

A 7-year Experience with Thoracoscopic Sympathectomy for Critical Upper Limb Ischemia

Arvind Dhas Lee, MS, DNB, Sunil Agarwal, MS, David Sadhu, MS, FACS

Department of General & Vascular Surgery Unit 2, Christian Medical College Hospital, Vellore, South India 632 004

Abstract

Background: Severely symptomatic arterial insufficiency of an upper limb not suitable for revascularization is a difficult condition to manage. Thoracoscopic sympathectomy (TS) can be an effective procedure in this setting.

Methods: Our experience with 18 consecutive thoracoscopic sympathectomy (TS) procedures over a period of 7 years has been reviewed. Indications, operative technique, complications, and outcome of surgery are analyzed.

Results: We performed 18 TS procedures on 17 patients during this period. There were no deaths. One patient had intraoperative hemorrhage necessitating conversion to open thoracotomy. Mean postoperative hospital stay was 2.3 days. Follow-up ranged from 6 to 72 months. All patients demonstrated clinical benefit from the procedure.

Conclusions: Thoracoscopic sympathectomy is a useful option in patients with severely symptomatic hand and digital ischemia from occlusive small arterial disease like thromboangitis obliterans.

Upper limb ischemia requiring major amputation of the limb is unusual, because of the extensive collateral circulation around the shoulder and elbow. However, several conditions can lead to digital ischemia and localized finger gangrene.¹ Broadly, they can be divided into two categories: vasospastic conditions and small vessel occlusive disorders. As surgical revascularization of these cases is rarely possible, digital ischemia of this nature is a disabling condition with few treatment options. Thoracoscopic sympathectomy is one procedure that has been found to be useful in this condition.²

Although the first thoracoscopic removal of the sympathetic chain was described as early as 1942 by Hughes, it was only in the 1990s with the development of video-assisted thoracic surgery (VATS) that the procedure became well established and safe.^{3–5} Primary palmar hyperhidrosis remains the most frequent indication for the

operation,⁵ and its exact role in hand and digital ischemia is controversial.^{6,7}

We are a tertiary care referral center in South India, catering to a wide geographical distribution of patients. Hand and digital ischemia is a frequently encountered problem in our vascular surgery unit. Most cases respond to conservative management with anticoagulation and pain relief. However, some patients have significant pain at rest and tissue loss, neither of which responds to conservative measures. We present a 7-year experience with thoracoscopic sympathectomy in the management of this latter group of patients.

METHODS

From July 1997 to June 2004, we performed 18 TS in 17 patients (15 men and 2 women) with critical hand ischemia. One woman with systemic lupus erythematosus (SLE) had TS of each side in separate operations

Table 1.
Patient details

Case No.	Age/Sex	Diagnosis	Tissue Loss
1	49/M	TAO	+
2	40/M	TAO	+
3	69/M	ASO + CVD	+
4	39/M	TAO	-
5,6	19/F	SLE	+, -
7	65/M	Atherosclerosis	-
8	35/M	TAO	+
9	42/M	TAO	+
10	38/M	TAO	-
11	22/F	CVD	+
12	45/M	TAO	+
13	68/M	Atherosclerosis	-
14	37/M	TAO	+
15	48/M	TAO	+
16	38/M	TAO	+
17	40/M	TAO	-
18	42/M	TAO	+

M: male; F: female; TAO: thromboangitis obliterans; SLE: systemic lupus erythematosus; ASO: Atherosclerosis; CVD: Collagen vascular.

2 years apart. All patients had clinical and radiological evidence of organic blockage of distal arteries not amenable to surgical revascularization. Doppler ultrasound was used to confirm the physical findings in 14 cases, and 4 patients had an angiogram as well. The primary diagnosis was thromboangitis obliterans (TAO) in 12 patients, atherosclerosis in 3, and collagen vascular disease in the other 2 (Table 1). Thromboangitis obliterans was diagnosed on the basis of accepted clinical criteria,⁸ a proximal embolic source being excluded by an echocardiogram. The other diagnoses were made on the presence of risk factors for atherosclerosis or on the basis of work up for collagen vascular disorders. All patients had pain at rest that was unresponsive to maximal medical therapy and that interfered with sleep. Twelve patients had terminal digital necrosis, gangrene, or ulceration.

Thoracoscopic sympathectomy was performed under general anesthesia with double-lumen endotracheal intubation. The patient was placed in the supine position with the ipsilateral upper limb abducted. Two entry sites were used, one in the fifth intercostal space in the mid-axillary line for placement of a 10-mm 0-degree scope, and the other in the third intercostal space in the mid-clavicular line for placement of a 5-mm instrument. Pleural adhesions when encountered were released. One lung was collapsed, and single lung ventilation was continued. The lung apex was pushed downward and the sympathetic chain was identified where it runs over the neck of the upper ribs. After the chain was identified,

the pleura over it was incised with diathermy, and the second and third thoracic ganglia and the intervening chain were fulgurated until destroyed. Minor bleeding was controlled by pressure from the probe or by further precise diathermy. The anesthetist then reinflated the lung while the surgeon allowed gas to escape from the pleural cavity through the 5-mm port, checking expansion of lung through the telescope. When the lung was fully expanded, the ports were removed and the incisions were closed with a deep stitch. Chest drainage was not required.

RESULTS

There were no perioperative deaths in this series. One patient had significant intraoperative bleeding which required conversion to open thoracotomy. No Horner's syndrome or other collateral effects were noticed in any of the cases. Mean postoperative hospital stay was 2.3 days. Follow-up ranged between 6 and 72 months, with a mean of 18 months.

All patients had improvement from pain at rest. It was possible to suspend pain medication in 11 (61.1%) patients, and the use of pain killers was reduced to intermittent doses in the other 7 (38.9%). Of the 12 patients with digital ulceration and gangrene, 4 had complete healing and the other 8 had good demarcation of the gangrene. Five of these 8 patients later required local amputations, and 4 had complete healing at the amputation site. The fifth patient with TAO, who continued to smoke cigarettes, had a persistent ulcer at the amputation site.

DISCUSSION

The clinical manifestations of disease involving the distal small arteries of the upper limb can range from episodic vasoconstriction and Raynaud's phenomena to ulceration and gangrene of the digits. The latter end of this spectrum often follows fixed organic occlusions of the distal arterial tree. The common conditions causing distal arterial occlusion include collagen vascular diseases, Buerger's disease, and hypersensitivity angiitis.^{9,10} A combination of measures like vasodilators, phosphodiesterase inhibitors,¹¹ antibiotics, and conservative debridement is reported to result in healing rates of up to 88%.⁹

Cervicothoracic sympathectomy has been performed for occlusive and vasospastic small arterial disease for

several decades with mixed results.^{6,12} Most series have found recurrence of symptoms after an initial period of improvement, especially in patients with vasospastic Raynaud's syndrome.¹³ However, in a clear subset of patients with organic blockage of the distal vasculature resulting in terminal digital necrosis, gangrene, and significant pain at rest, TS has been found to be a valuable therapeutic option.¹⁴

In our series, the most common indication for the operation was Buerger's disease of the upper limb. Patients with Buerger's disease usually present with tissue loss and severe pain at rest, and there is definite evidence of small vessel occlusion that often is not amenable to surgical correction. Conservative measures like vasodilators and analgesics can alleviate symptoms only to a limited degree, so TS is especially suited to this group. Cessation of disease progression by avoiding tobacco and control of symptoms by sympathectomy results in a return to near normal function that is durable. We strongly recommend TS in patients with Buerger's disease of the upper limb.¹⁵

Patients with autoimmune disorders form the other group of patients who often present with hand and digital ischemia. The use of TS in this group is more controversial. It appears that good results can be obtained in selected patients with digital arterial occlusion in the absence of Raynaud's syndrome.¹⁶ Available evidence does not appear to support the use of TS in patients with spastic forms of Raynaud's syndrome.^{13,17}

Development of VATS has made sympathectomy for the upper limb safe and minimally invasive. This has resulted in the procedure being done widely, especially for palmar hyperhidrosis. A recent meta-analysis of all published literature confirms TS to be safe with very low morbidity.¹⁸ The common complications are hemorrhage (5%), pneumothorax (2%), and Horner's syndrome (rare). However, there have been several anecdotal reports of fatalities after TS, and use of the procedure should not be taken lightly. In our series, one patient developed hemorrhage requiring a thoracotomy. Preoperative informed consent must always include this eventuality. There are also reports of compensatory sweating after VATS sympathectomy for palmar hyperhidrosis,¹⁹ however none of the patients in this series complained of this problem.

Vasoconstrictor fibers to the arteries of the upper limb arise from the ventral roots of T2 and T3. Hence, destruction of these is sufficient to treat upper limb ischemia, whereas in axillary hyperhidrosis the trunk below the fourth thoracic ganglion also needs to be interrupted. However, the occurrence of the nerve of Kuntz²⁰ and other anatomic variations in the upper

thoracic sympathetic chain²¹ has led investigators to question the completeness of TS. Local digital artery sympathectomy has been described as an option to circumvent this problem.²² However, there are no large trials that have studied this modality and until such time as broad studies are available, thoracoscopic sympathectomy should be considered the safest and least invasive method of performing sympathectomy of the upper limb.

In conclusion, we believe that TS is a good option in the management of a carefully selected group of patients with severe digital ischemia caused by demonstrable occlusion of the distal arteries of the upper limb. Patients with Buerger's disease of the upper limb especially benefit from the procedure and because of its efficacy, safety, and durability it should be considered early in the natural course of the disease.

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