

Prevention of compensatory hyperhidrosis after thoracoscopic sympathectomy for hyperhidrosis

M. van't Riet,¹ A. A. E. A. de Smet,² H. Kuiken,² G. Kazemier,¹ H. J. Bonjer¹

¹ Department of Surgery, Erasmus University Medical Center, Rotterdam, The Netherlands

² Department of Surgery, St. Clara Hospital, Rotterdam, The Netherlands

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Abstract

Background: Compensatory hyperhidrosis is a troublesome complication of thoracoscopic sympathectomy for hyperhidrosis. After extensive resection of the second through the fourth ganglion (T2–4), as well as after limited resection of the second ganglion (T2), the reported incidence of compensatory hyperhidrosis ranges as high as 50–97%. The purpose of this study was to determine whether the incidence of compensatory hyperhidrosis can be reduced by limiting the thoracoscopic sympathectomy to another level, the third ganglion.

Methods: We analyzed 28 thoracoscopic sympathectomies for palmar and/or axillary hyperhidrosis. In all patients, the sympathetic chain was transected cranially and caudally to the third ganglion (T3 dissection). Long-term follow-up was conducted by interviewing patients using standardized questionnaires.

Results: The surgery was effective in all patients. After a median follow-up of 3.5 years, compensatory hyperhidrosis was not recorded in any of the patients. There were no recurrences of hyperhidrosis.

Conclusion: Limited thoracoscopic sympathectomy at the level of the third ganglion is effective and seems to prevent compensatory hyperhidrosis.

Key words: Hyperhidrosis — Compensatory hyperhidrosis — Thoracoscopic sympathectomy — Sympathectomy — Sweating

Hyperhidrosis of the palms and axillae is a common condition that can be a severe professional and social burden. Various therapeutic modalities, such as antiperspirants, aluminium ointment, electrolytic therapy, and acupuncture, have been advocated, but these methods are rarely effective.

Correspondence to: H. J. Bonjer

Subepidermal injections with botulinum toxin appear to be more effective, but they have to be repeated every few months [21].

Transection or resection of the sympathetic chain provides long-term relief of hyperhidrosis. Many surgeons resect the second through the fourth ganglion (T2–4), but others resect only the second ganglion. After both procedures, high success rates of 94–98% have been reported [10, 16, 24]. However, compensatory hyperhidrosis commonly occurs after both extensive (T2–4) and limited (T2) resection. Compensatory hyperhidrosis, which affects mostly the trunk but also the face and legs, occurs in 50–97% of patients who undergo thoracic sympathectomy and can be even worse than the preoperative hyperhidrosis of the upper limb [2, 4, 6, 7, 9, 11, 13, 14, 15, 16, 19, 20, 23, 24]. For this reason, compensatory hyperhidrosis is the main source for patient dissatisfaction [13].

Our hypothesis was that both the extent of resection and the level of resection influence the incidence of compensatory hyperhidrosis. Therefore, we limited the thoracoscopic sympathectomy to the level of the third ganglion (T3). The aims of the present study were to investigate the long-term effectiveness of this procedure and to assess whether compensatory hyperhidrosis can be prevented by limited transection of the sympathetic chain at this level.

Materials and methods

All consecutive patients who had undergone thoracoscopic sympathectomies for essential palmar and/or axillary hyperhidrosis between January 1994 and December 1999 at the Erasmus University Medical Center Rotterdam and the St. Clara Hospital in Rotterdam were selected and analyzed. All patients in whom the sympathetic chain was transected only cranially and caudally of the third ganglion (T3-limited sympathectomy) were included and interviewed at the time of the study (May 2000) using standardized questionnaires. In these questionnaires, patients were asked if they had achieved permanent relief of symptoms and if compensatory hyperhidrosis, defined as excessive sweating that was considered abnormal, had developed. Compensatory hyperhidrosis was graded as follows: 1, absent compensatory hyperhidrosis, with no excessive sweating; 2, minor and intermittent excessive sweating (for example, during exercise or hot

weather); 3, embarrassing or visible sweating; 4, disabling sweating (requiring one or more changes of clothing per day). Further, patients were also asked whether they had experienced gustatory hyperhidrosis (facial sweating at the sight or smell of food), intercostal neuralgia, or Horner's syndrome.

Preoperative analysis included radiography of the chest in patients who were at risk for pulmonary adhesions. Blocking of the stellate ganglion with local anesthetics was not performed.

Thoracoscopic sympathectomy was performed under general anesthesia. The patient was placed in a lateral decubitus position with one arm elevated to expose the axilla. Both the surgeon and the assistant were positioned at the ventral side of the patient. All procedures were bilateral and performed in one session. Until 1996, ventilation was conducted by a double-lumen endobronchial tube, which enabled the desufflation of one lung. After 1996, ventilation was performed using a normal tracheal tube with high-frequency respiration. This technique has been described in detail by Den Hoed et al. [8]. High-frequency ventilation was combined with interpleural insufflation of carbon dioxide to 8 mmHg.

A 5-mm incision was made through the fourth intercostal space at the midaxillary line, and the thoracic cavity was opened. A blunt-tip trocar was inserted, and a 5-mm 30° optic instrument was introduced. A pneumothorax was created, and two additional 2- or 5-mm trocars were placed under direct vision. The trocars were inserted through different intercostal spaces with triangulation of the three trocars. If high-frequency respiration was used, the lung was compressed by blunt endoscopic instruments.

After visualization of the sympathetic chain, the third and fourth ribs were identified. At the level of the crossing of the sympathetic chain with these ribs, the parietal pleura was opened with a diathermic hook. The sympathetic chain was divided with scissors at the level of the third rib, to prevent ascending electrical current to the stellate ganglion, and with diathermia at the level of the fourth rib. Transection was always performed directly over the rib, to avoid bleeding from the intercostal vessels. Thus, in all patients, the sympathetic chain was transected just cranially and caudally to the third ganglion, at the level of the third and fourth ribs (Fig. 1).

All procedures were completed by insertion of a small-diameter chest tube through one of the trocars. The chest tube was connected to a water seal and removed on the 1st postoperative day if there was no sign of pneumothorax.

Results

In the study period, 28 limited thoracoscopic sympathectomies at the level of the third ganglion were performed in 14 patients (eight men and six women). The median age was 29 years (range, 18–43). Five patients had palmar hyperhidrosis, six patients had axillary hyperhidrosis, and three patients had combined palmar and axillary hyperhidrosis. In all patients, hyperhidrosis was disabling and considered a social burden.

The median operating time was 124 min (range, 95–159). There were no conversions to an open procedure. Two patients required repeated thorax drainage after removal of the chest tube because of a pneumothorax. One patient developed a pneumonia that was treated successfully by antibiotics. None of the patients developed Horner's syndrome or intercostal neuralgia. The median hospital stay was 2 days. The original hyperhidrosis resolved in all patients immediately after the operation.

The response to the questionnaires was 100%. After a median follow-up period of 3.5 years (range, 10–72 months), all sympathectomies were successful and all patients judged the intervention as excellent. None of the patients experienced recurrent palmar or axillary hyperhidrosis. Regarding the development of compensatory sweating, all patients were graded in the first category of absent hyperhidrosis. Five of these patients experienced slightly changed patterns of sweating after the sympathectomy, with

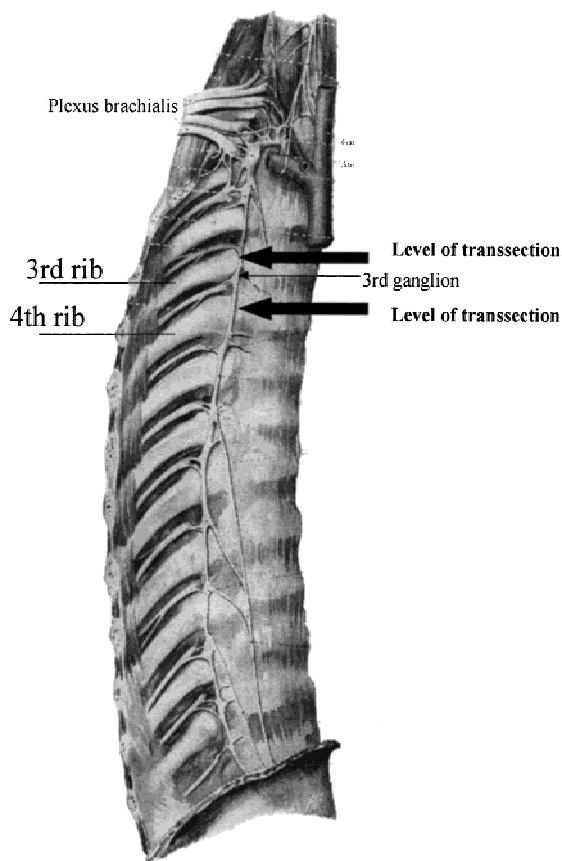


Fig. 1. Sympathetic chain. Transection cranially and caudally to third ganglion at level of third and fourth ribs. (Adapted from Spalteholz W (ed) (1933) *Handatlas der Anatomie des Menschen*. 13th ed., Verlag Von S. Hirzel, Leipzig, p 861).

slightly increased sweating on the back ($n = 2$), chest ($n = 2$), or feet ($n = 1$) during heavy exercise, but they all considered it as normal physiologic sweating that was not excessive. None of the patients developed gustatory hyperhidrosis.

Discussion

Thoracoscopic sympathectomy for hyperhidrosis can be performed by a number of surgical approaches. Traditionally, this procedure was performed via an open thoracic approach through supraclavicular, transaxillary, or posterior pathways [17]. However, these open techniques were associated with significant tissue trauma and postoperative pain and therefore only performed very selectively. Development of the minimally invasive thoracoscopic technique, which is associated with minimal postoperative pain, rapid recovery, and excellent cosmetic results, has led to renewed interest in the treatment of hyperhidrosis by transection of the sympathetic chain [18, 23]. Because sympathectomy is the only permanent treatment for patients with hyperhidrosis, it is currently considered to be the first-choice procedure.

One complication related to the operative method is the occurrence of transient or permanent Horner's syndrome. Horner's syndrome can occur if the stellate ganglion is ma-

Table 1. Overview of published series of thoracoscopic sympathectomies for hyperhidrosis

First author [ref.]	No. of patients	Level of surgery	Compensatory hyperhidrosis, grade unspecified (%)	Compensatory hyperhidrosis, embarrassing or disabling (%)
Zacherl [24]	369	T1–4	68	n.r.
Andrews [2]	42	T2–3	86	26
Gossot [11]	54	T2–4	72	50
Drott [7]	850	T2–4	55	n.r.
Shachor [20]	150	T2–4	50	n.r.
Byrne [4]	85	T2–4	64	n.r.
Herbst [13]	323	T2–4	67	n.r.
Yilmaz [23]	28	T2–5	67	n.r.
Reisfeld [19]	650	T2	83	27
Lin [16]	1360	T2	84	n.r.
Lin TS [15]	438	T2	86	n.r.
Chiou [6]	91	T2	97	13
Kopelman [14]	53	T2	67	8
Present study	14	T3	0	0

T1–4, resection of lower part of stellate ganglion to fourth ganglion; T2–4, resection of second to fourth ganglion; T2, limited resection at level of second ganglion; T3, limited resection at level of third ganglion; n.r., not reported

nipulated during the surgical procedure or if heat from the diathermy is transmitted to the stellate ganglion. The incidence of this complication is 0–10% [1, 6]. To avoid the development of Horner's syndrome, it has been recommended that the sympathetic chain be dissected at a level below the stellate ganglion and that scissors be used instead of heat-producing diathermy for the transection [5].

Transection of the sympathetic chain varies in extension and level. An overview of published series of thoracoscopic sympathectomy for hyperhidrosis is given in Table 1. Traditionally, an extensive sympathectomy was performed by dividing and removing the sympathetic chain en bloc from the lower part of the stellate ganglion through the fourth ganglion. Although this procedure was effective in 94–98% of cases, compensatory hyperhidrosis occurred in the majority of patients (50–86%) [2, 4, 9, 11, 13, 20, 23, 24]. Only a few authors have distinguished between varying degrees of severity of the compensatory hyperhidrosis. They reported incidences of embarrassing or disabling compensatory hyperhidrosis between 8% and 50% [2, 6, 11, 14, 19, 22]. It has been suggested that this phenomenon is caused by a compensatory thermoregulatory mechanism of the body and that a larger dissection would result in an increase in the compensatory mechanism. For that reason, it was hypothesized that compensatory hyperhidrosis is related to the extent of the sympathectomy [3, 12]. Therefore, more limited resections at the level of the second ganglion (T2) were performed. However, although limited resection offered the advantages of a shorter operative time and a reduction in intraoperative complications, such as bleeding and Horner's syndrome, limiting the resection solely to the level of the second ganglion seemed to result in even higher incidences (84–97%) of compensatory hyperhidrosis [6, 16, 19].

In 1996, we reported on six patients with palmar and axillary hyperhidrosis in whom a limited sympathectomy was performed at the level of the third ganglion (T3) [3]. In

these patients, the third ganglion was resected. None of them developed compensatory hyperhidrosis (mean follow-up, 10 months). These results are consistent with the findings in the present study, where patients were operated on at the same level (T3) but using a different technique (the sympathetic chain was transected cranially and caudally of the third ganglion, without resection of the third ganglion). Although we are aware that our number of patients is low and we are only reporting purely empirical data for which we do not have an explanation, this is a remarkable finding when one considers the high rates of compensatory hyperhidrosis reported by other authors [2, 4, 6, 7, 9, 11, 13, 14, 15, 16, 19, 20, 23, 24]. It supports our hypothesis that the incidence of compensatory hyperhidrosis is correlated not only with the extent of the sympathectomy but also—and possibly more importantly—with the level of the sympathectomy. However, further studies are still needed to confirm this hypothesis.

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