RE-EVALUATION OF PARAVERTEBRAL LUMBAR
SYMPATHETIC BLOCK IN TREATMENT OF
PERIPHERAL VASCULAR DISEASE

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In the therapy of peripheral vascular disease of the lower extremity, various methods have been utilized to produce an increased blood flow by vasodilatation. Confusion has frequently developed because some authors vigorously and enthusiastically advocate their own particular methods of producing vasodilatation when there is inadequate physiological or pharmacological foundation for their enthusiasm. The purpose of this paper is to present a comparative study of sympathetic block, sympathectomy, and two relatively new vasodilating drugs in effecting an increased blood flow in the lower extremities.

As a result of this comparative study, a clarification of the role of paravertebral lumbar sympathetic block as an important adjuvant in the management of peripheral vascular disease of the lower extremity is attempted.

The cell bodies of the sympathetic motor neurons supplying the lower extremity lie in the intermediolateral cell column of the tenth thoracic through second lumbar cord segments. Preganglionic fibers pass to the sympathetic chain via the white rami to synapse in the sympathetic ganglia located on the anterolateral aspect of the vertebral bodies from the tenth thoracic to the third or fourth lumbar segment and chiefly in those ganglia at the level of the first, second and third lumbar vertebrae. These ganglia are very variable in their number and location (1). Since white rami rarely enter the sympathetic chain below the level of the second lumbar vertebra, blockade at this point will denervate postganglionic impulses from all lower ganglia. The sympathetic chain lies anterior to the psoas muscle in a relatively well demarcated plane which, when injected with solution, tends to cause the fluid to pass up or down the chain rather than to diffuse in an anterior direction (fig. 1). Studies on the fresh cadaver in the postmortem room and on living subjects with roentgen-rays of the diffusion of radio opaque material (Diodrast 17½ per cent) demonstrated the spread of 30 cc. of injected fluid over a distance comprising the length of three or four lumbar vertebrae. Follow-up studies using local anesthetic agents, again injected at the second lumbar vertebra in amounts of 30 cc., gave complete sympathetic blockade as evidenced by the abolishment of the sympathogalvanic reflex (2). It was found that the experienced operator could consistently inject the lumbar sympathetic chain using a one needle technique.

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FIG. 1. Cross section at 2nd lumbar vertebra showing prevertebral space.

METHOD

This study includes 208 patients with peripheral vascular disease of the lower extremity. These patients were divided into diagnostic categories and results following sympathetic block were determined (table 1).

During the study, the patients were placed in a room with a constant temperature of 20°C. The linear air flow was 50 cubic feet per minute and the relative humidity was 50 per cent. The cutaneous areas to be measured were exposed to room air and care was taken to avoid contact with the mattress, blankets or other objects which might prevent rapid circulation of air past the exposed lower extremities. The study was performed with the patients under basal conditions which are defined as the least emotional stress possible, six hours postprandial, three hours after smoking, and after one hour of stabilization of the skin temperatures in the constant temperature room. Multiple skin temperatures were recorded with a Brown potentiometer with copper constantan thermocouples and with a 6-channel Yellow Springs Tele-thermometer. The leads were taken from the forehead and the right and

<table>
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<th>Condition</th>
<th>Number Patients</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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<tbody>
<tr>
<td>Raynaud's disease or phenomenon</td>
<td>20</td>
<td>100</td>
<td>0</td>
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<tr>
<td>Phlegmasia cerulea dolens</td>
<td>6</td>
<td>66.7</td>
<td>33.3</td>
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<td>Acute thrombophlebitis</td>
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<td>88.2</td>
<td>11.8</td>
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<td>Thromboangitis obliterans</td>
<td>18</td>
<td>55.5</td>
<td>33.4</td>
<td>11.1</td>
</tr>
<tr>
<td>Arteriosclerosis obliterans</td>
<td>89</td>
<td>48.6</td>
<td>15.1</td>
<td>36.3</td>
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<tr>
<td>Sudden arterial occlusion</td>
<td>4</td>
<td>50.0</td>
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<tr>
<td>Postthrombotic syndrome</td>
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<td>30.0</td>
<td>40.0</td>
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<td>Average</td>
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<td>62.7</td>
<td>22.7</td>
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Beneficial in 85.4%—Not beneficial in 14.6%.
left first, third and fifth toes. It has been shown that with vasodilating procedures which produce maximal vasodilatation higher temperatures are recorded in the toes than in the more proximal portions of the legs and that the forehead skin temperatures represented the temperature obtained by maximal vasodilatation (3). The point of maximal vasocostriction was established when the temperature of the toes approached room temperature. The skin temperature studies were utilized to compare the effectiveness of sympathetic block and sympathectomy with two relatively new adrenolytic and sympatholytic agents. The adrenolytic agent, azapetine (Ilidar®) phosphate (1 mg./kg. in 250 cc. normal saline) and the sympatholytic agent, trimethaphan camphorsulfonate (Arfonad®) (2 mg./kg. in 250 cc. normal saline) were admin-

![Graph showing temperature response](image)

**Fig. 2.** A comparison of the response of skin temperature of the toes following sympathetic block in a case of Raynaud’s disease and arteriosclerosis obliterans showing the differentiation between vasospastic disease and obstructive disease.

istered intravenously until the maximal response was obtained or adverse side reactions developed. Paravertebral lumbar sympathetic block was performed using the single needle technique with insertion at the level of the second lumbar vertebra and injection of 30 cc. of 0.15 per cent tetracaine hydrochloride. Evidence of complete sympathetic blockade following sympathetic block and sympathectomy was determined by the disappearance of the sympathogalvanic reflex. The abolishment of the sympathogalvanic reflex in the lower extremity is also accomplished by the intravenous administration of azapetine and trimethaphan camphorsulfonate without producing adverse side effects consisting chiefly of postural hypotension which is alleviated by the horizontal position. Postsympathectomy studies were done five days
postoperatively. Temperatures were recorded until the majority of leads stabilized.

**Results**

Temperature curves following sympathetic block aptly illustrate the differentiation between vasospasm and organic obstruction (fig. 2). A greater response followed sympathetic block than with I lidar or Arfonad when intense or moderate vasospasm is present. When normal or decreased vasoconstrictor tone was present the results were comparable. Temperature studies following sympathectomy were consistent with the presympathectomy block temperature studies indicating the value of sympathetic blockade as a prognostic tool. If the vasodilating drugs were administered to the point where hypotension developed in an effort to eliminate increased vasoconstrictor elements a concomitant decrease in skin temperature occurred. In those diseases characterized predominately by spasm (for example, Raynaud's disease) sympathetic block gave the best results and more nearly approximated the results obtained by surgical sympathectomy (fig. 3). In infectious or traumatic conditions associated chiefly with direct or reflex spasm, sympathetic block was more effective as a therapeutic measure than drug therapy. In the diseases associated with varying amounts of occlusion and spasm the results of drug and block therapy were comparable (figs. 4 and 5). Drug therapy is best confined to these conditions associated with mild spasm.

![Graph](http://anesthesiology.pubs.asahq.org/pdfaccess.ashx?url=/data/journals/jasa/931676/)  
**Fig. 3.** A composite graph of toe temperature determinations showing the comparative effect of a vasodilating drug and sympathetic block in the group with Raynaud's disease and phenomenon.
Fig. 4. A composite graph of toe temperature determinations showing the comparative effect of a vasodilating drug and sympathetic block in the group with thromboangiitis obliterans.

Phlegmasia cerulea dolens, a relatively uncommon disease of unknown etiology, is a rapidly progressing total thrombophlebitis with concomitant intense arterial spasm in the lower extremity. The use

Fig. 5. A composite graph of toe temperature determinations showing the comparative effect of a vasodilating drug with sympathetic block in the group with arteriosclerosis obliterans.
of sympatholytic and adrenolytic drugs to induce vasodilatation has been of no avail. The six cases reported in this study have been treated with anticoagulant therapy in conjunction with continuous lumbar sympathetic blockade utilizing an indwelling polyethylene catheter inserted at the level of the second lumbar vertebra to administer 0.15 per cent tetracaine hydrochloride. The success achieved by this method of treatment has been most gratifying.

**DISCUSSION**

In peripheral vascular disease of the lower extremity, the obstruction to blood flow is the result of two components, either or both of which may be present in varying degrees: (1) organic occlusion and (2) functional vasospasm. Vasospasm is the controllable factor and the most responsive to therapy. In each of the peripheral vascular disease entities considered in this study, the vasospastic component varies. In Raynaud’s disease and phenomenon, the vasospastic element predominates. Thromboangiitis obliterans exhibits a decreasing vasospastic element as the organic occlusive element progresses. In arteriosclerosis obliterans, the occlusive element predominates, but some vasomotor component is often present. Thus a wide range variation in the vasospastic element exists.

Sympathetic inhibition resulting in the abolishment of the vasospastic element will produce beneficial improvement in the circulation. The more severe and more extensive the organic occlusive element, however, the less possibility for improvement by any vasodilating procedure.

Ray, Burch and DeBakey (4) have made comparative studies of the vasodilating effect of tetrethyl ammonium chloride and sympathetic block on the lower extremity. Their results reveal a much greater response with lumbar sympathetic block. The explanation of these results was attributed to the borrowing-lending hemodynamic phenomenon which they labeled hemometakinesia. This physiological mechanism is described as the shifting of a limited blood volume to a part where local vasodilatation has been produced. Such hemodynamic adjustment is not accomplished by generalized vasodilatation as that produced by the sympatholytic and adrenolytic drugs. Thus in the treatment of peripheral vascular disease of the lower extremity, the direct, specific method of sympathetic block and sympathectomy in relaxing vasospasm is the more physiological therapeutic approach to the problem.

Our comparative studies of azapetine and trimethaphan camphorsulfonate to lumbar sympathetic block reveal similar results. The intense vasospasm observed in Raynaud’s disease showed a much greater response from sympathetic block than from the vasodilating drugs. In thromboangiitis obliterans, with its varying degrees of vasospasm and organic obstruction, the results were better with sympathetic block.
When sympathetic block and the drugs were compared in arteriosclerosis obliterans the results were similar. In these studies it is shown that sympathetic inhibition of the lower extremity which is produced by sympathetic block more accurately determines the degree of vasoconstrictor tone and is a valuable aid in the differentiation between vasospasm and organic obstruction. In arteriosclerosis obliterans with normal vasoconstrictor tone positive results with sympathetic block were comparable with postlumbar sympathectomy studies. Negative results with sympathetic block were attributed to little or no vascular tone or to the slow progressive development of collateral circulation which may follow surgical sympathetic inhibition. Evidence of vasodilatation in extremities affected by severe, chronic arterial occlusive disease is much less impressive. However, since the smaller arteries are much less frequently affected by organic changes in arteriosclerosis obliterans than they are in thromboangiitis obliterans a greater capacity for arteriolar dilatation and concomitant increase in blood flow can often be expected. Digits revealing a decrease in temperature and increased pain following sympathetic block may become gangrenous following sympathectomy. This paradoxical effect is ascribed to the mechanism of a shunting of much of the circulating blood away from the distal portion of the extremity through dilated arterioles proximal to an area of obstruction in the main artery. Sympathectomy is contraindicated when this phenomenon occurs.

**Summary**

A comparative study of trimethaphan camphorsulfonate, azapetine, paravertebral lumbar sympathetic block and lumbar sympathectomy in 208 patients with peripheral vascular disease of the lower extremity was made. Sympathetic block was most effective in diagnosis (presence or absence of spasm), prognosis (to determine the potential effect of a surgical sympathectomy) and in treatment (traumatic or infectious spasm). Thus, even with the advent of newer sympatholytic and adrenolytic drugs an adequately executed sympathetic block continues to be a valuable tool in the anesthesiologist’s armamentarium in the management of peripheral vascular disease of the lower extremity.

**References**