1952

Cervical sympathetic block in the treatment of cerebrovascular occlusion

Joseph Raymond Volk
University of Nebraska Medical Center

CERVICAL SYMPATHETIC BLOCK
IN THE TREATMENT OF CEREBROVASCULAR OCCLUSION

Joseph Raymond Volk, Jr.

Submitted in Partial Fulfillment for the Degree of

Doctor of Medicine

College of Medicine, University of Nebraska

December 15, 1951

Omaha, Nebraska

Introduction

Vascular lesions affecting the central nervous system have a mortality rate of 1/1000, thus causing approximately 150,000 deaths annually. The frequency of cerebral vascular accidents has been variously estimated at 500,000 per year. The difference between the frequency and the mortality is great, and it is in this difference that we find the residual of apoplexy, the hemiplegia, the asphasia and the hemianopsia. Less often referred to, but none the less prominent, is the emotional trauma incurred.

The cervical sympathetic block is the first therapy, not strictly symptomatic, to be offered in the treatment of cerebral vascular accidents. The procedure, itself, is not new to medicine but large scale re-evaluation is recent. When the results of these clinical re-evaluations were published in the various professional journals, they served as ammunition for a series of sensational articles in lay publications. These articles would have us believe that the results are miraculous; that we have a simple treatment that offers spectacular results in the majority of cases. (6-7-9)

It is the object of this paper to present the

findings of recent investigators regarding the possible mechanism, the technique and the value of the cervical sympathetic block in cerebral vascular occlusion.

Mechanism of the Cervical Sympathetic Block

It is generally accepted, that there is an acceleration of spontaneous recovery following cerebrovascular occlusion, if a cervical sympathetic block is accomplished early. Exactly how this accelerated restitution is effected, by the block, is a matter of no little controversy. It is unfortunate that this procedure has not received the clinical attention it deserves because of theoretical differences as to the mechanism.

In contrast to findings of physiologists and laboratory experimentalists, clinicians have postulated, for many years, the occurence of fleeting and reversible vascular phenomena, which were difficult to explain on a vasomotor basis. (12) This cerebral 'vasospasm', could logically initiate or contribute to such neurological disorders as hemiplegia, aphasia and hemianopsia. With this in mind, Leriche and Fontaine first proposed the interruption of intracranial vascular sympathetics by means of a stellate ganglion block. Their dramatic success in two cases of postoperative hemiplegia, gave substance to the theory. As they explained it, "The vascular lesion, be it hemorrhage or softening, acts as an irritant on surrounding vessels and produces a 'halo' of irritative spasm. If this be

true, vasospasm by rendering anoxemic an area of cerebral tissue around the lesion, may play an important part in the initial symptoms, and if persistent, contribute to the ultimate neuronic degereration."

In attempting to substantiate 'vasospasm', Villaret and Cachera (23) photographed vasoconstriction of cortical vessels after experimental embolism. This vasoconstruction could be abolished by blocking the cervical sympathetics. Wolpitto and Risteen (24) observed, through burr holes, dilitation of pial vessels following a stellate ganglion block. Previously, it had been shown that there was an increase in size of the ipsilateral intracerebral capillary bed in sympathetic paralysis, resulting from cervical sympathectomies. (22)

Conversely, it is believed by many that while there are certainly vasomotor nerves present, their activity is minimal. (10-11) Cerebral circulation is remarkably stable, and the neurovascular mechanism is so weak that it is not likely to participate in any process giving permanent damage to nervous tissue. (10) Others suggest that the observations of the cortical vessels are of no value in determining the possible reaction of cerebral vessels to the same stimuli.

It seemed likely that studies of cerebral blood flow would enable investigators to settle the question.

Kety (14) devised the nitrous oxide method of measuring cerebral blood flow, based on the rate of loss of an inert gas from the blood passing through the brain. He found no evidence for normal tonic constrictor effect from cervical sympathetics, in man; in whom bilateral stellate ganglion block produced no change in cerebral blood flow. This of course, does not exclude the possibility of reflex cerebrovascular spasm, in response to embolism or thrombosis, mediated through the sympathetics.

Using Kety's technique, Scheinberg (19) came to the conclusion that there may actually be a decrease in blood supply to the cerebrum following a stellate ganglion block. In explanation, he offers the possibility that the blood is directed to the skin and subcutaneous tissues.

Naffziger and Adams (18) suggest that the change in cerebral blood flow is too slight to be discernible by Kety's technique or that there is possible redistribution of blood flow through smaller vessels without change in total blood flow. They, further, recorded consistently a rise in cerebrospinal fluid pressure following stellate blocks, suggesting a transient rise in total cerebral blood flow.

In the face of accumulating evidence both for and against vasospasm, and the seeming impossibility of

proving or disproving it conclusively, a more acceptable concept was evolved. That is, in apoplexy the basic patho-physiological defect is due to vasospasm and/or circulatory insufficiency associated with disorders of the cardiovascular mechanism (3, 13, 27) It was found in a series of 542 cases of cerebrovascular accidents, that 83% showed cardio-circulatory inefficiency. (27) Indicating, that systemic circulatory inadequacy plays an important part in the causation of apoplexy. It is suggested that some effects of the cervical sympathetic block may be due to improvement of systemic circulatory efficiency. Improvement has been noted in paroxysmal tachycardia and in fibrillation following stellate ganglion blocks. These findings seem logical in view of the origin of the cardiac sympathetics from the middle and inferior cervical ganglia.

At the present, vasospasm, which is a very attractive theory, has not been substantiated or disproved, and the liklihood of its being so, in the near future is remote. Of more importance now are the good clinical results of the cervical sympathetic block. From the standpoint of future therapy, investigation would seem to be more fruitful if it were directed toward the role of cardiocirculatory insufficiency in apoplexy. Since control of cerebral circulation is largely extra-

cerebral, it logically follows that the blow unbalancing this steady mechanism is extracerebral. (3)

Differential Diagnosis of Cerebrovascular Accidents

In the past, the differential diagnosis of cerebral vascular accidents was largely of academic value only. The symptomatic treatment was much the same in hemorrhage, thrombosis and embolism. More recently, with the relative increase in number of cerebrovascular accidents, there has been increased investigation of treatment. Therapy must necessarily differ in hemorrhage and occlusion and even in thrombosis and embolism. The cervical sympathetic block, which has been heralded as the first treatment not strictly symptomatic, (13) impresses one with the necessity of an early differential between these conditions.

It is held by some that the cervical sympathetic block, while it is of no value in hemorrhage, doesn't aggravate the situation. (24) They do recommend, though, that therapy be withheld in these cases, on theoretical grounds. The majority of recent investigators agree that the block has no place in early hemorrhage and has its greatest value in early embolism

and thrombosis. Amyes and Perry were particularly impressed, in their series, in finding that 9 out of 10 improved when blocked within 6 hours of onset of symptoms. (1)

Aring and Merrit made a clinical and pathological study of 245 cases of cerebral vascular accidents in an attempt to establish a differential diagnosis. It is their conclusion that this can be accomplished in one hundred percent of cases, in life. (2) The criteria that they established have been largely unchallenged and recent investigators of therapy in cerebral vascular accidents almost unanimously refer to this differential.

A review of their findings is as follows:

1. The average age of the patients with cerebral hemorrhage was found to be slightly lower than that of patients with cerebral thrombosis. Cerebral vascular accidents were rare below the age of 40, but cerebral hemorrhage occurred more frequently between the ages of 40 and 50 than did thrombosis.

2. The symptoms occurring at the onset of the lesion were of considerable aid in the differential diagnosis. Sudden severe headache and vomiting or convulsions at the onset was strongly in favor of a diagnosis of cerebral hemorrhage. The onset with immediate

unconsciousness was more frequent in cases of cerebral hemorrhage (51 percent) than in cases of cerebral thrombosis (32 percent). Signs of progression of the cerebral vascular lesion after the onset were more frequent in the cases of cerebral hemorrhage.

3. Abnormalities in the depth, rate, rhythm and sound of the respirations were more frequent in cases of cerebral hemorrhage.

4. The blood pressure ranged higher in the cases of cerebral hemorrhage than in cases of cerebral thrombosis.

5. Fundoscopic evidence of arteriosclerosis was more common in cases of cerebral thrombosis than in the cases of cerebral hemorrhage.

6. Abnormalities in the eyes were more frequent in the cases of cerebral hemorrhage.

7. Stiffness of the neck was usually indicative of a cerebral hemorrhage. It was present in 55 percent of the cases of cerebral hemorrhage and in only 7 percent of the cases of cerebral thrombosis.

8. A bilateral Babinski sign was more common in the cases of cerebral hemorrhage.

9. Leukocytosis was more common in the cases of cerebral hemorrhage.

10. Elevation of the cerebrospinal fluid pressure

and a bloody spinal fluid was more common in the cases of cerebral hemorrhage. A grossly bloody fluid was found in 74 percent of the cases of cerebral hemorrhage and rarely, if ever, found in the cases of cerebral thrombosis.

11. The period of survival was usually shorter in cases of cerebral hemorrhage than in those of cerebral thrombosis. In 50 percent of the cases of cerebral hemorrhage the patient died within four days of the onset as contrasted with 28 percent of the cases of cerebral thrombosis which died within this period.

The diagnosis of cerebral embolism is based largely on the finding of the etiological cardiovascular lesion. In some series ninety percent have cardiac enlargement and an equally great number, auricular fibrilation. Cerebral embolism is found in a much younger age group than thrombosis or hemorrhage due to Rheumatic Heart Disease. Its greatest incidence, though, is in the sixty to seventy year age group because of myocardial infarcts and sclerotic plaques. On the whole, its diagnosis is considered easy. (2) Cerebral thrombosis, on the other hand, is considered largely a diagnosis of exclusion. A diagnosis to be arrived at after the elimination of hemorrhage and embolism. (12)

It is very difficult to determine the relative

frequency of cerebrovascular lesions. Autopsy statistics are largely invalid because of the difference in mortality rate; whereas, figures based on clinical diagnosis are unreliable due to difficulty in establishing the diagnosis. (17)

	245 cases diagnosed on autopsy:	604 cases diagnosed clinically:
Cerebral hemorrhage	47%	21%
Cerebral thrombosis	43%	66%
Cerebral embolism	10%	5%
Subarachnoid hemorrhage		8%
	100%	100%

Blocking the Cervical Sympathetics

The cervical portion of the sympathetic trunk consists of three ganglia, distinguished according to their positions, as the superior, middle, and inferior ganglia, connected by intervening cords. Its spinal fibers are derived from upper thoracic nerves. The inferior cervical ganglion is situated between the base of the transverse process of the last cervical vertebra and the neck of the first rib. In approximately fifty percent of the people, it is fused with the first thoracic ganglion to form the cervico-thoracic or

stellate ganglion. It is at the level of the stellate ganglion and the cervical sympathetic trunk immediately above it, that sympathetic blocks are directed.

A successful block is evidenced by the appearance of Horners Symdrome. This consists of miosis, enophtalmos, partial ptosis and the cutaneous manifestations of vasodilitation and anhydrosis; all ipsilateral to the block, and immediately following it.

Possible complications of the procedure include: pheumothorax, intra-vascular and intraspinal injections. The procedure, on the whole, seems rather formidable but the incidence of complications is extremely low. Many techniques and approaches have been devised to circumvent complications and to adapt the procedure to routine use. Volpitto and Risteen advocate the antero-lateral approach and in 1944 published their technique which they had used 500 times. (25) The only complications encountered were 2 cases of pneumothorax which recovered spontaneously. The anterior approach was used by Naffziger and Adams in 700 blocks without any complications. (18) These techniques are highly successful but are more likely to be used by the expert. The posterior approach is considered less dangerous and has more advocates. (20) A modification of the posterior approach, as suggested by Gilbert and

de Takats, is actually a cervical sympathetic block rather than a stellate. It is probably the best procedure in the hands of the less experienced and occasional operator. (12)

The cervical sympathetic block, advocated by Gilbert and de Takats, is as follows:

"The patients neck is hyper-extended by a small pillow placed under the shoulder blade of the side of the injection. The head is turned away from the side of injection. With an iodine applicator, draw a line from the mastoid process to the clavicle, through the tips of the palpable transverse processes. Place skin wheal over tip of seventh transverse process. Using a 4 inch, 22 gauge needle, pierce the wheal and make contact with the transverse process. Slide along the superior border of the transverse process until the needle strikes the body of the sixth cervical vertebra. Aspirate for air, blood and spinal fluid, and if none is observed, inject 10cc. of 1% procaine."

A further modification, consists of giving a 2cc. test dose after aspiration, to further safegaurd against an intra-thecal injection, which would most likely be fatal at this level. (20) Irritation of the stellate ganglion from the needle has on occasion given symptoms of coronary spasm and in these cases immediate injection

is necessary. On the whole, "the cervical sympathetic block (not the stellate ganglion block which is hazardous in the hands of the average physician) is an easy procedure."-Editor J.A.M.A. (7)

The block is logically performed contralateral to the paralysis but on occasion the response is as good, or better, if done on the ipsilateral side. (15-18) Repeated injections are used, if necessary, and are usually accomplished at daily intervals; however, the procedure has been done as often as 2-3 times a day with good results. (18) Since the response is greatest with the first successful block and diminished with successive ones (12-18), attempts have been made to prolong the effect. Longer acting anesthetics have had some success, and alcohol and phenol solutions have been experimented with. Nafzigger and Adams (18) have, on occasion, introduced a catheter of polyethylene tubing and left it in place for subsequent injections.

Survey of Clinical Cases

There is almost complete lack of uniformity in reporting the effect of cervical sympathetic blocks in cerebral vascular occlusion. This makes the procedure

very difficult to evaluate. There are, however, two criteria that are generally accepted and basic in determining the success of this therapy. (1) To be considered effective, a cervical sympathetic block must produce a Horners Symdrome. (2) Improvement must manifest itself within one-half to one hour to be considered attributable to the block. This is essential, since in most cases there is neurological recovery of some degree following the stroke. This recovery is greatest in the first weeks but is not considered maximal until six months have elapsed. (17)

In this review of the literature, no clinical series could be found that showed a harmful effect or no effect, of this procedure in cerebral vascular occlusion. This leaves only the positive phase, how often improvement follows and its degree. It has been shown in some series that there is decreasing effectiveness of the procedure in proportion to the time elapsing between the 'accident' and the therapy. This aspect is neglected by most investigators and if they differentiate at all, with respect to time it is only to refer to it, as 'recent' or 'late'. The greatest difficulty is in the degree of improvement. Reports of 'no clinical change', 'no response', and 'poor response' are immediately evident as being synonymous. Other reports such as

'fair', 'good', 'improved', and 'effective' leave the degree in great measure to the readers interpretation.

The following are exerpts, in chronological order, of statistical presentations with observations and conclusions of the clinical groups evaluating this procedure.

1936 Leriche, R. and Fontaine, R. (15) France.

"Two cases of postoperative hemiplegia treated with a stellate ganglion block with remarkable results."

1938 Mackey, W. A. and Scott, L. W. D. (16) England.

Stellate ganglion block used on 19 patients with cerebral vascular accidents:

9 Clinical improvement in minutes.
5 Block did not produce Horners Symdrome--So not effective?
5 No improvement. Of these, 2 had cerebral hemorrhage and died, 2 had blocks 5-7 days after onset and in 1, no improvement.

It was thought that the results do not justify the adoption of the procedure for routine use. However, further study would be necessary before rejection of the procedure as of negligible value.

Conclusions:

1. Use of the procedure in cerebral hemorrhage and in older patients will put the method in disrepute.
2. Ideal case is embolism in the young.
3. Treatment should be as soon as possible after the onset.
4. The degree of improvement in thrombosis probably depends on the degree of arteriosclerosis.

1943 Volpitto, P. P. and Risteen, W. A. (24) Augusta, Georgia.

Twelve patients with cerebrovascular accidents received stellate ganglion blocks:

4 Possible cerebral hemorrhage. No improvement on aggravation of symptoms.
* 7 Cerebral thrombosis.
* 1 Cerebral vasospasm.

12

* 6 showed marked improvement within 5-15 minutes and continued well. 2 improved 8-12 hours following stellate ganglion block.

1946 Volpitto, P. P. and Risteen, W. A. (26) Augusta, Georgia.

Stellate ganglion block performed on 56 cases of cerebral hemorrhage of long standing, on week up to six years.

There was some improvement in each case. There is relaxation of spasticity following the block and these people are more comfortable.

Observations:

In embolism it is best to wait 24 hours because relaxation could allow the embolus to move on to a more terminal type of circulation where there could be no possible aid from collateral circulation.

The block can be performed at any time in the thrombus group. With advancing signs, the response has been immediate and often complete; while, with older lesions, the response is less abrupt and may require repeated injections. Improvement has varied from 30-90% in this group.

When cerebral hemorrhage is suspected, block therapy is best delayed 3-5 days on theoretical grounds. Fresh hemorrhages have been blocked without apparent change in condition.

1948 Gilbert, N. C. and de Takats, Geza. (12-13) Chicago, Illinois.

25 cases of cerebrovascular accidents treated with stellate ganglion block:

Good Response in 19 of the 25 Cases

	Cases	Good Response	Poor Results
Cerebral Hemorrhage	3	1	Death in 3
Cerebral Thrombosis	12	8	No improvement in 1 Death in 3
Cerebral Embolism	10	10	Death in 1
	25	19	Death in 7 No improvement in 1

Observations:

Of significance is the conversion of flaccid paralysis to spastic, since it offers proof that in the human brain affected by occlusion of a blood vessel, the cerebral shock can be shortened to give way to a focal upper neuron lesion. Any method of reducing edema due to stasis or imppoving the blood flow in the brain not effected, would bring quicker recovery and lessen the permanent damage.

1948 Butt, T. C. and Mathers, Fred (5) Orlando, Florida.

Six case presentations illustrating old and recent cerebrovascular accidents with single, multiple and bilateral stellate ganglion blocks.

Conclusions:

Recommend immediate and repeated stellate ganglion blocks in recent occlusions. It shortens the recovery and gives maximum return of motor function.

In old hemoplegia, or thrombosis or hemorrhage there is some functional improvement and relief of pain.

If results not sustained, block the contralateral ganglion.

1948 Blain, Alexander. (4) 1948. Detroit, Michigan.

Repeated stellate ganglion blocks in cases of long standing with no improvement in one-half.

1950 Aymes, E. W. and Perry, S. M. (1) Los Angeles, California.

Forty-four patients with acute cerebral embolism or thrombosis treated with multiple stellate ganglion blocks:

Improvement in 28.

Results with reference to time elapsing between onset of symptoms and administration of block.

Hours	Patients Improved	Patients Unimproved
0-6	9	1
7-12	5	6
13-24	5	5
25--	9	4
	28	16

Observations:

Nine out of ten improved with stellate ganglion blocks in the first 6 hours. Improvement varied from 1/3 to 2/3 toward normal.

Impression that the milder the symptoms the greater the relative improvement.

Conversely to findings of others at no time did flaccid paralysis convert to spastic.

Conclusions:

Stellate block, a relatively innocuous procedure, is yet the most effective treatment of acute cerebral embolism and thrombosis.

The benefit to the patients was outstanding in a few instances and the good results in the group as a whole, far outweigh the trouble or risk involved.

1950 Naffziger, H. C. and Adams, J. E. (18) San Francisco, California.

Stellate ganglion blocks performed on 225 patients of which 155 had acute cerebrovascular accidents:

	No. of Cases	Results Good	Fair	Poor
Cerebrovascular thrombosis				
proved by angiography	12	6	3	3
diagnosed clinically	102	57	27	18
Cerebral embolism	28	15	7	6
Cerebrovascular spasm				
following angiography	4	4	--	--
with encephalopathy	9	9	--	--
	155	91	37	27

Observations:

There is much variation in degree and character of response following the stellate ganglion block, but several features are constant.

If a favorable response occurs, it manifests itself in 5-10 minutes.

Maximum effect follows the 1st block with diminished effect in subsequent ones.

Frequently a better response is obtained when the contralateral ganglion is blocked, rather than the ipsilateral.

Because of the excellent results with acute lesions the procedures has been extended to patients with neurological defects remaining as a result of prior cerebrovascular accidents. We have been surprised to find improvement occurring as late as 6 years after the initial vascular insult.

1950 Searles, P. W. and Nowill, W. K., (20) Buffalo, New York.

Fifty-five patients with cerebrovascular accidents receiving stellate ganglion blocks as compared to a control group of 158 patients:

		Results in Percent			
	Cases	Good	Fair	Poor	Mortality
Embolism	10	0	30	70	60
*	8	25	12	62	50
Hemorrhage	28	4	0	96	75
	4	0	0	100	25
Thrombosis (recent)	89	9	10	81	58
*	36	29	16	58	35
Thrombosis (old)	31	0	9	91	32
*	7	0	43	57	0

*Receiving stellate ganglion block.

Conclusion:
Stellate ganglion block of value in acute thrombosis and embolism and in chronic states of cerebral thrombosis.

1951 Sussman, Irvin (21) Jersey City, New Jersey.

Forty-two patients with thrombosis or embolism treated with supportive therapy; alternate patients treated with stellate ganglion block.

Observations:
Immediate effects of the block were in accordance with those reported by others.

Of major significance was a lesser mortality rate in those patients blocked. Forty-five percent of the controls and thirty percent receiving stellate ganglion blocks expired. The hospital stay was essentially the same.

Subjectively many patients noted varying degrees of improvement immediately following the block. Most notable was the clearing of the sensorium with increased alertness.

The clinical investigation and use of this procedure is much more extensive than these series, appearing in the literature, indicate. From this, one can only conclude that the results are very similar, or they would have been published to refute the claims made by proponents of this form of therapy.

From these series surveyed, it would seem that the cervical sympathetic block is of sufficient value in cerebral vascular occlusion to warrant its routine use. Early use of the procedure and its non-use in cerebral hemorrhage are rather unanimous conclusions. The extent of the recovery will vary indirectly with the severity of the 'accident' and will depend on the individual case. The percentage of these accelerated recoveries one could expect, with proper use of the procedure, is probably 50-60%. Recovery, here, should mean physical recovery since the psychological recovery is more or less secondary to it. That is, the depressed spirits of these individuals is due largely to the bewildering suddenness and the severity of the symptoms, together with the realized hopelessness of the situation.

It is alleged, by many, that with the accelerated recovery there might be more complete recovery than would spontaneously occur. (12-13) This would be based on the fact that with circulatory disturbances

of long duration there is gliosis in response to the hypoxia. (8) To disprove this, one would have to disprove 'vasospasm', so it cannot be evaluated.

Deaths from cerebrovascular accidents are due in part to the secondary debility and it is logically concluded that the mortality is less with accelerated recovery. There are indications that this is so (20-21), but more detailed study is necessary.

It would seem that this therapy is of value in cases of long standing, but this is much more a point of controversy. The improvements claimed here, seem to be largely psychological in nature, and the percentage of responses is very much lower. Logical conclusions will have to await further investigation.

Summary

The concept of 'vasospasm' has long been used to explain the neurological symptomatology following cerebral vascular accidents. The vascular lesion acting as an irritant on surrounding vessels produces spasm causing hypoxia of cerebral tissue, thus contributing to the neurological symptomatology. Stimulated by this theory, Leriche and Fontaine, in 1936, were the first to attempt to relieve this 'vasospasm' by blocking the cervical sympathetics. Their clinical success was duplicated by subsequent investigators but the procedure was for the most part neglected. This, was due to the apparent hazards of the procedure and to the limited acceptance of 'vasospasm' as a theory. The years 1947-1948 mark a re-awakening in the investigation of apoplexy and its treatment. The cervical sympathetic block was thoroughly re-evaluated by many clinical groups throughout the country.

The mechanism of the cervical sympathetic block is not known. A great deal of experimental work has been done, in past years, to determine the status of 'vasospasm'. This research has been revealing, but has not succeeded in proving or disproving the theory, and its liklihood of doing so, in the near future, is

remote. Another concept has recently been presented and is now under investigation. That is, that systemic circulatory inadequacy plays an important role in the causation of apoplexy. Beneficial results of the cervical sympathetic block are theorized to be due to the correction of this systemic circulatory inadequacy. The correction brought about by the 'cardiac effect' which is mediated by blocking cardiac sympathetics at the cervical level.

The majority of recent investigators agree that the block has no place in recent cerebral hemorrhage and its greatest value in early embolism and thrombosis. This makes a differential diagnosis of cerebrovascular accidents mandatory before using this therapy. It is the conclusion of Aring and Merrit that this differential diagnosis can be made, in life, in 100% of the cases. This is an impossibility under the average circumstances but never the less cerebral hemorrhage can be excluded in a very high percentage of cases.

Originally the cervical sympathetics were blocked at the level of the stellate ganglion, exclusively. The procedure was considered very hazardous because of the possible complications, such as pneumothorax, intravascular and intraspinal injections. The incidence of these complications has proved to be very low

due to the fact that only the expert attempted the procedure. Many techniques and approaches have subsequently been devised to circumvent complications and adapt the procedure to routine use. Most acceptable, to the occasional and unskilled operator, is a cervical sympathetic block (not a stellate ganglion) using the posterior approach.

The cervical sympathetic block is accomplished contralateral to the paralysis, and, to be considered successful, produces Horners Symdrome ipsilateral to the injection. This response appears within a few minutes and is followed almost immediately by the clinical improvement, if there is to be any. Most investigators set a time limit, of one-half to one hour, for this improvement to appear and be attributable to the block. Since there is such great variation in the degree of neurological symptomatology following apoplexy, the degree of improvement is very difficult to evaluate. Some clinicians are most impressed with the improvement of the paralysis and others with the improved emotional status of the patient. Most important is the fact that there is improvement in over 50% of those cases of cerebrovascular occlusion receiving a cervical sympathetic block within the first twelve to twenty-four hours.

Conclusions

1. The cervical sympathetic block has no proved physiological basis. The basic patho-physiological defect is best viewed as (a.) cerebral 'vasospasm' and/or (b) systemic cardio-circulatory insufficiency.

2. Results, to date, indicate that the procedure has no value and may be harmful in cerebral hemorrhage. Routine use of this therapy necessitates a differential diagnosis of cerebrovascular accidents.

3. Cervical sympathetic block is not a hazardous procedure as is the stellate ganglion block. It would be a valuable addition to the armamentarium of the practitioner.

4. The cervical sympathetic block is the first treatment, not strictly symptomatic, introduced in cerebrovascular occlusion. Early administration gives an acceleration of spontaneous recovery. Of equally great value is the 'psychological effect' of the accelerated recovery.

5. The following are not yet evaluated;

   (a) The effect of this procedure on the mortality rate of cerebral vascular occlusion.

   (b) The value of multiple, contralateral and long acting cervical sympathetic blocks.

(c) The value of this therapy in cases of long standing.

(d) Does this accelerated restitution give a greater degree of recovery than could 'normally' be expected?

References Cited

1. Amyes, E. W., and Perry, S. M. : Stellate ganglion block in the treatment of acute cerebral thrombosis and embolism, J.A.M.A., 1950, 142:15-20.

2. Aring, C. D., and Merritt, H. H.: Differential diagnosis between cerebral hemorrhage and cerebral thrombosis, Arch. Int. Med., 1935, 56:435-456.

3. Aring, C. D.: Vascular diseases of the nervous system, Brain, 1945, 68:28-55.

4. Blain, Alexander: Cervical sympathetic and stellate ganglion block in apoplexy, J. Michigan M. Soc., 1948, 47: 1356-1358.

5. Butt, T. C. and Mathers, Fred: Hemiplegia- Treatment by stellate ganglion block, J. Florida M. A., 1948, 35:285-287.

6. Editor G. P.: Blocking the stellate ganglion, G. P., 1951, 3:87.

7. Editor J.A.M.A.: Cervical sympathetic blocks, J.A.M.A., 1950, 144:1533.

8. Evans, J. P., and Scheinker, I. M.: Histologic changes following head trauma, J. Neuro. Surg., 1944, 1:306-320.

9. Flothow, G. P.: Cerebrovascular accidents, J.A.M.A., 1951, 145:429.

10. Forbes, H. S., and Cobb, S.: Vasomotor control of cerebral vessels, Brain, 1938, 61:221-233.

11. Forbes, H. S.: Physiologic regulation of the cerebral circulation, Arch. Neurol. & Psychiat., 1940, 43:804-814.

12. Gilbert, N. C., and de Takats, Geza: Emergency treatment of apoplexy, J.A.M.A., 1948, 136: 659-665.

13. Gilbert, N. C., and de Takats, Geza: The immediate treatment of cerebrovascular accidents, Am. Pract., 1948, 2:287-290.

14. Kety, S. S.: Circulation and metabolism of the human brain in health and disease, Am. J. Med., 1950, 8:205-217.

15. Leriche, R., and Fontaine, R.: De l'infiltration stellaire dans les embolies cerebrales, dans les spasmes vasculaires postoperatoires de l'encephale et chez les hemiplegiques Rev. de chir., Paris, 74:755-758, 1936. cited by Mackey and Scott.

16. Mackey, W. A., and Scott, L. W. D.: Treatment of apoplexy by infiltration of the stellate ganglion with novocain, Brit. M. J., 1938, 2:1-4.

17. Merritt, H. H.: Practical aspects of cerebral vascular accidents, N. Y. State J. Med., 1948, 48: 2371-2378.

18. Naffzigger, H. C., and Adams, J. E.: Role of stellate block in various intra-cranial pathologic states, Arch. Surg., 1950, 61:286-294.

19. Scheinberg, Peritz: Cerebral blood flow in vascular disease of the brain, with observations on the effects of stellate ganglion block, Am. J. Med., 1950, 43.1:229-234.

20. Searles, P. W., and Nowill, W. K.: Cerebral vascular accidents, So. Med. J., 1950, 43.1:229-234.

21. Sussman, Irvin; Lempke, Richard, and Wallace, Robert: Stellate ganglion block in cerebral thrombosis and embolism, Am. Pract. & Digest of Treat., 1951, 2:217-220.

22. Talbot, J. H.; Wolff, H. C. and Cobb, S.: Cerebral circulation-changes in cerebral capillary bed following cervical sympathectomy, Arch. Neurol. & Psychiat., 1929, 21:1102-1106.

23. Villaret, M. and Cachera, R.: Les embolies cerebrales, Paris, Masson & Cie, 1939. cited by Gilbert and de Takets.

24. Volpitto, P. P. and Risteen, W. A.: The use of stellate ganglion block in cerebral vascular occlusions, Anesthesiology, 1943, 4:403-408.

25. Volpitto, P. P. and Risteen, W. A.: Stellate ganglion block- A definite antero-lateral approach, Anesthesiology, 1944, 5:491-494.

26. Volpitto, P. P. and Risteen, W. A.: Role of stellate ganglion block in certain neurologic disorders, So. Med. J., 1946, 39:431-434.

27. Wilson, George; Rupp, Charles; Riggs, H. E. and Wilson, W. W.: Factors influencing development of cerebrovascular accidents, J.A.M.A., 1951, 145:1227-1229.