

WHITE, J. C.: *Procaine Block of the Sympathetic Nerves in the Study of Intractable Pain and Circulatory Disorders*. Surg. Clin. North Am. 1263-1280 (Oct.) 1947.

"Blocking the viscerosensory axones by paravertebral injection of procaine hydrochloride was first proposed by Kappis and greatly advanced by the pioneer work of Lawen, von Gaza, Mandl and Leriche. The method was first used in this hospital [Massachusetts General] by me early in 1927 in the investigation of pain transmission in angina pectoris. Later, while working at Professor Leriche's clinic in Strasbourg, I was further impressed by its value and, on returning here in 1928, lost no time in putting it to wider use. In the intervening years Dr. R. H. Smithwick and I have blocked the visceral nerves with procaine extensively. This has enabled us to develop a number of operative measures for the relief of hitherto intractable forms of visceral pain. In addition, its adaptation for measuring the degree of vasoconstrictor tone in peripheral vascular disease was first proposed and developed here. . . .

"Following the prediction of Francois-Franck that medically intractable angina pectoris could be relieved by sympathectomy, Jonnesco in 1916 first removed the cervical sympathetic ganglia. In his first patient the relief of pain was striking and complete, but in the large number of cervical sympathetic ganglionectomies performed by European and American surgeons in the following decade only slightly over 60 per cent obtained satisfactory relief. . . . At this hospital the early experience of Drs. E. P. Richardson and P. D. White with cervical sympathectomy gave even more disappointing results. By 1925 it had become obvious that the cause of surgical failure was incomplete anatomical knowledge of the pathways of pain from

the heart. In that year, during the course of an operation for angina pectoris under local anesthesia, Leriche made a most important observation. Direct injection of the exposed stellate ganglion with procaine resulted in immediate relief of an attack of severe cardiac pain which developed on the operating table. In the same year the publication of Mandl's experience with paravertebral injection of procaine first suggested the presence of upper thoracic cardiac rami in addition to the classical cervical cardiac nerves. . . . Soon after Mandl's important paper Swetlow described the use of alcohol to secure a lasting interruption of all the cardiosensory fibers. 'Chemical block by paravertebral injection has now been used in seventy-five cases at this hospital. . . .

"At first we routinely used diagnostic injection with procaine before attempting a permanent block with alcohol. Today, after twenty years' experience we are so sure that all the sensory pathways from the heart run through the upper three or four thoracic sympathetic ganglion that we no longer believe that a preliminary diagnostic block with procaine is necessary unless anginal pain is referred to unusual areas. Furthermore, during this twenty-year experience Dr. E. M. Bland and I have been convinced that in all but the poorest risk cases direct surgical intervention should be used, either by resection of the upper three thoracic sympathetic ganglia or by posterior rhizotomy. Today paravertebral alcohol injection is reserved only for the poorest risk cases. It fails to give effective block of cardiac pain in some 8 per cent of cases and is followed by troublesome intercostal neuralgia in 10 per cent. Recurrence secondary to nerve regeneration has been relatively rare (18 per cent) and usually mild. On the other hand, resection of the upper three or four

thoracic sympathetic ganglia or cutting the corresponding posterior spinal roots is nearly certain to give permanent relief. Although the injection method for control of the most severe cases of angina pectoris has been largely superceded, we have nevertheless learned a great deal from our extensive early experience. . . .

"Most aortic aneurysms are not acutely painful but cause symptoms only through pressure on neighboring structures. At times, however, they may produce intense suffering. In our experience this has been particularly true when the aneurysm is situated in the aortic arch and is expanding upward into the outlet of the thorax. It would be logical to suppose that under these circumstances the pain is caused by pressure on the parietal pleura and the intercostal nerves. In order to test the pathway of pain sensation White performed diagnostic procaine block in three patients with large and intensely painful aneurysms of the aortic arch. The first case was particularly interesting because the pain was referred to the right upper chest, shoulder, neck, and scalp. . . . All pain was relieved for thirty-six hours by paravertebral procaine injection of the first and second thoracic ganglia, although there was no detectable anaesthesia of the skin. A subsequent injection with 95 per cent alcohol gave the patient complete relief for the remaining three months of his life. . . . In the two subsequent cases the aneurysms involved the transverse and descending portions of the arch. Here the pain was left-sided. These three patients were all given satisfactory relief, which in the case of the longest survivor lasted until his death five and one-half years later. . . .

"Chronic disease of the upper abdominal viscera may be intensely painful and injurious to the patient's morale. Formerly division of the posterior sensory spinal roots or section of the

anterolateral pain tract in the spinal cord were the only neurosurgical methods which could relieve continuous suffering and prevent addiction to morphine. Investigation by paravertebral block in the last fifteen years has shown that such radical surgery is often unnecessary and can be superseded by more selective resection of the lower thoracic ganglia and splanchnic nerves. . . . At times the general condition of the patient was so poor, owing to the cachexia of advanced malignancy or coronary disease, that no form of major surgery was possible. A number of patients in this precarious state have been given comfort for the remainder of their lives by chemical block of the paravertebral ganglia with procaine and alcohol. . . .

"In testing our unusual varieties of pain of any sort it is advisable to repeat the injection of procaine on more than one occasion and also to make sure that inert saline is not equally effective. In many of these cases of obscure pain, especially when complicated by drug addiction, it is essential to make certain that the complaints are not, in part at least, the result of a functional disturbance. It is only by taking precautions of this sort that failures can be avoided and the patient's morale not be further impaired by ill-advised surgery. In general, however, we have been pleasantly surprised to find how often the neurotic appearing victim of intractable visceral pain has responded and been transformed into a stable individual as soon as his chronic discomfort has been relieved. . . .

"The intense discomfort of causalgia, post-traumatic arthritis with osteoporosis, and the diffuse aching or burning pain that sometimes follows peripheral amputations in individuals with chronic cold, sweaty extremities can often be relieved by paravertebral procaine block. . . . The criteria for evaluating the role of the sympathetic

innervation in the post-traumatic neuralgias, which should be followed with care, are as follows: (1) Relief during the period of effective sympathetic block with procaine must be complete. (2) The persistence of relief for a period of over two hours indicates that repeated injections may result in further improvement with more prolonged periods of freedom from discomfort and that ultimate lasting recovery may be attained without recourse to actual operation. (3) When sympathetic block with procaine has given complete relief for only a short interval, upper thoracic sympathectomy or resection of the lumbar ganglia is reasonably certain to succeed. In the case in which diagnostic block has been followed by no response, sympathectomy is not likely to succeed and some other course of treatment should be adopted. Experience in the recent war has further emphasized the importance of preliminary procaine block in order to avoid useless operations, as these invariably lead to a further deterioration of the patient's morale. . . .

"In 1930 I reported that the sympathetic vasomotor fibers could be blocked temporarily by procaine as effectively as by direct operation. Two preliminary papers, following a year's period of clinical use, showed that maximal vasodilatation can be brought about by paralyzing the sympathetic fibers in the anterior spinal roots (spinal anesthesia), by injecting procaine around the upper thoracic or lumbar sympathetic ganglia (paravertebral block) or by infiltrating the vasoconstrictor axones in the principal nerve to the extremities (peripheral nerve block). . . . These methods have stood up well under the test of time and continue to be the most effective tests for determining the degree of vasoconstrictor tone and differentiating between states of excessive vasoconstriction and occlusive vascular disease. Except for the recent substitution of differential spinal

block for full spinal anesthesia, a method devised at this hospital by Sarnoff and Arrowood, there have been no important modifications in these procedures. . . .

"In thromboangiitis obliterans and arteriosclerosis the experience of the Peripheral Vascular Clinic has shown that our earlier hopes for an accurate prediction of the ultimate postoperative improvement in circulation have not been consistently borne out. While some 90 per cent of patients with obliterative vascular disease in whom the popliteal pulse is present will show a rise in temperature of the foot following paravertebral or spinal block, when the popliteal pulse is absent the great majority will have no post-injection rise. Nevertheless, some 40 per cent of this group will have a good response following resection of the three upper lumbar sympathetic ganglia. It is evident that a vasoconstrictor block of short duration does not permit full development of blood flow through patent small collateral vessels. Perhaps this difficulty will be overcome through the production of safe, longer-lasting anesthetic drugs." 52 references.

J. C. M. C.

WIGGINS, S. C.: *Factors which Modify the Choice of Anesthesia in the Surgery of Trauma*. *Am. J. Surg.* 74: 788-793 (Nov.) 1947.

"All cases in the surgery of trauma are initially emergency operations, but for the purpose of reconstruction or plastic repair may be secondarily elective operations. In these cases there are many factors which modify the choice of anesthetic agents and methods of administration. There are those due to the general condition of the patient and others which are the direct result of trauma or incidental to trauma. . . . The choice of an anesthetic agent is modified more by the