETS in the T2-T3, T2-T4, T2-T5, and T2-T6 levels for palmar or axillary hyperhidrosis at the University of Iowa Hospital and Clinics ($n = 97$) were included in a retrospective chart review. A total of 7 patients underwent ETS at levels different from the 4 groups, none of whom reported CH, were omitted from the present study owing to an inadequate sample size. The data obtained included patient demographics, family history, site of primary hyperhidrosis, previous therapies, surgical details, outcome, and complications. The patient demographics are listed in [Table 1](#). Of the 90 patients, 39 (40%) experienced widespread hyperhidrosis with excessive perspiration at the palmar, axillary, and plantar locations. Of the 97 total operations, 96 were bilateral ETS. One patient underwent a planned staged procedure; he had previously undergone right-sided ETS, and only left-sided ETS was performed at our institution. The level of sympathetic ganglia removal is listed in [Table 2](#). Seven different surgeons performed the operations.

Operative Technique

ETS is performed as a bilateral procedure with the patient in the lateral decubitus position using single lung ventilation with a double lumen tube. The arm is mildly hyperextended for exposure of the axillae. Three 5-mm thoroscopic ports are used, with 2 placed in the axillae, 1 at the level of the hairline for the highest port and the other in the fifth intercostal space in the mid-axillary line. After the lung has been deflated, the lowest port is inserted with a stab incision without the use of electrocautery or spreading to prevent skin damage. The other 2 ports are placed in the axillae, with the highest port placed first to not obstruct the view for placement of the third port, 1 rib space below the highest port. The lung is manipulated and compressed away from the spine to provide visualization of the sympathetic chain. The first rib is identified, and the second through sixth ribs are marked with electrocautery 3 to 5 cm away from the chain laterally to ensure that the level of resection stays below the first rib.

Next, the lowest level is identified, and the pleura immediately lateral to the chain is opened from the lowest to the highest point. The lowest point of the chain is then isolated and grasped with the 5-mm grasper proximally and divided with electrocautery distally. With traction in a cranial and anterior direction, the chain is gently removed using electrocautery to separate the chain from the surrounding tissues and the intercostal vessels and attachments.

Each ganglion is dissected using cautery until the second ganglion is reached. The chain is then divided just below the second rib after removing the ganglion sharply with scissors.

The area is monitored for hemostasis, and the pleura that laterally overlies the rib is superficially incised for a distance of 4 to 5 cm from the chain laterally with electrocautery to divide any accessory nerves that might remain. A 14F rubber catheter with multiple holes is inserted into the chest,

and the lung is reinflated, with suction applied to the catheter to allow full re-expansion of the lung. The tube is then withdrawn on suction and with positive pressure of 30 cm H₂O applied to the lungs. The wounds are then closed with tissue adhesives. A similar procedure is performed on the other side. No chest tube or drain is used. The patient is discharged after a chest radiograph to document pulmonary re-expansion.

Statistical Analysis

Univariate comparisons of the preoperative variables were performed among the ETS T2-T3, T2-T4, T2-T5, and T2-T6 levels. Categorical variables were tested using the chi-square test, and continuous variables were assessed using the analysis of variance test for associations. Univariate comparison of the postoperative variables, including the incidence of CH, was not performed owing to the low sample size in the T2-T3 and T2-T4 resection groups. All analyses were performed using SPSS Statistics, version 21 (IBM Corp, Armonk, NY).

RESULTS

A total of 97 patients receiving ETS for palmar or axillary hyperhidrosis were included in the present study. The sample consisted of 60 women and 37 men, with an average age of 24 years (range, 13-66). The patients had hyperhidrosis at ≥ 1 sites, including 85 with palmar (88%), 65 with axillary (67%), and 61 with plantar (63%) sites. Twelve patients (12%) reported a family history of hyperhidrosis. All patients had been treated before surgery with medical management. This included oral glycopyrrolate (Robinul), topical aluminum chloride hexahydrate 20% (Drysol), iontophoresis with Drionic (General Medical Co, Pasadena, Calif), injections of *Botulinum* toxin A, and oral clonidine. The medical interventions had failed in all patients included in the present study. The differences in the measured preoperative variables among the 4 groups were not statistically significant.

Sympathetic levels T2-T6 were removed in 41 patients (42%), T2-T5 in 36 patients (37%), T2-T4 in 11 patients (11%), and T2-T3 in 9 patients (9%). No mortalities occurred. The length of stay was <23 hours for all patients. All patients experienced resolution of palmar hyperhidrosis. Additionally, of the 61 patients with plantar hyperhidrosis, 7 experienced complete resolution of symptoms, and 4 reported decreased symptoms. The morbidities included 4 cases of pneumothorax, 1 episode of subcutaneous emphysema, in addition to CH. The pneumothorax and subcutaneous emphysema resolved spontaneously without chest tube placement. No cases of Horner syndrome, excessive bleeding, or infection were reported. Most patients were satisfied with the results of the procedure.

CH was characterized as transient or severe. Transient CH was defined as a minor increase in sweating present for <90 days at any level, and severe CH was defined as persistent sweating for ≥ 90 days requiring additional treatment. Of the 97 patients, 28 (29%) experienced transient CH. The breakdown of patients who experienced CH and the location of transient CH stratified by the level of sympathectomy is listed in [Table 2](#).

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