can be used with perfect satisfaction to patient and surgeon. In amputations of the legs for gangrene in diabetes it is also indicated. It can of course be used for any operation coming within the field of anesthesia, but it should be reserved for those cases where a definite indication exists. Caudal anesthesia has no advantages over spinal and is more difficult to give.

LOCAL ANESTHESIA.

This form of anesthesia has gained in importance since the introduction of novocaine, which can be used in almost unlimited amounts in a one-half per cent. solution without any danger of toxic symptoms. Practically all the operations of surgery have been performed by some men, with the use of local anesthesia, and while that is not necessary or even desirable in the majority of cases, it shows what can be done. There is a definite and, as our skill increases, probably broadening class of cases in which local anesthesia is, or will, become the anesthetic of election. But here, as in spinal anesthesia, a conscious patient must be considered, and that fact alone contraindicates the use in individuals of a certain type. Considerable practice and patience are necessary to make this form of anesthesia a success. It is indicated today in all operations on the scrotum or its contents, as the nerves can be easily and completely blocked, and on very minor operations. Operations on the fingers can be easily performed by blocking the nerves at the base of the finger.

To summarize: A surgeon should make every attempt to pick out for each patient on whom he operates the right anesthetic, which should be given for a definite indication.

THE TREATMENT OF PARESIS BY INTRA-VENTRICULAR INJECTIONS OF DIARSENOLIZED SERUM, WITH PRESENTATION OF CASES.

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A FAIRLY large experience with the treatment of syphilitic affections of the central nervous system by intra-spinal injections of salvarsanized serum by the Swift-Ellis method and its modifications, begun in my service at the City Hospital by Dr. Sanborn about three years ago, has shown that in no other way have I ever obtained such constantly good results. This opinion has been reached from the study of about five hundred injections on over a hundred patients, with pretty constant benefits, with no bad ef-

fects other than a temporary increase of pain, except in one case that died suddenly soon after injection from causes not fully determined. Among these cases, of course, were a goodly number of paretics and cases of cerebral syphilis. Although many of these cerebral patients showed a very considerable improvement, I have never seen such striking benefit as in the spinal cases. I have seen tabetics, who could stand only by the support of two nurses when treatment was first begun, who after a few injections would walk several miles with an approximately normal gait. I have seen a patient, completely paraplegic, with total loss of control over the bladder and marked anesthesia, leave the hospital walking normally, with complete control of the bladder and with normal sensibility and reflexes after three injections. Such brilliant results I have not seen in cerebral cases.

My own experience is like that of most observers and has led me to accept the hypothesis that the action of salvarsan, and its substitutes—neosalvarsan and diarsenol—is most pronounced when it is exerted most directly upon the spirochaete, wherever may be its lair. I was therefore much interested to learn from Dr. Graeme Hammond of his attempts to accomplish this result and later to have a practical demonstration of the methods employed by him and Dr. Sharpe as reported by them a year ago,¹ and to see the benefits obtained in several cases which were shown me by him at the Post-graduate Hospital in New York.

Experiments seem to indicate that the cerebro-spinal fluid is subjected to some form of circulation or is not confined in a single cavity, but in separate enclosures in the cerebro-spinal canal. Not only does its physical and chemical constitution seem to differ in different parts of the cerebro-spinal axis, but if a substance be injected into it in one place it does not become gradually diffused through the whole fluid, but exerts only a local action near the point of injection, and is gradually eliminated from the fluid. Tilney,² for example, found that pigment injected into the veins was not much diffused through the cerebral cortex, and Goldmann,³ that injections into the lumbar regions of the spinal canal were not fully carried up to the cortex. Symmers¹ went a step farther and found that solutions injected beneath the cerebral dura had much more difficulty in diffusing and were much more rapidly drained out of the cranium than if they were injected into the lateral ventricle. By any method of approach it is probable that some of the injected substance reaches the cortex, but not so fully or so completely as by the ventricular route.

Attempts have been made to obtain the action of salvarsan on the cerebral cortex in paresis by all of these routes. We are all familiar with the attempts to treat paresis by the intra-venous and intra-spinal methods, and I think that most will agree that, although our treatment is often

attended with some good results, it is not so satisfactory as is the treatment of spinal affections. Marinesco⁴ and Cotton⁵ have tried the injection of salvarsanized serum beneath the cerebral dura with considerable benefit. Hammond and Sharpe have given intra-ventricular injections to a number of patients with very considerable benefit and no bad results, one or more of their patients being able, after three injections, to return to a business which involved considerable mental application. Ballance⁶ and Förster⁷ had previously tried a similar method with fairly good results.

The operation is comparatively simple. A small trephine hole about half an inch in diameter is made just in front of the bregma and an inch to the right of the median line. The dura is then incised so as to give an opportunity to select a spot free from large cortical vessels and a blunt-pointed cannula is inserted downward and backward about six to seven centimeters into the lateral ventricle. Hammond has usually found the dura very thick and opaque, but such has not been my experience. Ten to twenty cubic centimeters of cerebro-spinal fluid is then slowly drained off and an equal amount of serum, containing .6 to .8 milligrams of salvarsan, neosalvarsan or diarsenol is allowed to flow in very slowly and gently. The wound is closed in the usual way. Subsequent injections are made directly through the scalp. Hammond does this under local anesthesia from novocaine, but I have preferred to etherize the patient again rather than run any risks. Hammond gives a second injection in two weeks and a third four weeks after the second. Neither of us has as yet seen any unpleasant results from the operation.

The first patient entered the hospital February 7. He was extremely demented and it was felt that nothing could be of much benefit. He was an Irish coal heaver of forty, barely able to read or write, who denied syphilis. For a year and a half he had been apathetic, dull, neglected his work and was careless and filthy. He was untrustworthy and uncommunicative. There was loss of sexual power. The pupils were unequal, irregular and usually did not react at all to light, although occasionally there was a very sluggish reaction. The left leg was spastic and the left knee-jerk lively, the right absent. The speech was slow and slurring, the hand-writing illegible. He was silly, apathetic and disoriented and could remember but little. He was somewhat euphoric and always felt "fine." The blood and spinal fluid gave a triple positive Wassermann reaction, the fluid showed no increase of pressure, a cell count of 25, positive globulin and a negative colloidal gold reaction.

On March 10 he was given an intraventricular injection of serum containing 0.6 mmg. of diarsenol. The ventricular fluid removed was contaminated with blood so that the usual tests could not be made, but a negative Wassermann was reported. Nine days later he was much brighter, recognized a nurse and called her by name, took more interest in what was going on, talked more clearly and

wanted to go home. The knee-jerks were lively, but unequal, and he wrote more legibly.

On March 29 the injection was repeated. The fluid removed showed a negative Wassermann, the cell count was 15, the globulin double positive, and the colloidal gold a paretic reaction. It also contained some large (plasma?) cells. After this he seemed still brighter, was interested in what was going on, talked cheerfully and more clearly, and the pupils reacted promptly. On April 3 he was discharged. Since then he has returned temporarily to his work and seems more reasonable at home.

The second patient was admitted March 2. He was a drug clerk of forty who had contracted syphilis eighteen years ago. He took medicine by the mouth for eight or nine months, and during the last two months he had had thirteen doses of diarsenol intravenously. For over a year he had complained of tremor and loss of memory, but under his recent treatment the memory had improved. The memory, however, was poor, he was a good deal disoriented, and he made many mistakes in simple calculations. There was a good deal of slurring of speech and the handwriting was characteristic. There was tremor of the tongue and hands, the reflexes were lively, and the pupils did not react to light. The blood and spinal fluid gave a triple positive Wassermann, the cell count was 84, the globulin triple positive and the colloidal gold suggestive.

He was given, March 15, 0.6 mmg. diarsenol in serum by injection into the lateral ventricle. After this he seemed considerably brighter; he did simple sums correctly, he remembered better, the tremor was less, and the pupils reacted promptly to light. On March 29 the injection was repeated, and he has continued to do well. The ventricular fluid removed at the time of the first injection showed a negative Wassermann, a cell count of 20, double positive globulin, and the colloidal gold showed the reaction of paresis. The fluid removed at the time of the second injection showed negative Wassermann, a cell count of 5, positive globulin, and a paretic reaction in the colloidal gold test.

It is too soon and our experience is too limited as yet to permit us to come to any conclusions as to the merits of this form of treatment. The operative procedure seems to be fairly safe and the risks are apparently slight. The changes in the physical signs,—the return of the knee-jerk, the reaction of the pupils to light,—are not often seen in paresis under treatment, and, taken in conjunction with the apparent general improvement encourage me to continue with this method.

In conclusion, I would express my gratitude to Drs. E. H. Nichols and G. P. Sanborn for their hearty coöperation.

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