

REPEATED SYMPATHETIC BLOCKS: THEIR LIMITATION AND VALUE * †

LIEUTENANT COMMANDER FRANK L. FAUST

Medical Corps, United States Naval Reserve

TEMPORARY interruption of the sympathetic nervous system for acute phlebitis was introduced in 1934 by Leriche and Kunlin. Through the efforts of subsequent investigators, it has been applied successfully in many cases to the various chronic disorders of the peripheral vascular system. Peripheral vascular disorders, while previously not common in the healthy young individual of military age, have shown evidence of being on the increase. The psychic stress of war, the greatly increased consumption of tobacco, the stress and strain placed on the nervous, osseous, and vascular systems of the extremities due to factors incident to the service, the trauma to these systems associated with fractures, penetrating wounds, and contusions are but a few of the predisposing and precipitating factors in these frequently disabling afflictions.

Although sympathetic blocks (interruption of the sympathetic impulses by procaine infiltration of its ganglia and trunk) are by no means the epitome of therapy in these individuals, they form an important instrument in our armamentarium for combating these conditions. Although curative in some of these disturbances, in others the procedure frequently produces the much needed comfort for useful existence, without influencing the course of the organic disease. In this latter group a clear idea is obtained of just what may be expected of a cervical or lumbar sympathectomy, and thus operability may be determined.

PHYSIOLOGIC BASIS OF THERAPY

The role played by spasm in the peripheral vascular system has been appreciated for some time. The work of Ochsner (1) on acute phlebitis and its successful management by paravertebral sympathetic block has emphasized this role and suggested many possibilities. Vasospasm and more recently vasodilatation are factors in vascular disturbances amenable to control—partial or complete. According to Ochsner (2) in peripheral vascular disorders the prognosis in any given case is dependent directly upon the degree of spasm present.

* From the Department of Surgery (Anesthesia), U. S. Naval Hospital, New Orleans, Louisiana.

† The opinions and assertions expressed herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

Although the role of the sympathetic nervous system is quite controversial, it is generally accepted that, whether it be vasoconstriction (Ochsner) or both vasoconstriction and vasodilatation (Miller and deTakats, 3), the reflex arc is mediated in whole or in part through the sympathetic nervous system. According to Harvey (4), the terminal distribution of the sympathetics follows that of the somatic nerves which give off and receive filaments from the vessels in the segmental neural areas.

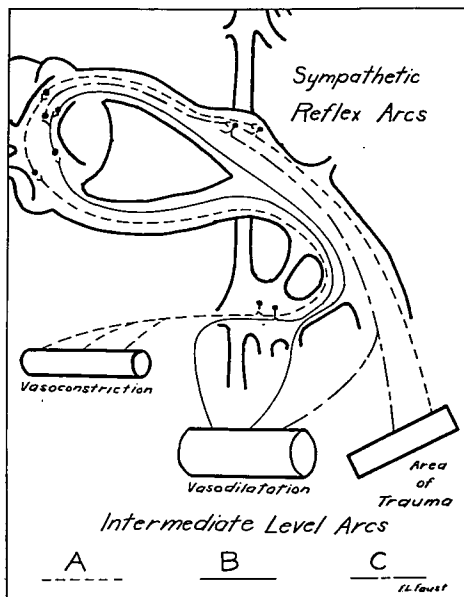


FIG. 1. Sympathetic reflex arcs of the second intermediate level which are interrupted by infiltration of the sympathetic ganglion.

The nature of the afferent impulse is not so well understood. According to Miller and deTakats (3) the stimulus is trauma, consisting of mechanical, chemical and thermal injury, inflammation or vascular occlusion. This trauma applied to skin, nerves, muscles, bones, ligaments or vessels initiates impulses in these structures which are carried centrally in somatic sensory fibers toward the central nervous system. From the point of initiation it may follow three separate and distinct arcs as shown in figure 1 (1). A reflex vasoconstriction may

occur through activation of the efferent sympathetic fibers (A in fig. 1). According to deTakats, contrary to the much emphasized vasoconstriction following trauma or thrombosis, vasodilatation is frequent, and if it persists, it gives rise to posttraumatic edema, osteoporosis and the burning pain of causalgia (2). According to some but denied by others, reflex vasodilatation may occur through a spinal cord reflex (B in fig. 1) (3). Though the nerve impulse may never reach the cord, it may produce reflex vasodilatation, mediated by posterior root efferent dilators (nocifensor nerves). They are the so-called "axon reflexes" (C in fig. 1).

Sympathetic blocks interrupt both the reflex vasoconstriction and vasodilatation through the sympathetic ganglia but do not abolish the axon reflex. They affect only the sympathetic reflex arcs of the second or intermediate level. This is the much more definite and better understood reflex level. According to Harvey (4), there are three reflex levels in the sympathetic nervous system. They are as follows: First, there is the lowest intrinsic level within the plexi about the vessels. This is the less tangible level, and it is doubted whether any neurogenic function is involved at all. Second, as just described, the intermediate level, mediated through the sympathetic ganglia, is that level with which we are primarily concerned. Third, there is the highest level through the central nervous system which is oriented in the diencephalon. According to Harvey, in this level the reflexes are insignificant, and the indications for interrupting the tracts within the cord and brain stem are not yet apparent.

SYMPTOMATOLOGY

In dysfunction of the sympathetic nervous system in relation to the peripheral vascular system there are two symptoms that cause the patient to seek intervention. These are: pain and/or edema associated with a cold, pale and moist extremity. According to Mahorner (5), one of the most controversial of all phases of the sympathetic nervous system is the part it plays in pain, especially deep pain of the vessels, bones and muscles. Some believe that this pain is conveyed by the sympathetic nervous system, while others believe that it is carried over somatic afferents, whose end organs are stimulated by painful metabolic products produced by the irritated sympathetic nervous system. According to Mahorner the pain of peripheral vascular disorders may be of the diffuse, deep, often intense type or in other cases it may simulate the intense, burning pain of the posttraumatic syndrome. The role played by vasospasm and the resulting ischemia is not too clear. Mahorner classified pain of the sympathetic nervous system clinically into five groups. They are: (1) posttraumatic pain; (2) causalgia; (3) Sudeck's atrophy; (4) sympathetalgia, and (5) nontraumatic reflex vasospasm (from inflammation, thrombosis, embolus, etc.)

Ochsner and DeBakey (1, 2) have repeatedly discussed in detail the mechanism by which vasospasm can produce clinical manifestations. The edema associated with vasospasm may be caused by factors that result from vasospasm and increase in the amount of perivascular fluid; increased filtration pressure, anoxia of the capillary endothelium and diminution in flow of lymph. Because of arteriolar spasm and evidence of diminished vascularity, anoxia of the capillary endothelium probably occurs which increases its permeability, permitting excessive exudation of fluid into the perivascular spaces and thus resulting in the production of edema. Once in the perivascular spaces, the lymph has difficulty in getting back because of two factors: first, as occurs in thrombophlebitis, the increase of pressure of the venous side, and second, probably of greater significance is the fact that the pump, which is responsible for the movement of lymph, is lost. It has been shown that the movement of lymph is dependent on arteriolar pulsations. In the presence of marked vasospasm arteriolar pulsations are reduced to a minimum, and the lymphatic pulse is lost. Thus a vicious circle is at work. This circle according to Ochsner, is interrupted by sympathetic block.

The pale, cold, moist extremity is a manifestation of the same sympathetic overactivity occurring in the skin of the same extremity. The color of the skin depends on the caliber of the surface capillaries and of the subpapillary venous plexuses, which are under direct innervation of the sympathetics. If the capillaries are contracted, the skin is pale. The temperature of the skin, like that of any part, depends on the caliber of the arterioles. Cold, pale skin means that both arterioles and capillaries are constricted. The other skin structures supplied by sympathetics, in addition to the arrectores pilorum muscles, are the sweat glands, which, though innervated by the sympathetics, are functionally cholinergic (Wright, 6).

INDICATIONS FOR INTERRUPTION OF THE SYMPATHETICS

Since many conditions are benefited by interruption of sympathetic impulses in the lumbar or cervical regions, and since the procedure is relatively simple, safe, and by no means time consuming, its indications are many (2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13):

1. In diseases of the arterial system.
 - A. Vasospastic functional disturbances.
 1. Raynaud's disease.
 2. Erythromelalgia.
 3. Chilblain.
 4. Scalenus anticus syndrome.
 5. Volkmann's ischemic contracture.

- B.* Vasospastic organic disturbances.
1. Buerger's disease.
 2. Acute arterial catastrophies.
 - a.* Arterial injuries.
 - b.* Embolism.
 - c.* Thrombosis.
 3. Aneurysms.
- C.* Arterial degenerative disease.
1. Arteriosclerosis.
 2. Diabetes with neuritis and trophic ulcers.
2. In diseases of the venous system.
- A.* Acute.
1. Thrombophlebitis in superficial veins.
 2. Femoro-iliac thrombophlebitis.
 3. Phlebitis migrans, associated or unassociated with Buerger's disease.
- B.* Chronic.
1. Chronic thrombophlebitis.
 2. Postphlebotic edema.
3. Posttraumatic dystrophies.
- These apparently are different manifestations of the same syndrome in muscles, bones, and nerves. They include acute atrophy of bone, traumatic edema, peripheral trophoneurosis, posttraumatic osteoporosis with spreading neuralgia, reflex nervous dystrophy, causalgia, sympathetocalgia and according to de-Takats (11) possibly phantom limb pain.
4. Traumatic shock associated with a crushing wound of an extremity.
5. Miscellaneous.
- A.* Inflammatory processes.
1. Infections of the hand and foot.
 2. Bursitis (subaeromial).
 3. Epididymitis.
 4. Fungus infections associated with lymphedema.
- B.* Herpes zoster.
- C.* Joint stiffness.

MATERIAL

Despite the fact that sympathetic nerve block is a simple and relatively harmless procedure, it seems that all too frequently it is used as a last resort. During the past several months, 40 patients have been

referred for conditions which demanded temporary interruption of the sympathetic nervous system. Their diagnoses were as follows:

	No. of Cases
Arteriosclerosis (Cases 1, 11)	2
Diabetes, trophic ulcers and neuritis (Case 3).....	1
Thrombo-angiitis obliterans (Cases 2, 7)	2
Acute thrombophlebitis (Cases 16, 18, 24, 25, 26, 27, 28, 30, 32) ..	9
Chronic thrombophlebitis (Cases 8, 5)	2
Postphlebitic edema (Cases 5, 12, 13, 22)	4
Posttraumatic dystrophies (Cases 10, 19, 20, 21, 29, 31, 33, 36) ..	8
Miscellaneous	
Epididymitis (Cases 4, 17, 34, 35)	4
Chronic fungus infection with lymphedema (Cases 6, 9)....	2
Chronic leg ulcers (cause unknown) (Cases 14, 23, 37)	3
Sympatheticalgia (Cases 38, 39, 40)	3

The results of 225 sympathetic blocks on these 40 patients form the basis for the present communication. The hypothesis which guides us in the selection of cases, in the interpretation of symptoms, and in planning the therapy is as follows: In some cases of peripheral vascular disturbances and injuries there is apparently also an element of abnormal vasoconstriction and/or vasodilatation which is superimposed upon the underlying condition and aggravates the circulatory deficiency. Thirty-seven patients showed improvement after sympathetic blocks, while 3 showed no improvement whatsoever. In the former group, patients with acute thrombophlebitis, epididymitis and chronic leg ulcers showed marked circulatory improvement and dramatic relief of pain after each block. The patients with arteriosclerosis, thrombo-angiitis obliterans and diabetes showed subjective and less objective improvement, which was most marked when the blocks were given more frequently, that is, at the end of the second week. These are the patients who should do well after sympathectomy. In the cases of postphlebitic edema and posttraumatic dystrophies the marked subjective and marked objective improvement after repeated blocks was most encouraging. Two complete failures occurred in chronic fungus infections of the legs. The blocks were not directed at the fungus infection but at the edematous skin which provides a fertile habitat for saprophytes. In both of these cases treatment was discontinued much too early to be decisive. The other failure in Case 19 of posttraumatic dystrophy is similarly criticized.

PROCEDURE

In order to evaluate the efficacy of this form of therapy, an effort has been made to keep the entire procedure as constant as possible. The premedication, preoperative studies, position, technic of block, local anesthetic, and determination of response to sympathetic blocks were in each case identical except for certain minor alterations to fit the particular patient.

TABLE OF CASE SUMMARIES

Case Number and Initials	Age, years	Symptoms	Duration	No. Blocks	Walking Distance		Relief of Pain	Results and Comments
					Before	After		
1 AWD	49	Cramping pain in calf. Cyanosis of foot on dependency. Dorsalis pedis absent on left.	6 mos.	8	3 blocks	6 blocks	Yes partial	Complete absence of night cramps after first block.
2 EN	44	Kinetic claudication, atrophy of rt. calf muscles. Dorsalis pedis absent.	2 mos.	8	2 blocks	6 blocks	Yes partial	Pain now comes on slowly and is less intense.
3 FW	53	Diabetes, neuritis, trophic ulcers both feet, poor pulsation and marked arterial calcification.	5 yrs.	5 R 5 L	3 blocks	5 blocks	Yes partial	Ulcers completely healed, no neuritic pain.
4 DAC	22	Intractable scrotal pain with old gun-shot wound of pelvis. Induration of epididymis. T. 105°.	2 days	3	—	—	Yes complete	Required no sedation after first block. Induration subsided gradually.
5 RR	37	Edema of leg, ankle and foot after phlebitis. Pains in calf in evenings.	6 yrs.	9	—	—	Yes complete	Half inch reduction in dimension of leg.
6 PSP	18	Chronic lymphedema with tropical fungus infection.	8 mos.	4	—	—	—	No changes apparent.
7 BFJ	26	Pallor, sweating, coldness and pitting edema of both feet. Dorsalis pedis absent and decrease in post. tibials.	3 mos.	5 R 5 L	3	4½	Yes partial	Vastly improved circulation and less disability. L. dorsal-pedis palpable.
8 ST	36	Pain, tenderness, induration along great saphenous. Edema of leg. Evening rise in temperature.	6 mos.	5	—	—	Yes complete	Complete relief of symptoms.
9 WHB	27	Chronic eczema with scaling and oozing.	3 yrs.	6	—	—	—	No changes apparent.
10 PS	31	Cold, sweating hand with paraesthesia. Wound involving superficial radial nerve.	6 mos.	4 Cerv.	—	—	Yes partial	Improved circulation. Required exploration of radial nerve.
11 EW	50	Edema of ankle and foot, cold extremity. Skin dry and atrophic. Dorsalis pedis absent.	1 mo.	4	4 blocks	1 mi.	Yes partial	Improved circulation. Leg said to have "exhilarated" feeling.

TABLE OF CASE SUMMARIES—Continued

Case Number and Initials	Age, years	Symptoms	Duration	No. Blocks	Walking Distance		Relief of Pain	Results and Comments
					Before	After		
12 EH	21	Swelling, soreness and cyanosis of foot and ankle on dependency. Old bullet wound of thigh. Only partial weight bearing.	6 mos.	8	$\frac{1}{2}$ blocks	$\frac{1}{2}$ mi.	Yes complete	Complete weight bearing. Only slight discomfort and edema.
13 AW	19	Postphlebotic edema and soreness in calf.	6 mos.	6	—	—	Yes complete	One inch reduction in circumference.
14 SFT	45	Chronic ulceration of leg with pain. All therapy including skin graft unsuccessful.	2 $\frac{1}{2}$ yr.	7	—	—	Yes complete	Ulcer now healed for one month.
15 ECW	18	Night cramps, aching pain on dependency after vein ligation.	3 mos.	5	8 blocks	1 mi.	Yes partial	No night cramps, leg much more comfortable.
16 EN	44	Acute thrombophlebitis.	3 days	8	—	—	Yes complete	Flare-up one week after clinical cure.
17 JLM	18	Swelling, pain and induration of the epididymis. Low grade fever.	5 days	2	—	—	Yes complete	Required no sedation after first block. Induration subsided in 1 week.
18 CF	40	Acute thrombophlebitis of basilic vein with local pain, edema, redness. T. 102°.	2 days	4 Cerv.	—	—	Yes complete	Temperature subsided in 3 days. Arm normal in 10 days.
19 HW	36	Swelling and discoloration of the foot after gun shot wound. Poor post. tibial pulsation.	3 mos.	2	—	—	Yes partial	Pt. refused further treatment. Wanted survey from service.
20 MG	18	Massive edema of penis, scrotum and perineum after hydrocelectomy.	3 days	5	—	—	Yes partial	Marked regression of edema. In 10 days scrotum was $\frac{1}{2}$ × its size at first block.
21 JES	36	Osteoporosis with shiny, burning, swollen ankle following simple fracture of the talus. No weight bearing and little physiotherapy tolerated.	3 mos.	8 to date	—	—	Yes partial	Now has about 90% weight bearing and tolerates physiotherapy. 1 inch decrease in circumference of foot.
22 EJS	52	Postphlebotic edema, night cramps and kinetic claudication.	6 yrs.	2	3 blocks	9 blocks	Yes partial	$\frac{1}{2}$ inch decrease in circumference of leg. Treatment to be continued elsewhere.

TABLE OF CASE SUMMARIES—Continued

Case Number and Initials	Age, years	Symptoms	Duration	No. Blocks	Walking Distance		Relief of Pain	Results and Comments
					Before	After		
23 CTP	23	Stasis dermatitis with ulceration 4 × 8 cm. at site of bullet wound. Local therapy did not prevent extension.	8 mos.	8	—	—	Yes complete	Ulcer competely healed. New skin area approximates normal.
24 CJV	38	Calf pain and large ecchymotic area on leg. T. 99° for 5 days. Chronic edema of leg for 2 years.	5 days	3	—	—	Yes complete	Discoloration disappeared completely. Decrease of $\frac{1}{4}$ to $\frac{1}{2}$ inch in circumference of leg.
25 SHR	21	Acute thrombophlebitis. 12 days p.o. T. 104°.	1 day	4	—	—	Yes complete	Temperature normal. No tenderness or edema.
26 JWO	28	Pain in entire thigh and leg. Tenderness along great saphenous vein. T. 101°.	2 days	10	—	—	Yes complete	Temperature gradually returned to normal. Only slight tenderness after 2nd injection. Flare-up on 3rd day required further treatment.
27 L.I.C.	22	Markedly emaciated bedridden, post-pneumonic empyema patient who developed successive areas of phlebitis in (1) r. leg (2) l. leg (3) r. basilic vein.	5 days (1)	5	—	—	Yes complete	Temperature, edema, tenderness along r. gt. saphenous reduced to normal in 7 days.
			$\frac{1}{2}$ day (2)	3	—	—	Yes complete	This process followed the above in 14 days. Checked in 4 days.
			$\frac{1}{2}$ day (3)	3 Cerv.	—	—	Yes complete	This process followed the above in 3 days. Checked in 3 days.
28 CR	36	Marked edema of leg with large ecchymosis, marked tenderness over femoral vein. T. 102°.	5 days	4	—	—	Yes complete	Process subsided completely in 9 days.
29 TFH	9	Stiffness, edema, burning pain in leg following shrapnel wound to thigh. Evidence of poor circulation.	7 mos.	9	—	—	Yes partial	Stiffness, edema decreased ($1\frac{1}{2}$ inch reduction in circumference). Venous filling time reduced from 59 sec. to 18 sec.
30 TJF	19	Acute thrombophlebitis 1 month p.o.	7 days	4	—	—	Yes complete	Complete relief in 8 days.

TABLE OF CASE SUMMARIES—Continued

Case Number and Initials	Age, years	Symptoms	Duration	No. Blocks	Walking Distance		Relief of Pain	Results and Comments
					Before	After		
31 CD	20	Osteoporosis and pain on use of wrist after fracture of radius and ulna.	6 mos.	5 Cerv.	—	—	Yes complete	Osteoporosis decreased gradually and pain disappeared completely.
32 PJE	30	Acute thrombophlebitis of basilic v.	6 days	6 Cerv.	—	—	Yes complete	One inch reduction in circumferences of arm after 2 blocks.
33 AHL	19	Extensive trauma to leg and thigh with protean pain and marked deficiency of circulation.	7 mos.	7	0	1 block	Yes partial	Leg more comfortable. Much improvement in circulation esp. on dependency.
34 OTL	24	Chronic epididymitis not responding to usual measures.	2 wks.	4	—	—	Yes complete	
35 JA	27	Chronic epididymitis.	5 wks.	4	—	—	Yes complete	No pain after first block.
36 HFS	34	Pain in foot following removal of metatarsal head. X-ray shows moderate osteoporosis.	6 mos.	7	0	2 blocks	Yes partial	Less osteoporosis more comfortable.
37 WGS	34	Large ulcer 6 × 4 cm. on leg. All previous therapy unsuccessful.	9 mos.	5	—	—	—	Area now covered by thin red new skin.
38 SAT	31	Pain in distal radio-ular joint for which no reason can be found.	3 mos.	4 Cerv.	—	—	Yes complete	No pain on prolonged use of wrist for one week.
39 CVB	35	Had cyst of scapula curetted. Pain out of proportion to the pathology.	2 mos.	1 Cerv.	—	—	Yes complete	
40 WS	30	Unexplainable pain in shoulder after plane crash.	6 mos.	1 Cerv.	—	—	Yes complete	

Nembutal, 1½ grains, one hour preoperatively, was used as premedication to allay excitement and, even more important, to protect the patient against toxicity from the cocaine derivative. In 225 blocks minor sensitivities were observed in 2 per cent of the cases. These consisted of mild bradycardia, slight pallor, and fall in systolic blood pressure of 15 to 20 mm. of mercury. It was thought that pallor, dyspnea, apprehension, and tremor due to epinephrine did not occur because only

5 minims per 100 cc. of anesthetic solution was used in all cases. According to Lundy (14) the two quite similar reactions to the derivatives of cocaine and to epinephrine are distinguished by the fact that the pulse associated with the epinephrine reaction remains for a time after the injection and the blood pressure level is usually normal or elevated.

In lumbar sympathetic blocks the position of the patient is thought to be of great importance. When possible, as it is in a great percentage of the cases, the patient is placed in the prone position with the pelvic intercrystal line over the break of the operating table. The table is broken approximately 40 degrees in such a fashion as to keep the trunk horizontal. This position is preferred for it not only obliterates the lumbar lordosis and makes the landmarks prominent but also keeps the vertebral column in better alignment. What is even more important, it maintains the patient in better position without the services of an attendant should the former move during the introduction of the needles. Certain structures were found to be painful to the patient when impinged upon by needles. These are: the subcutaneous tissue, the posterior tendinous portion of the sacrospinalis muscle, the periosteum of the transverse process and body of the lumbar vertebrae, and the psoas major muscle which contains the lumbar plexus of somatic nerves. The first two can easily be taken care of by a little additional infiltration, and the last three by gentleness in the manipulation of the needles. Great concern is always present over the final resting place of the point of the needle. Frequent aspirations are mandatory at the beginning and during the injection to make certain that the point of the needle does not lie in either a blood vessel or the subarachnoid space.

The technic of lumbar sympathetic block employed in all cases was that of Ochsner and DeBaKey with certain modifications which have been found helpful. Four skin wheals are raised two and one half fingerbreadths lateral to the first, second, third, and fourth lumbar interspinous ligaments. After infiltration of the subcutaneous tissue and posterior muscle layer, a 4 inch number 22 block needle is introduced through the lowest wheal vertically until it strikes the transverse process. Two and one half fingerbreadths are measured on the shaft of the needle from the skin. The needle is then withdrawn to the skin and directed upward to pass over the transverse process and medially towards the anterolateral aspect of the body of the vertebrae to the depth previously determined on the shaft of the needle. When the four needles are properly placed, they should be in a straight line with the most cephalad needle several millimeters closer to the midline and half to one fingerbreadth more superficial than the most caudad.

In the case of cervical sympathetic block the technic described by Ochsner was found to be the most successful. It is simple and consists of raising a skin wheal one fingerbreadth above the clavicle at a point 1 cm. medial to the midpoint of the clavicle. A 3 inch number 22 needle

is then introduced, slowly at right angles to the long axis of the body at an angle of 45 degrees to the midline until the tip strikes bone.

Metycaine in 1 per cent solution of distilled water to which had been added epinephrine was the anesthetic solution in all cases. Metycaine was used not only because its action is a little more prolonged but also because it has been our experience that many patients with a history of procaine sensitivity confirmed by skin test when checked against metycaine show no hypersensitivity to this agent. Repeated sympathetic blocks with metycaine are not offered as a substitute for sympathectomy. It is hoped that the prolonged relief from vasoconstriction or vasodilatation, whichever the case may be, will accomplish the same end. If this end is not maintained after blocks are stopped, then, at

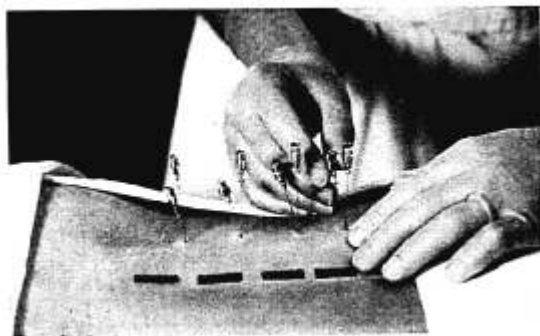


FIG. 2. Composite picture of the various steps in the lumbar sympathetic block. The tips of the spinous processes of the first, second, third, fourth, and fifth lumbar vertebrae are outlined in black from right to left, respectively. The relation of the skin wheals to the interspinous spaces is shown. The four vertically placed needles in contact with the second, third, fourth, and fifth transverse processes. The diagonally placed needles from right to left lie as follows: (1) just cephalad to the transverse process of the second vertebra in the direction of the first lumbar sympathetic ganglion; (2) in contact with the periosteum on the lateral aspect of the body of the second lumbar vertebra; (3 and 4) in the vicinity of the third and fourth lumbar sympathetic ganglia.

least, it has demonstrated by therapeutic test what results may be expected if the sympathetic ganglia are surgically extirpated. White and Smithwick have stated that if a favorable response is obtained with sympathetic block, treatment by repeated injections should be given a thorough trial. Prolonged sympathetic block produced either by the addition of 10 per cent glucose to the anesthetic solution or with alcohol has not been attempted.

The danger of alcoholic neuritis precludes its use in the cervicodorsal region. In the lumbar region, according to Ochsner (2), neuritis occurs in 15 per cent of the cases of alcohol blocks. Neuritis of the

genitofemoral nerve, because of its proximity to the lumbar sympathetic chain, is frequent and undesirable. Although alcohol blocks may produce a prolonged interruption of sympathetic impulses through their ganglia, the effects according to Mahorner (5) are less marked than immediately following procaine block. If complete and more permanent interruption of sympathetic impulses is desired beyond that obtained by repeated metycaine block, operation is indicated. White, quoted by Saland (15), stated that the effects of alcohol block rarely last longer than six months and the neuritis in none of the cases lasted longer than forty-five days. The tentative routine for repeated blocks is as follows: three times a week for two weeks, twice a week during the third week, then once a week until the desired results are obtained.



FIG. 3. Technic of stellate ganglion block. The acromial end, midpoint, and sternal end of the clavicle are shown in black. The wheal is shown 1 cm. medial and in one fingerbreadth above the midpoint of the clavicle. The needle lies horizontally and makes an angle of 45 degrees with the transverse process of the seventh cervical vertebra or neck of the first rib on which lies the stellate ganglion. This ganglion is formed by a fusion of the inferior cervical, first, and sometimes the second thoracic sympathetic ganglia.

DETERMINATION OF RESULTS

Successful interruption of the sympathetic impulses to the extremities in the cervical region should result in Horner's syndrome (miosis, ptosis, enophthalmos, and conjunctival congestion); in the lumbar region, it should result in absence of sweating in the lower extremity. The response may appear rapidly in several minutes, or more slowly in thirty minutes. While oscillometric, plethysmographic tracings and calorimetric readings on the involved extremity are desirable, they are frequently not obtainable. According to deTakats (15), sufficient information may be gathered by mere palpation of the extremity in

question. The observer can tell whether or not the extremity has warmed up sufficiently. As long as sweating is present in areas under observation, the sympathetic paralysis is incomplete.

After ascertaining whether or not the sympathetic paralysis is complete or partial by palpation alone, the venous filling time seems a simple excellent way of estimating the rate of flow in an extremity. The method, as described by deTakats (16), consists in elevating the extremity until the dorsal veins collapse. With a blood pressure cuff around the thigh or upper arm, a pressure of 60 mm. of mercury is produced and the limb placed in horizontal position. When the dorsal veins become prominent or show slight pulsations, the veins are considered filled. From the normal of five to ten seconds, some extremities may show a filling time as slow as a hundred and twenty to one hundred and eighty seconds. Our longest was a hundred and five seconds in Case 1. Whether or not sympathetic nerve blocks produce the desired results are determined in a number of different ways. In cases of kinetic claudication, night cramps and pain associated with post-traumatic dystrophies, the walking distance is determined before and immediately after the lumbar sympathetic block. An increase in walking distance, increased warmth, decreased sweating, and increased arterial pulsations are taken as evidence of increased blood flow. In the sympatheticalgias the prompt subsidence of pain following block is of diagnostic importance. In postphlebitic and posttraumatic edema the extremity is measured at various levels before and repeated after the sympathetic block when the patient has walked eight blocks. In a successful block the extremity invariably decreases in size.

SUMMARY

The value and limitation of repeated sympathetic blocks in the immediate postwar era are emphasized. The rationale of this form of therapy, its indications, and 40 cases of World War II veterans have been presented. The technics of lumbar and cervical blocks which in our hands have given the best response are reemphasized.

REFERENCES

1. Ochsner, A., and DeBakey, M.: Therapeutic Considerations of Thrombophlebitis and Phlebotrombosis, *New England J. Med.* **225**: 207-227 (Aug. 7) 1941.
2. Ochsner, A.: Indications and Technic for Interruption of Impulses Traversing Lumbar Sympathetic Ganglia, *S. Clin. North America* **23**: 1318-1334 (Oct.) 1943.
3. Miller, D. S., and deTakats, G.: Posttraumatic Dystrophy of the Extremities, *Surg., Gynec. & Obst.* **75**: 558-582 (Nov.) 1942.
4. Harvey, S. G.: Peripheral Vascular Disease and Its Treatment by Interruption of Sympathetics, *J. Maine M. A.* **34**: 169, 1934.
5. Mahorner, H.: Control of Pain in Posttraumatic and Other Vascular Disturbances; The Role of the Sympathetic Nervous System in the Treatment of Peripheral Vascular Diseases, *Ann. Surg.* **119**: 432-444 (Mar.) 1944.
6. Wright, S.: *Applied Physiology*, ed. 6, New York, Oxford University Press, 1936, pp. 406-411.

7. Griffiths, D. L.: Volkmann's Ischaemic Contracture, *Brit. J. Surg.* **28**: 239-260, 1940.
8. Nicholson, M. J.: Treatment of Thrombophlebitis by Paravertebral Sympathetic Block, *S. Clin. North America* **24**: 538-550 (June) 1944.
9. DeBakey, M.: Traumatic Vasospasm, *Bull. U. S. Army M. Dept. No. 73*: 23-28 (Feb.) 1944.
10. Homans, J.: Minor Causalgia: A Hypersthetic Neurovascular Syndrome, *New England J. Med.* **222**: 870, 1940.
11. deTakats, Geza: Causalgic States in Peace and War, *J. A. M. A.* **128**: 699-704 (July 7) 1945.
12. Engle, D.: Sympathetic Block: Proposed Therapy in Traumatic Shock, *Brit. M. J.* **2**: 434-435 (Sept. 30) 1944.
13. Mahorner, H.: Personal communications with the author.
14. Lundy, J. S.: *Clinical Anesthesia*, Philadelphia, W. B. Saunders Co., 1942, pp. 28-30.
15. Saland, G. and Klein, C.: The Evaluation of Alcohol Lumbar Paravertebral Block in Peripheral Vascular Disease, *Am. J. M. Sc.* **207**: 749-753 (June) 1944.
16. deTakats, G.: Value of Sympathectomy in Treatment of Buerger's Disease, *Surg. Gynec. & Obst.* **79**: 359-367 (Oct.) 1944.

ANNUAL MEETING OF THE OHIO SOCIETY
OF ANESTHETISTS

in conjunction with the Ohio State Medical Association

DESHLER-WALLICK HOTEL, COLUMBUS, OHIO

Wednesday, May 8, 1946

- 9:00 A.M.: War Advances Anesthesia. K. C. McCarthy, M.D., Toledo, Ohio.
- 9:30 A.M.: Cyclopropane Anesthesia—An Evaluation of Ten Years' Experience. A. A. Brindley, M. D., Toledo, Ohio.
- 10:15 A.M.: Practical Concepts in Anesthesia. Edward B. Tuohy, M.D., Rochester, Minn.
- 11:00 A.M.: Spinal Anesthesia—Panel Discussion. R. J. Whitacre, M.D., Cleveland, Ohio, Moderator; E. B. Tuohy, M.D., Rochester, Minn.; K. C. McCarthy, M.D., Toledo, Ohio; N. E. Lenahan, M.D., Columbus, Ohio; J. K. Potter, M.D., Cleveland, Ohio; B. B. Sankey, M.D., Cleveland, Ohio.
- 12:00 N.: Business Meeting and Election of Officers.