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Endoscopic thoracic sympathectomy

J. Patrick Johnson, M.D., Chinyere Obasi, M.B.B.S., F.R.C.S.C., Michael S. Hahn, M.D., and Paul Glatleider, M.D.

Division of Neurosurgery, University of California, Los Angeles; and Kaiser Permanente Medical Center, Los Angeles, California

Thoracic sympathectomy has evolved as a treatment option for patients with hyperhidrosis and pain disorders. In the past surgical procedures were highly invasive and caused significant morbidity, but the minimally invasive thoracoscopic procedure provides detailed visualization of the sympathetic ganglia and is associated with minimal postoperative morbidity. In a previously published series the authors performed 60 thoracoscopic procedures in 39 patients; in this paper, they report the addition of 52 procedures performed in 26 patients, for a total of 112 procedures in 65 patients. Overall, the outcomes were equivalent to those for previously established open surgical techniques; however, the rate of surgery-related morbidity, length of hospital stay, and time until return to normal activity were substantially reduced. Complications and recurrence of symptoms were comparable with those demonstrated in previous reports. Overall patient satisfaction and willingness to undergo a repeat operative procedure ranged from 66 to 99%. Postoperatively, higher satisfaction rates were observed in patients with hyperhidrosis whereas in those with pain syndromes, satisfaction rates were lower. Minimally invasive thoracoscopic sympathectomy procedures are useful in treating sympathetically mediated disorders, and the results indicated that the procedure is associated with reduced morbidity and similar outcome when compared with results obtained after open surgery. Hyperhidrosis is well treated, but patients with pain syndromes have significantly poorer outcomes.

Key Words * thoracoscopy * sympathectomy * hyperhidrosis * Raynaud's syndrome * causalgia

In the past decade[3,7,10,22-26] video-assisted endoscopic imaging has made minimally invasive procedures technically feasible. Treatment of sympathetically mediated syndromes affecting the upper extremities, including hyperhidrosis, pain syndromes (causalgia or reflex sympathetic dystrophy, now commonly referred to as complex regional pain syndrome [CRPS]), and Raynaud's syndrome, are the primary indications for thoracoscopic sympathectomy.[1,3,7,10,11,21,24] Thoracoscopy provides a magnified view of the sympathetic chain and adjacent anatomy for precise surgical resection of the sympathetic ganglia, and it avoids the morbidity associated with open thoracotomy, supraclavicular, and paraspinal procedures.[10,22] Because length of hospital stay (LOS) and morbidity rates are reduced, patient satisfaction is improved, which now makes thoracoscopic sympathectomy the preferred procedure

for these disorders; however, long-term outcome studies have been limited.

CLINICAL MATERIALS AND METHODS

Patient Population

In a previously published paper,[15] we reported on the outcome of 39 patients who underwent 60 thorascopic procedures for sympathetically mediated pain disorders between 1993 and 1995. In this report, we update the series, providing outcome data for an additional 26 patients who underwent 52 procedures between 1996 and 1999. The reuslts presented here represent a combination of both time periods. All procedures were performed to treat uni- or bilateral symptoms. Overall, 20 patients underwent a unilateral thorascopic sympathectomy procedure, whereas 11 patients with bilateral symptoms underwent staged thorascopic procedures several weeks apart in the early phase of the series (1993-1995). During the most recent 4-year period, 34 patients with bilateral symptoms have undergone sequentially staged same-day thorascopic procedures.

Indications and General Considerations

Patients with sympathetically mediated syndromes, such as hyperhidrosis, CPRS, causalgia, and Raynaud's syndrome, and those in whom medical treatment failed to relieve pain underwent sympathectomy. Imaging studies such as chest radiography and computerized tomography or magnetic resonance imaging of the cervical and thoracic spine and brachial plexus were necessarily performed in each case. Psychological evaluation, an important component in the evaluation of patients with chronic pain, was performed as well. Stellate ganglion anesthetic blocks were used to obtain diagnostic confirmation that symptoms would be responsive to sympathetic blockade in patients with pain and ischemic disorders and only in a limited number of patients with hyperhidrosis regarding diagnostic blocks.

Intubation and Positioning

General anesthesia was induced, and patients underwent selective intubation, with single-lung ventilation being required for patients in whom a thorascopic sympathectomy was to be performed. Positioning of the patient during the procedure has evolved during the present series (Table 1).

TABLE 1 SYMPATHECTOMY PROCEDURES IN WHICH UNI- AND BILATERAL APPROACHES WERE USED IN 65 PATIENTS WHO UNDERWENT 112 PROCEDURES		
Approach	No. of Patients	No. of Procedures
unilat	20	22
bilat (staged)	11	22
bilat (same day)	34	68

Early in the series, patients underwent surgery while in a lateral position with the side in which surgery was performed facing up (Fig.1), and in patients with bilateral symptoms surgery was performed on the opposite side several weeks later. Later in the series, those patients with bilateral symptoms who were undergoing bilateral sympathectomies were repositioned for an immediate second-stage procedure on the contralateral side. Currently, in patients requiring bilateral sympathectomies the procedure is performed

while the patient is in the supine position to obtain exposure of both axillary regions in immediately staged procedures (Fig. 2).

Fig. 1. Artist's drawing depicting the lateral positioning of the patient (same as for a thoracotomy) undergoing right thoracoscopic sympathectomy.

Fig. 2. Artist's drawing illustrating the supine positioning of the patient undergoing sequential bilateral thoracoscopic sympathectomies.

To view the following sections previously described in **Neurosurgical Focus 4 (2):**Article 4, 1998, click the heading below. Please note that reference numbers in these two manuscripts do not correspond.

[*Equipment and Instruments\[14\]*](#)

[*Ports and Placement\[14\]*](#)

[*Steps of the Procedure\[14\]*](#)

[*Postoperative Care\[14\]*](#)

Outcome Analysis

The follow-up period was 6 months to 6 years, with annual clinic evaluations of all patients after thoracoscopic sympathectomy. Further details are described in the earlier work.[14]

RESULTS

The largest group of patients were those with hyperhidrosis (Table 2) who underwent thoracoscopic sympathectomy, and they also had the highest success rates (Tables 3 and 4).

TABLE 2 DIAGNOSIS IN PATIENTS UNDERGOING THORACOSCOPIC SYMPATHECTOMY	
Symptoms	No. of Patients
hyperhidrosis	48
causalgia/RSD/CRPS	12
Raynaud's syndrome	5

TABLE 3 OUTCOME IN 48 PATIENTS WITH HYPERHIDROSIS				
Symptom	Relief of Symptoms	Partial Relief of Symptoms	Recurrent Symptoms*	Lost to Follow Up
hyperhidrosis	47	1	0	0
*Although no patients experienced recurrent palmar hyperhidrosis, 11 patients suffered mild compensatory sweating in the trunk and two patients suffered gustatory sweating.				

TABLE 4 PATIENT SATISFACTION AND WILLINGNESS TO UNDERGO REPEATED PROCEDURE*		
Symptom	Patient Satis- faction Rate (%)	Willingness to Repeat (%)
hyperhidrosis	96	98
RSD/vasculitis	66	65
*RSD = reflex sympathetic dystrophy.		

Also in this group the highest complication rates were demonstrated, most often related to compensatory hyperhidrosis (manifesting as sweating in the trunk/torso or gustatory sweating); however, most patients were sufficiently satisfied with the postoperative result. Patients treated for pain syndromes or vasculitic disorders are noted in Table 2, and their initial response to treatment was very high; however, the effectiveness of treatment diminished after more than 6 months postoperatively (Tables 4-6), and the recurrence of symptoms was variable in these patients. Symptoms did not worsen in any patient who underwent sympathectomy, and the causes of symptom recurrence are unknown. Their overall satisfaction and willingness to repeat the operative treatment was correspondingly decreased (Table 4).

TABLE 5 OUTCOMES IN 17 PATIENTS WITH PAIN AND VASCULITIS DISORDERS			
Disorder	No. of Patients		
	Relief of Symptoms	Recurrence of Symptoms	Lost to Follow Up
RSD/causalgia/CRPS (12 patients)	7	4	1
Raynaud's syndrome/vasculitis (5 patients)	4	1	0

TABLE 6 OUTCOMES IN PATIENTS WITH PAIN AND VASCULITIS DISORDERS AS MEASURED BY THE OSWESTRY PAIN SCALE*			
Disorder	Oswestry Pain Scale Score		
	Preop (%)	1-mo Postop (%)	>6-mos Postop (%)
RSD/causalgia/CRPS	42	92	65
Raynaud's syndrome/vasculitis	51	96	88
*Oswestry Pain Scale score is derived from a 10-item questionnaire administered to each patient pre- and at 1 and 6 months postoperatively with a scale of 1 to 100. Patient data are presented as a percentage of the mean.			

Hospital LOS was short in those patients who underwent thoracoscopic sympathectomy: most patients remained 1 or 2 days postoperatively (Table 7). In historical cohorts of patients at our institution who underwent posterior paraspinal sympathectomies, hospital LOS ranged from 3 to 6 days. The overall complication rates (Table 8) were comparable with previous treatment alternatives.

TABLE 7 HOSPITAL LOS FOLLOWING THORACOSCOPIC SYMPATHECTOMY		
Duration	Unilat Sympa- thectomy (days)	Bilat Sympa- thectomy (days)
median	1	2
mean	1.5	1.8
range	0-4	1-3

TABLE 8 POSTOPERATIVE COMPLICATIONS AFTER SYMPATHECTOMY*	
Complications	No. of Patients
Horner's Syndrome	
transient	7
permanent	1
compensatory hyperhidrosis	11
gustatory sweating	2
pneumothorax (requiring chest tube)	1
pleural effusion (not requiring thoracocentesis or chest tube)	4
wound infection	1
intercostal neuralgia	
transient	3
permanent	1
death†	1
* Patients with hyperhidrosis who only experienced compensatory sweating symptoms.	
† Death occurred in an elderly patient with intractable Raynaud's syndrome who suffered a myocardial infarction 1 month after undergoing an uncomplicated unilateral sympathectomy procedure.	

DISCUSSION

Evolution of Sympathectomy Techniques

By utilizing recently evolved techniques for thoracic sympathectomy we can now achieve improved patient care and outcomes.[3,6,14,15,17,18] Previously, sympathetically mediated syndromes required highly invasive surgical procedures to resect a relatively small portion of the upper thoracic sympathetic ganglia.[2,4,5,9,13,28,30,31] Despite these issues, previous surgical procedures produced acceptable long-term clinical results.[2,4,5,9,26,31] Open operative procedures to treat hyperhidrosis have successfully resolved symptoms in more than 95% of cases, and in patients with pain disorders long-term improvement has been only 60 to 80% of cases.[5,22,28,31] Consequently, less traumatic and invasive procedures for sympathectomy have been sought.

[History of Thoracoscopy Procedures](#)

For a summary of the uses of thoracoscopic procedures[14], click on the heading.

[Hyperhidrosis](#)

A thorough characterization of hyperhidrosis can be found by clicking the heading and viewing our previously published paper.[14] One finding not discussed in our earlier work was that compensatory hyperhidrosis was found to occur in 22% of patients in our series, which is consistent with that reported in other series.

[Pain Syndromes, Raynaud's Syndrome and Vasculitis, and Thoracoscopy-Related Complications](#)

For a discussion of these topics, click the heading to view the previous report.[14]

CONCLUSIONS

In the treatment of sympathetically mediated disorders, minimally invasive techniques for thoracoscopic sympathectomy have equivalent outcomes to those reported for previous open surgical techniques; however, the associated morbidity rate and the hospital LOS are substantially reduced when utilizing these newer techniques. We recommend that surgeons undergo formal training in these procedures, with didactic and laboratory training, followed by work with an experienced surgeon who performs these procedures on a regular basis.

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Address reprint requests to: J. Patrick Johnson, M.D., Division of Neurosurgery, UCLA Medical Center, Box 956901, Los Angeles, CA 90095-6901. email: johnson@surgery.medsch.ucla.edu.