

# Thoracoscopic Sympathetic Surgery for Hand Sweating

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**Recently, thoracoscopic surgery has been shown to be effective for the relief of hand sweating. Although it is not fatal if left untreated, the treatment aim is to improve the quality of daily life. Therefore, it is important to understand the complaints of the patient, and provide an adequate explanation regarding postoperative sequelae. Surgeons should also recognize that thoracoscopic surgery might cause problems when performed, as the general risk of surgery remains. Many patients have been helped by the procedure, as their choices in life have expanded, and satisfactory results can be obtained when indication is determined by a full examination of the patients condition.**

**Between December 1999 and September 2002, we performed thoracoscopic sympathetic surgery in 556 consecutive patients. Five-hundred seventeen (93%) of these complained of profuse hand sweating.**

**Based on the new concept presented, we consider that this method of operation is an effective treatment. (Ann Thorac Cardiovasc Surg 2004; 10: 4–8)**

**Key words:** hand sweating, endoscopic sympathetic surgery, compensatory sweating

## Introduction

Heavy sweating initiated suddenly in the palm is commonly referred to as hand sweating. Since it is not considered to be a disease, but rather a disposition or constitutional by nature, the condition is generally left to take its own course without specific treatment. However, patients are distressed and uncomfortable, since their hands are often cold and wet. Furthermore, the condition makes daily activities difficult, or shaking hands with others at social occasions, making origami (folding papers) with wet hands, writing paper and playing musical instruments such as the piano.<sup>1)</sup>

Thoracoscopic sympathetic surgery is being increasingly performed for this condition, as hand sweating can

be arrested by a simple operation that requires only one night's hospitalization. We have carried out this surgery on more than 500 subjects since 1992 and confirmed its effectiveness.

## Development of Thoracoscopic Sympathetic Surgery

The 12 pairs of sympathetic ganglia present in the thoracic cavity are considered to control essential functions for human survival. In the 19th century, the concept of the automatic nervous system was established and, in the late 1800's the sympathetic and parasympathetic systems, which act antagonistically toward each other, were elucidated.<sup>2)</sup> With this knowledge, many trials of treatment for severe diseases were attempted. In the early 20th century the Leriche group<sup>3)</sup> and Smithwick<sup>4)</sup> performed surgical resection of the sympathetic nerve as a new therapy for intractable diseases.

Sympathetic surgical methods were later developed into periarterial sympathetic ablation and cervical sympathectomy, after which surgical thoracic sympathectomy from the supraclavicle, as well as from the back follow-

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ing resection of the ribs and from the axilla were attempted in the 1930s. Using thoracic sympathectomy, surgeons attempted to treat angina, epilepsy, migraine and hypertension, as well as gastric and duodenal ulcers, however, were unable to obtain stable results. In contrast, the procedure proved to be effective in increasing blood flow in the arms and arrest hand sweating, though it was not employed extensively due to its technical difficulty.

We performed thoracic sympathectomy on a few cases of Raynaud's syndrome 30 years ago using the method of Smithwick, in which the second and third ganglia were removed by resecting the ribs through a back incision. It was a difficult procedure, as the field of vision was narrow. Later, the Atkins procedure,<sup>5)</sup> in which the ganglia in the posterior mediastinum is reached from the thoracic cavity through a skin incision in the axillary via an intercostal approach under endotracheal intubation, was extensively employed as it provided better vision and easier manipulation. We have been performing that method for treating poor blood circulation of the arm in cases of Buerger's disease and Raynaud's syndrome. However, the procedure required a one week hospital stay for open chest surgery. Further, an interval of three weeks is needed to repeat the surgery, as bilateral sides must be treated.

Endoscopy was introduced to thoracic surgery many years ago. In the early 20th century, this technique was employed to resect fibrous adhesions in the thoracic cavity that was disturbed to make air-thorax for treating pulmonary tuberculosis. On the basis of those experiences, a thoracic sympathectomy was attempted by Kux in 1940,<sup>6)</sup> Hughes in 1942,<sup>7)</sup> and Hukukei 1955 in Japan,<sup>8)</sup> using a direct vision scope or cystoscope. At that time, the technique was only performed by a few highly trained surgeons, because a bright field was hard to obtain due to the weak light source. In the latter half of the 1980s, video-assisted endoscope was improved drastically, and employed not only in diagnosis but also for surgery, namely video-assist thoracic surgery (VATS). In 1990, a thoracic sympathectomy was first performed using VATS,<sup>9)</sup> after which it spread rapidly, as the technique was found to be easy and reliable. Further, both sides could be treated simultaneously, resulting in a short period of hospitalization. We have been performing the surgery with this technique since 1992.

### **Thoracic Sympathetic Block for Hand Sweating**

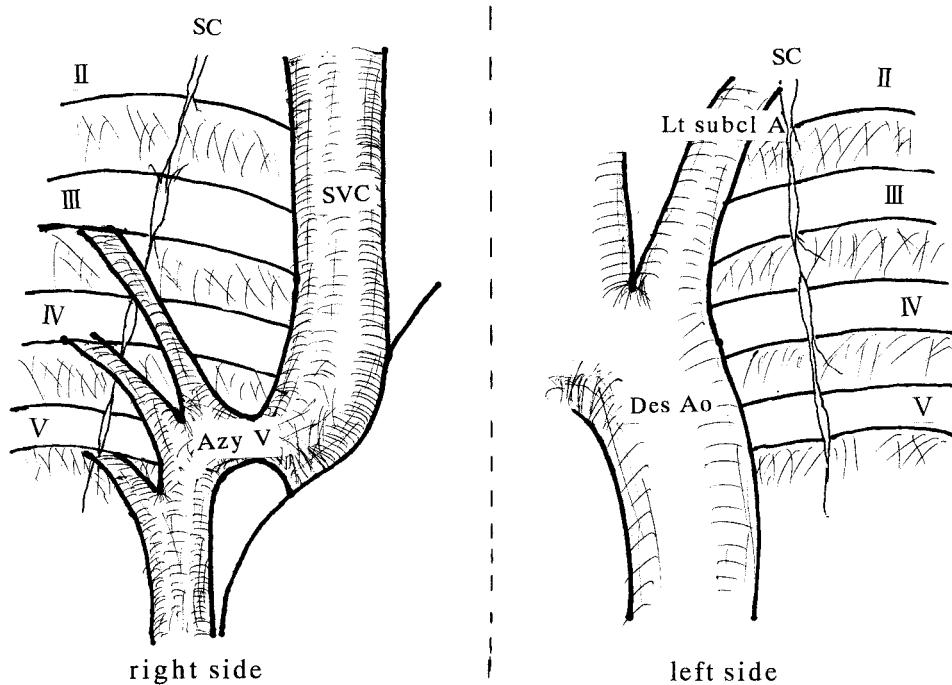
Increased blood flow in the arms and arrest of hand



**Fig. 1.** Body posture of thoracic sympathetic operation.

sweating are recognized as a positive effect of thoracic sympathectomy. Furthermore, such procedures have been applied for treatment of severe pain or ischemic ulcers in the arm, though the arrest of hand sweating was generally ruled out, because of the large invasion involved. However, Kotzareff carried out thoracic sympathectomies for this condition in 1920,<sup>10)</sup> while in 1969 Cloward reported performing the surgery in 74 cases<sup>11)</sup> and in 1975 Gjerris et al. treated 36 cases.<sup>12)</sup> They each found the surgery to be effective, however, noted postoperative compensatory sweating and gustatory disorders. In contrast, Kux performed thoracoscopic surgery for hand sweating in 63 cases, reported in 1978, and found that it was less invasive and showed nearly no complications.<sup>13)</sup>

In the latter 1980s, the progress of VATS technology made it highly useful for thoracic sympathetic surgery and it became accepted into practice in Europe. Claes et al. of Sweden blocked the ganglia by cauterization using an endoscope.<sup>10)</sup> This method was found to be easy to perform and had the advantage that bilateral sides were treated at the same time. With that method, we have treated patients with Raynaud's syndrome and Buerger's disease since December 1992 and have performed it for patients with hand sweating since August 1993. In October 1995, the Japanese Society of Thoracoscopic Sympathetic Surgery was inaugurated 30 members, with nine meetings held so far and memberships of more than 300.

**Fig. 2.** Schema of posterior mediastinum.

SC, sympathetic chain; SVC, superior vena cava; Azy V, azygos vein; Des Ao, descending aorta; Lt subcl A, left subclavian artery.  
II, III, IV, V: number of ribs.

## Our Procedure for Thoracoscopic Sympathetic Surgery

The surgery is performed under general anesthesia. After stabilizing the hemodynamic conditions, the upper body of the patient is elevated to 45 degrees, at that time attention must be paid to blood pressure decline. The bilateral hands are then extended externally to 90°, while the forearms are raised towards the head (Fig. 1). A 1 cm skin incision is made at the third intercostal space on the anterior axilla line and a 14F surgical needle is inserted into the thoracic cavity, through which 1.2-2.0 L of carbon dioxide gas is injected to prepare a pneumothorax. The outer tube of the endoscope is inserted into the thoracic cavity and then the endoscope follows. At the mediastinum, the sympathetic nerves and ganglia lie across the junction of the vertebra and ribs (Fig. 2). In the case of hand sweating, the target ganglia are the third and fourth, while the fifth is added in the cases of axilla sweating.

After confirming the absence of bleeding, the scope is extubated, while an 8F silicon tube is left in the thoracic cavity for gas removal by inflating the lung. The same procedure is then followed for the opposite side. We rou-

tinely perform the surgery with a one day hospitalization period.

## Statistics to the End of 2000 in Japan

Many suffer from circulatory disturbances of the hand, especially in Buerger's disease. Our experience of surgery in children is better than in patients over 18 years. So we recommend early thoracoscopic sympathetic surgery, particularly if the child has a complex about their hand sweating.<sup>14)</sup>

We sent a questionnaire to the members of the Japanese Society of Thoracoscopic Sympathetic Surgery to determine the number of operations performed, mortality, and the incidence of bleeding as an intraoperative complication, as well as regarding pneumothorax, Horner's syndrome and compensatory sweating sequela in cases treated up to the end of 2000. At the same time, we asked for the numbers of effective and ineffective results, and recurrence, according to their judgment.

We obtained responses from 50 institutions that had operated on 7,017 cases, of which 6,777 (96.6%) were for hand or axilla sweating. As for other type of hyper-

hidrosis, 157 cases demonstrated facial sweating and 16 facial redness. The remaining 67 cases were for poor blood flow in the arms and chronic severe pain in an upper limb.

There were no fatal cases, while intraoperative bleeding was observed in 28 patients. Of them, six required hemostasis by open chest surgery. Horner's syndrome persisted permanently in 18 cases (0.25%). As a measure to prevent that syndrome, our society recommends that a sympathetic block up to the third ganglion is fully effective for hand sweating, or at most, that up to the lower half of the second ganglion is enough. The incidence of this syndrome has been in decline since the announcement of this recommendation.

Seven cases were judged ineffective, because of fat in the mediastinum, and the nerve and ganglia could not be found in 21 cases, possibly because of incorrect operative procedures. In all 13 cases that underwent a reoperation, sweating was stopped.

Once sweating in the upper half on the body is arrested following a blockade of the thoracic sympathetic system, sweating that increases in the chest and back under the mammary line and hips, has been seen after the early days of this surgical procedure and is called compensatory sweating. Although it is observed in almost all cases, most patients are satisfied with the surgical outcome, as they face fewer restrictions in daily life because of sweating as compared to their previous hand sweating condition. However, it remains the most frequent sequela following the surgery and is a new problem for some patients. In the present survey, 83 cases (1.2%) complained that compensatory sweating problems resulted in further in their daily life.

Evaluations made by the surgeons are shown in Table 1 for hand sweating, the results were evaluated as effective in the 68.7% that ranked excellent and the 29.0% rated as good. For axilla sweating, results were less favorable, as 10.3% were rated excellent, with 43.6% good, 33.3% fair and poor 12.8%.

## Discussion

Hand sweating can cause trouble for patients, as it imposes various restrictions on their daily life. Since it is not a life-threatening and its disturbance is not well understood by people not affected, the condition has not become a popular subject of medical treatment. A thoracic sympathectomy is now recognized as effective for arrest hand sweating, however, it was not widely applied until recently due to the surgical risk involved. Develop-

**Table 1. Evaluation of thoracic sympathetic surgery for hand sweating by surgeons (%)**

	Excellent	Good	Fair	Poor
Hand sweating	68.7	29.0	3.3	0.0
Axillary sweating	10.3	43.6	33.3	12.8
Facial sweating	31.6	47.4	21.1	0.0

ment of easy and safe video-assisted surgical procedures have allowed for a rapid spread of application for the treatment of hand sweating.

For the purpose of performing the surgery safely and reliably minimizing the incidence of complications and sequelae, surgeons and clinical researchers from around the world interested in the procedure held the first International Symposium on Sympathetic Surgery in 1993. In Japan, the first meeting of the Japanese Society of Thoracoscopic Sympathetic Surgery was held in 1995 and has become an annual event. That group has framed guidelines for this surgery, which it has been recommending since its formation. Of the nearly 2,000 operations carried out every year in Japan, none have been fatal, while fewer intraoperative complications and achievement of stable results have been seen after the establishment of guidelines.

Intraoperative bleeding is considered to be the most serious complication commonly experienced at the early stage, necessitating a thoracotomy to control the bleeding in some cases. However, the risk will decrease as surgeons became more accustomed to the procedure and are able to successfully arrest bleeding using an endoscopic maneuver. Further, Horner's syndrome was nearly zero in cases that underwent a blockade of the ganglia in the lower half of the second ganglion. Accordingly, it is important to accurately check the ganglion level.

The most troublesome sequela is compensatory sweating. At present, it is considered that those patients who have suffered hand sweating since childhood only might rarely suffer this phenomenon. Further, the incidence decreases when excluding patients whose hand sweating was manifested after 18 years age, as well as nervous males, patients with only axilla sweating and those with psychogenic or collagen disease. Thus, preoperative information is indispensable, as compensatory sweating is seen in all patients, though it varies in severity. Finally, in Western countries, reconstructive surgery of the nerve trunk has been performed and shown to be effective,<sup>15)</sup> however, it has not yet been performed in Japan.

## References

1. Ueyama T, Akemoto K, Ushijima T, et al. Thoracoscopic sympathetic surgery to children under 18 years old. *Geka* 1997; **59**: 1784–7. (in Japanese)
2. Kuntz A. Automatic neurosurgery. Automatic nerve system. Philadelphia: Lea & Febiger, 1953; pp 491–508.
3. Ewing M. The history of lumbar sympathectomy. *Surgery* 1971; **70**: 790–6.
4. Smithwick RH. Modified dorsal sympathectomy for the upper extremity. *Ann Surg* 1936; **104**: 339–46.
5. Atkins HJB. Sympathectomy by the axillary approach. *Lancet* 1954; **1**: 538–9.
6. Kux E. The endoscopic approach to the vegetative nerve system and its therapeutic possibilities. *Dis Chest* 1951; **20**: 139–47.
7. Hughes J. Endothoracic sympathectomy. *Proc R Soc Med* 1942; **35**: 585–6.
8. Hukkei I, Kuroiwa T. Thoracic sympathetic ganglia cauterization. *Kyobu Geka* 1958; **11**: 123–41. (in Japanese)
9. Robert A, Edmondson FRCS, Anjan K, et al. Endoscopic thoracic sympathectomy in the treatment of hyperhidrosis. *Ann Surg* 1991; **215**: 289–93.
10. Claes G, Drott C, Gothberg G. Thoracoscopy for autonomic disorders. *Ann Thorac Surg* 1993; **56**: 715–6.
11. Cloward RB. Hyperhidrosis. *J Neurosurg* 1969; **30**: 545–51.
12. Gjerris F, Olesen HP. Palmar hyperhidrosis. *Acta Neurol Scand* 1975; **51**: 167–72.
13. Kux M. Thoracic endoscopic sympathectomy in palmar and axillary hyperhidrosis. *Arch Surg* 1978; **113**: 264–6.
14. Matsumoto Y, Ueyama T, Endo M, et al. Long-term outcome of endoscopic thoracic sympathicotomy for palmar hyperhidrosis in children. *Japanese J Perispir Research* 2003; **10**: 9. (in Japanese)
15. Telaranta T. Reconstruction of the sympathetic endoscopically post ETS. *Clin Autom Res* 2003; **13**: 150.