

Evaluation of Lumbar Sympathectomy*

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LUMBAR sympathectomy is a surgical procedure that is now well established as a valuable adjunct in the treatment of selected cases of peripheral arterial disease. Immediately following World War II there was much enthusiasm for sympathectomy and as a result many patients with peripheral vascular disease underwent this procedure. In the next few years reports indicating a relatively high percentage of poor results were published. With the rapid development of direct operative attack on localized blocks in the peripheral arterial tree, sympathectomy is now assuming its rightful place in the procedures available for treatment. With careful evaluation and selection of patients, a relatively high percentage of good results is obtained. Sympathectomy is a procedure that must be considered as palliative, particularly in peripheral arteriosclerotic vascular disease, because the underlying pathologic process is not influenced by severance of the sympathetic nerves.

HISTORIC DEVELOPMENT

The anatomic presence of the sympathetic system was suggested by Galen. Vesalius and Eustachius in the sixteenth century further depicted the anatomy of the nerve trunk and some of the ganglionated plexuses. In the early eighteenth century, Jacques Benigne Winslow used the term "le grand sympathique," because he considered that through these nerves the "sympathies" of the body were controlled.

The physiologic function of the sympathetic nerves was hardly more than guessed at until 1858 when Claude Bernard demonstrated that these nerves controlled vasoconstriction. Further knowledge of the function of the sympathetics was forthcoming from other physiologists.

Adson and Brown observed that lumbar sympathectomy produced vasomotor changes in the lower extremities. In 1925, they carried out a bilateral lumbar sympathectomy on a young

patient with Raynaud's disease. Following operation the feet were warm and pink and without vasomotor disturbances. In 1935, Flothow described an anterior extraperitoneal approach which, with some modifications, is still used.

RATIONALE OF LUMBAR SYMPATHECTOMY

The interruption of the sympathetic system is basically designed to eliminate the mechanism of spasm, which in arterial vessels is a normal physiologic reaction. It is one of the defense mechanisms of the body in which trauma to a vessel invokes vasoconstriction which tends to limit bleeding from the injured blood vessel. This type of spasm, secondary to trauma, is probably mediated directly through sympathetic synapses.

Hormonal production of vasoconstriction is less well substantiated. In animals with shock a substance has been isolated that will cause peripheral vasoconstriction in other animals. The exact nature of this substance is not known, but it may be histamine, as advocated by Bach and others; sympathin, as postulated by White; or an unknown toxin, as suggested by others. It is possible that hypersensitivity to certain materials, such as tobacco, may trigger the reaction. Regardless of the etiology, the efferent fibers causing vasoconstriction are mediated wholly or in part through the sympathetic nerves.

In vasospastic diseases the etiology of the sympathetic overactivity frequently cannot be demonstrated with certainty. However, predisposing or inciting factors, such as cold, emotional stress or associated disease, are usually present. The vessel wall is ordinarily essentially normal. Sympathectomy, by interrupting the efferent pathway, allows more or less continuous vasodilation to take place.

In thromboangiitis obliterans and arteriosclerotic peripheral vascular disease, the trauma from the damaged or occluded wall of the vessel

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is probably the principal factor in the related vascular spasm. Sympathectomy eliminates the vasoconstriction proximal to the occluded vessel and permits maximal dilation of the collateral vessels. In extensive or far advanced arteriosclerosis the openings to the collateral vessels may also be occluded. In such an instance no beneficial effect will result from sympathectomy.

The sympathetic system controls blood flow through the skin and secretion of the sweat glands. In sympathectomy increased skin circulation and removal of hyperhidrosis are valuable adjuncts in treating superficial ulceration and chronic mild infections of the lower extremities.

INDICATIONS

Arteriosclerosis obliterans is the most common cause of ischemia of the lower extremities. The clinical picture, which includes intermittent claudication, coldness, color changes, ischemic pain, ulceration and gangrene, is well known. Although arteriosclerosis is a systemic disease, there has been increased appreciation that one segment of the arterial tree may be affected more than the remainder. The explanation for this segmental involvement is that a thrombus may form on an atheromatous plaque, causing complete occlusion of the vessel. When such occlusion occurs in the distal aorta, or iliac or femoral arteries, the recently developed direct attacks on occlusion by endarterectomy, resection or bypass graft will give the best long term results for the patient. Aortography and arteriography, in addition to demonstrating the area of occlusion, give the necessary information about the patency of the distal portion of the vessel. When the arteriogram shows a block with little or no distal filling or a patent artery with a markedly narrowed lumen and an irregular outline, direct surgical attack has little to offer the patient. It is in such cases, in which the arteriosclerosis is more generalized, that sympathectomy, by its effect on improving the collateral circulation, has its greatest usefulness. This procedure is also sometimes beneficially combined with the direct approach, particularly to reduce or eliminate arterial spasm in the post-operative period.

Thromboangiitis obliterans or Buerger's disease is an inflammatory disorder of unknown etiology affecting medium-sized arteries, veins and adjacent nerves. Tobacco, as well as other factors, seems to play a role in the disease. The

symptoms, resulting from the occluded arteries, are pain, color changes and ulceration. Sympathectomy is helpful in improving the symptoms by increasing the collateral circulation.

Angiospastic disease results from an abnormal vasoconstrictor sensitivity to cold or an emotional disturbance. The characteristic color changes of the skin described by Raynaud in 1862 are typical of the lesions. The skin changes are explained by degrees of vasoconstriction. The white color results from the ischemia due to arteriolar and capillary spasm. With anoxia, the capillary wall relaxes, allowing dilation and retrograde venous dilation and the blue coloration of the skin. The rubor follows relaxation of the arteriolar wall and flushing of the system with oxygenated blood. It would seem that removal of the controlling sympathetic system would relieve all symptoms. However, there is apparently also a local vascular sensitivity in many subjects with angiospastic disease. Sympathectomy may, therefore, produce complete or partial relief of symptoms.

Lumbar sympathectomy has been utilized as an adjunct in the treatment of many other pathologic conditions of the lower extremities. In the occasional case in which vascular spasm is of a severe degree, it may be of real value. In general, however, each case must be individually evaluated with the appropriate tests.

SELECTION OF PATIENTS

It would be ideal if lumbar sympathectomy would provide partial or complete relief of symptoms of all patients with ischemic changes in the lower extremities. However, experience has shown that the procedure is not such a panacea. Unfortunately, there is no reliable method of determining accurately which patient will get a good result from sympathectomy.

All evaluation is made on the basis of a block of the sympathetic nerves with a local anesthetic agent. The improvement in circulation is then measured objectively by oscillometric, plethysmographic or thermometric studies, or subjectively by a trial of ambulation for evidence of relief of symptoms.

The recent introduction of the sympathogalvanic reflex by Lewis has added a refinement which is helpful in evaluating the effectiveness of the sympathetic block. This simple test, using an electrocardiograph to record sympathetic impulses in the extremities before and after sympathetic block, indicates definitely whether or not an effective block has been obtained.

Such information is particularly helpful in borderline cases.

Value of Diagnostic Block: When there is a definite response to sympathetic block, the percentage of patients demonstrating improvement following surgical sympathectomy is high.

In sympathectomy, particularly for arteriosclerotic peripheral vascular disease, the improvement in circulation is due to a more effective collateral circulation. It has been frequently observed that the results from surgical sympathectomy are better than indicated by the diagnostic block. Also, the beneficial effect of sympathectomy is progressive over a period of several weeks. Since a diagnostic block with most anesthetic agents lasts only two to three hours, this may not be of sufficient time to permit more than token improvement in collateral circulation. A phenol sympathetic block, which persists for several months, seems to be a more rational approach to evaluating those patients in which the diagnostic block produced questionable results but who appear clinically to be good candidates for sympathectomy.

Clinical Evaluation: The clinical evaluation of the patient with peripheral vascular disease is of prime importance in determining whether or not he will respond to lumbar sympathectomy. In general, the more severe and generalized the pathologic process, the less the chance of improvement. When death of tissue has already occurred, dilation of collateral vessels will not bring about revitalization of the part. It is possible, however, that sympathectomy in the presence of gangrene may permit amputation at a lower level.

Marked atrophy of the soft parts of the leg, with capillary anoxia and severe pain involving the foot or lower third of the leg, and absent popliteal pulses have been the most constant findings in which minimal effect from sympathectomy has been found.

RESULTS IN PERIPHERAL ARTERIOSCLEROTIC DISEASE

One hundred patients with arteriosclerotic peripheral vascular disease treated by lumbar sympathectomy at the University of Michigan Hospital from 1953 to 1956 have now been followed up for a period of at least two years. In this group, thirty-eight had bilateral operations, making a total of 138 sympathectomies in the series.

Age and Sex: Eighty-nine of the 100 patients in the group were over fifty years of age (Table

TABLE I
Age of 100 Patients Subjected to Lumbar Sympathectomy

Age (yr.)	No.
Under 50	11
50 to 60	38
60 to 70	49
70 or over	2

I). Of the eleven under fifty years of age, all had confirmatory evidence of degenerative vascular disease by direct examination or by vascular roentgenograms. There were eighty-one men and nineteen women.

Preoperative Symptoms and Signs: Most of the patients undergoing sympathectomy had more than one type of symptom (Table II). Intermittent claudication was present in the highest percentage of cases (81 per cent), being the first and most constant symptom in the majority of patients. In most of the patients it appeared after walking one to two blocks. It was present in 115 extremities which were subsequently sympathectomized.

Color Changes and Cold Feet: Fifty-one patients (sixty-nine extremities) noted that they were aware of cold feet. Hyperhidrosis and blanching of the skin of the feet were present in thirty-eight.

Rest Pain: Pain in the foot or toes at complete rest and particularly at night was present in nineteen patients (thirty-one extremities). While this is a common symptom of arteriosclerotic peripheral vascular disease, the low incidence in the present series reflects the selection of the patients. Severe ischemic pain is an indication of severe disease, and in general the results with sympathectomy are poor in patients experiencing this symptom.

TABLE II
Symptoms and Signs in 100 Patients Prior to Lumbar Sympathectomy

Symptom	No. of Extremities	No. of Patients
Intermittent claudication	115	81
"Cold feet"	69	51
Rest pain	31	19
Tissue necrosis	34	16
Absent dorsalis pedis	124	90
Absent popliteal pulse	94	68

TABLE III
Amputations Following Lumbar Sympathectomy

Duration	No. of Extremities	No. of Patients
Within one year	28	20
After one year	11	8
Total	39	28

Ulceration: Tissue necrosis was present in sixteen patients (thirty-four extremities). In general, this was confined to superficial ulceration below the ankle and in a few patients included some gangrene of portions of the toes.

Pulses: The dorsal pedis pulse was absent in 124 (90 per cent) of the extremities in which sympathectomy was carried out. The popliteal pulsation was also absent in ninety-four (68 per cent) of the extremities.

Sympathetic Block: In eighty-six patients sympathetic block was carried out as a preoperative diagnostic test. In forty-three cases (fifty-eight extremities) there was evidence of a rise in skin temperature of 3°F. or more or a good subjective response. In twenty-eight cases (thirty-nine extremities) the testing showed some improvement. In fifteen cases (twenty-one extremities) there was minimal or no response.

Diabetes: Diabetes mellitus was present in thirty-one patients in this series. The diagnosis of this disorder was established during the work-up for the peripheral vascular disease in eleven patients.

RESULTS

Death: Two deaths occurred in the immediate period of hospitalization: one on the third and the other on the seventh postoperative day. Both were the result of coronary artery occlusion, as demonstrated at autopsy. In the period of follow-up, thirteen other patients have died. Of this group, nine deaths were attributed to complications of arteriosclerosis, two to unrelated causes, and in two the cause of death was not known.

Amputation: Major amputations were performed on thirty-nine extremities (28 per cent) in which sympathectomy had been performed (Table III). It is noteworthy, however, that twenty-eight (20 per cent) were performed in the first year postoperatively. In the patients who had late amputation, there was a period of

months in which the preoperative symptoms were partially or completely relieved. Amputations were twice as common in patients with diabetes than in those without diabetes.

Symptomatic Improvement: The interval from the time of operation is a factor in determining how much relief or improvement of symptoms had been obtained. Many patients had relief of symptoms initially but later the symptoms returned. The length of time the patient had relief was dependent on the progression of the arteriosclerotic obliterative disease.

In this series intermittent claudication was significantly relieved in 51 per cent of the patients. Two-thirds of the patients reported their feet were warmer after sympathectomy. Rest pain was relieved in one-third of the patients. Ulceration, with or without amputation of digits, was improved or healed in 60 per cent of the extremities after sympathectomy.

CLASSIFICATION OF RESULTS

In 100 patients, 138 lumbar sympathectomies were carried out. Results were evaluated at least two years after operation (Table IV).

TABLE IV
Classification of Results Following Lumbar Sympathectomy

Result	No. of Extremities	No. of Patients
Good	70	52
Fair	23	17
Poor	45	31
Total	138	100

Good Results: Patients were considered to have a good result if for a period of at least one year they had significant or complete relief of preoperative symptoms. Fifty-two patients fell into this group. Patients who later underwent amputation are included but only if symptoms returned or became worse after one year.

Fair Results: Patients were considered to have a fair result if they had partial improvement or relief of symptoms and no amputation during the first postoperative year. This group was comprised of seventeen patients.

Poor Results: Patients without relief of symptoms and those undergoing major amputation in the first year postoperatively were included in this group (thirty-one patients).

SUMMARY

Lumbar sympathectomy is a valuable palliative procedure in the treatment of selected cases of peripheral vascular disease. Clinical evaluation, plus objective and subjective response to lumbar sympathetic block, is helpful in selecting patients who will probably be helped by lumbar sympathectomy. Patients may have improvement of symptoms following lumbar sympathectomy but recurrence may occur later as the arteriosclerotic disease progresses. The results in a series of 138 sympathectomies in 100 patients are reported.

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