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Madden, Frank Cole, 1873-1929.
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Publication/Creation

[London] : [publisher not identified], 1912.

Persistent URL

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Reprinted from the BRITISH MEDICAL JOURNAL, August 17th, 1912.



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ON SPINAL ANAESTHESIA BY STOVAINE.

WITH REMARKS ON 1,000 CASES.

BY

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For rather more than four years it has been our custom at Kasr-el-Ainy Hospital to employ spinal anaesthesia whenever possible; and we have thus arrived at certain definite conclusions with regard to the efficacy of this method of anaesthesia, and, what is perhaps more important, its limitations. Such conclusions drawn from a large number of cases may be interpreted in different ways by different observers, and I am anxious, therefore, to supplement the excellent paper of my colleague, Mr. Owen Richards, published in the BRITISH MEDICAL JOURNAL of December 23rd, 1911, by some remarks based upon an experience of 1,000 operations performed in my section under stovaine anaesthesia; a series to be followed in the near future, I believe, by yet another 1,000 special operations from the section of our gynaecological colleague, Dr. Dobbin.

In all that concerns the general application and the technique of the method and its evident advantages and disadvantages, Mr. Richards's paper leaves but little to be said; and I will therefore confine myself to a personal record of my experience in the hope that some new points of interest may be elicited.

The Preparation of Stovaine Employed.

My first cases were anaesthetized by the well-known stovaine and adrenaline solution of Billon (epirenine borate 0.0026, stovaine 0.08, sodium chloride 0.0022, water to 2.00). Of this nearly the whole ampoule is injected in operations on the lower extremities and lower abdomen; but the dose

is considerably reduced in operations in and around the perineum, and especially piles and fistulae and perineal operations for stone. For suprapubic cystotomy and lithotrities the larger dose is required; and also in hydrocele, which, though not a severe operation, is often attended with some pain on handling the testicle; this pain may also be present in operations for herniae, especially when any drag is exercised on the neck of a hernial sac prior to its ligation. In growing boys and girls and in old people, particularly when suffering from arterio-sclerosis, the dose must be proportionately reduced.

After the publication of Jonnesco's results in the *BRITISH MEDICAL JOURNAL* of November 14th, 1909, I had his solutions made up for me by Messrs. Parke, Davis and Co. in ampoules; and with these I obtained the best results I have ever had. This was probably due to the freshness of the preparations. With them I was able steadily to reduce the dose of the stovaine until I was obtaining quite perfect results with low anaesthesia when using the weaker solutions that were only intended for high anaesthesia. With these solutions I also carried out a short series of twelve cases of cervical anaesthesia—of which I sent a note to the *BRITISH MEDICAL JOURNAL* of September 24th, 1910—but I do not propose to repeat the experience, as it seems to me quite unnecessarily dangerous.

The most generally applicable Jonnesco solution was that containing stovaine 0.10, strychnine 0.001, water to 1.0, the dose being modified as above described, and the injection being made in the upper part of the lumbar spine or in the space between the last dorsal and the first lumbar vertebra.

When my supply of ampoules was exhausted we had the same solutions made locally, but they were not at all satisfactory, many ampoules failing to produce any anaesthesia at all, and when they did, it was hardly possible to finish a comparatively short operation before sensation returned.

In order to simplify matters from an administrative point of view we decided to adopt the Billon preparation, and this has been the only solution used latterly at Kasr-el-Ainy Hospital; but I am nevertheless of opinion that freshly prepared Jonnesco solution of the above-mentioned formula is the most generally satisfactory.

It is probable, nay, almost certain, that neither the strychnine or the adrenaline are necessary; but undoubtedly, after brandy has been tried and proved ineffective, the best treatment for the sudden faintness and collapse sometimes seen after a stovaine injection is a hypodermic injection of 5 to 10 minims of a 1 in 1,000 adrenaline chloride solution. If a further stimulant is necessary 5 minims of a 1 per cent. solution of strychnine should be given, and this seems to have a more "solid" effect on the heart itself than the adrenaline, which would appear to act especially on the blood pressure. I have had no experience of Barker's stovaine-glucose solution.

Technique.

The whole back from the mid-dorsal spines to the sacrum is painted with iodine, and the injection made with the patient sitting on the edge of the table, the head well down on the chest, the elbows resting on the inner sides of the thighs and the back strongly arched. The injection may be made in any of the spaces from that below the last dorsal vertebra downwards, and the only certain proof of proper entry into the cerebro-spinal space is the flow of clear fluid, which may only run in drops or in a full steady stream. I make the puncture exactly in the middle line and use an ordinary exploring needle without a stilette, and fit it on to an ordinary all-glass (5 c.cm.) syringe. If I feel sure that the needle is properly placed, and still no fluid flows, I then introduce a stilette to clear the point of the needle, if twisting the needle round does not succeed in promoting a flow. It is better to remove the needle altogether or try a higher space than to persist in searching for the right track with the point still buried after two or three failures in different directions. When the flow is satisfactory, the syringe, already charged with the stovaine solution and cleared of air, is fitted on. The cerebro-spinal fluid then flows in by its own pressure, and dilutes the solution by half or even more. This mixture is then slowly injected, and an attempt made to draw back into the syringe another quantity from within the theca. This is again slowly injected, and then the needle with the syringe still attached is slowly withdrawn, and the patient at once placed in the semi-recumbent position, with his head, back, and shoulders well raised on pillows. If the cerebro-spinal pressure is not sufficient to force the fluid into the syringe, it may be assisted by drawing out the piston and exercising suction. It is well, I think, to dilute the stovaine solution with cerebro-spinal fluid before injecting whenever possible, though I must admit that in several cases, in operations in which a large dose of stovaine is not necessary, anaesthesia follows when no mixture has been effected. Further, I must confess that in old men, in whom I was certain that the needle was properly placed but no fluid came out, I have injected stovaine with perfectly successful anaesthesia. But this practice is to be deprecated, as failure is almost certain to occur.

Failure to enter the canal may occur in old men who cannot bend their backs properly, and in whom there may be some bone condition, such as osteo-arthritis, which occludes the already small intervertebral spaces.

In certain cases the injection is given with the patient curled up on his side, and is even easier than in the sitting position. A few drops of fluid very often escape from the puncture, but no dressing is required.

Effects of the Injection.

In most cases, beyond the pain of the prick of the needle in the skin, nothing is felt of the actual puncture; but almost at once tingling and formication commence in one

or both legs, followed by a feeling of dead weight, and within a few minutes of the injection sensation is entirely lost or considerably blunted. Rarely a sharp shooting pain runs down one leg immediately on insertion of the needle, presumably from the pricking of a bundle of nerves in the cauda equina.

If the anaesthesia is going to succeed, the operation may be started as soon as the necessary preliminaries are over. In the majority of cases anaesthesia is absolute and the operation can be completed without any difficulty, the effect, with a full dose of stovaine, beginning to wear off in about an hour. It may last longer, and I have had a case that remained anaesthetic during an operation that lasted 1 hour 40 minutes. As soon as the effect begins to wear off it is better to give a little chloroform—and it really is only a little that is usually required—instead of a second injection, to complete the operation.

The degree of anaesthesia varies considerably. Some fail absolutely (see Mr. Richards's paper). In cases not entirely successful the first incision through the skin is sometimes quite painful, but the subsequent steps of the operation are quite painless. As already mentioned, in operations for hernia the necessary pulling on the peritoneum before ligature above the neck of the sac is often felt, and the handling of the testicle in hydrocele may also give pain. Again, more particularly in hernia operations, it is not infrequently remarked that the suture of the muscle is more liable to be felt than the ligaturing or suturing of any other tissue in the course of the operation.

The anaesthesia usually extends up to the costal margins, thus permitting of operations on liver abscess, if a rib not higher than the eighth is excised, and also on hernias of the linea alba, just below the ensiform cartilage. Abdominal operations, provided they do not involve any handling of the under surface of the diaphragm, can nearly all be done with ease, and the relaxation of the muscles of the abdominal wall is particularly convenient. In cases of acute abdomen, however, I am not at all convinced that stovaine is better than, or as good as, scopolamine and chloroform. With all due deference, I submit that in quite a fair proportion of cases there is shock evidenced by pallor, faintness, nausea, and feeble pulse, in varying degrees, after stovaine injections; and though in our Egyptian experience acute abdomens, almost without exception, reach us in a very hopeless condition, and the selection of an anaesthetic scarcely influences the inevitable fatal issue, as a matter of experience I do not recommend stovaine in such cases. And yet in other situations associated with severe shock—as Mr. Thom has pointed out—good effects have been noted, some of which may, however, be due to the relief from pain afforded by the stovaine injection.

In operations on the perineum, particularly haemorrhoids, fistulae, both urinary and rectal, and perineal operations for stone or bladder conditions, a smaller quantity of stovaine is required to produce anaesthesia

than in any other situation. Lithotrity, suprapubic cystotomy, hernia, and hydrocele require proportionately larger doses, but amputations, excisions, and bone operations on the lower extremities may be performed with quite moderate doses.

The patients usually declare that below the level of the anaesthesia the parts are as if dead, yet occasionally some are quite conscious of the handling of the area of operation, but experience no pain at all. In such cases, too, the application of a hot lotion is sometimes quite severely felt.

The General Condition of the Patient during Operation.

Most cases lie perfectly still and placid, and are not upset in any way. Others feel faint or giddy, become very pale and have urgent nausea. If they are sick they are much better at once; but if not, their pallor increases, they have repeated retching, and bring up some mucus, and may have all the usual symptoms of a mild collapse or even definite heart failure. A drink of water may recover them at once, or, if this is without effect, a dose of brandy is a most potent and rapid remedy. It is best, however, when these milder measures are not effective, to give 5 minims of a 1 in 1,000 adrenaline chloride solution, followed, if necessary, by strychnine. The milder cases usually react very quickly, but if not, and there are signs of a failing pulse and gasping for breath, more active measures, and particularly intravenous saline injections, must be resorted to and continued till a definite improvement takes place. In cases of high anaesthesia this "air hunger," associated with extreme pallor, is only too common and to an alarming degree, and on this account this form of stovaine anaesthesia should not be used.

I have had two cases, both in private practice, in which symptoms of complete heart failure came on almost immediately after the injection; and it was only by dint of repeated injections of adrenaline, strychnine, caffeine, and sparteine, with artificial respiration, that I was able to save them and complete the operation. One case was an old full-blooded Turk, with advanced arterio-sclerosis, with an impacted stone in the urethra, who, after his narrow escape, surprised us all by taking French leave and walking out of hospital four hours afterwards. He came back two days later none the worse for his adventure. The second case was an alcoholic subject on whom I was operating for fistula in ano, and, though he had very alarming symptoms for a short time, he very rapidly recovered and had no further trouble.

Another accident happened with an old Egyptian army officer who was very ill with diabetes and a large gangrenous cellulitis all round the anus and ischio-rectal fossa. The operation was almost finished when he collapsed, and it took us all our time to bring him round. We eventually succeeded, and he went on well for nearly a fortnight, when he developed diabetic coma and died. The bad symptoms were, I think, due here to rough

handling of the patient, a very heavy man, when lifting him from the lithotomy position back to a recumbent position in bed.

Fatal Cases in this Series.

Dr. Hassan Shaheen, anaesthetist to the hospital, has kindly given me the following notes of three fatal cases that have occurred in my section. Of the first two I cannot speak, as I was not present at the operation, but the third would certainly have been best operated on under chloroform, though he had taken stovaine well at his first operation.

CASE I.—A little boy of 13 was admitted on April 4th, 1911, for ruptured urethra, with considerable extravasation of urine and blood. An injection of 0.04 of stovaine adrenalin was given in the second lumbar space. The patient was rather collapsed, and his condition was unsatisfactory from the beginning. A Cock's puncture was made and the bladder washed out. About five minutes after the injection the boy complained of discomfort in breathing, and his pulse became weak, and, though he improved after brandy, the pulse soon failed again, and in spite of everything he died of heart failure, verified also by the *post-mortem* examination.

The dose may have been too large and the injection too high, but, whatever happened, I am afraid we must consider this fatality as certainly directly due to the anaesthetic.

CASE II was a very feeble patient, admitted for anaemia, ankylostomiasis, and liver abscess. He was very emaciated, with a high pulse rate, 102, and complained of pain in the jaws and pharynx, with difficulty in swallowing. The heart sounds were hardly audible, and he was suffering from diarrhoea. He was operated on on July 14th, 1911. There was oedema behind as high as the third dorsal vertebra. The injection was made in the eleventh dorsal space. Breathing was stopped as soon as the rib was being cut, and then the pulse also. No treatment was of any avail.

Post mortem the heart was found very soft and flabby, and the right side dilated and filled with mixed blood clot. The lungs were very bloodless, and had some oedema at their bases. The liver and kidneys were extremely fatty, the spleen enlarged and cirrhotic, and there were many ankylostoma worms in the mucous membrane of the intestines.

This operation, which was one of urgency, would have been best done under a local anaesthetic, as the patient was in an extremely weak state. I do not think stovaine can be blamed for this fatality; it would probably have occurred with any general anaesthetic.

CASE III.—This man was admitted on November 19th, 1911, and operated on for an abdominal tumour, which turned out to be a twisting of the kidney, in such a way that the ureter lay right across the front of the organ. The ureter was replaced and the appendix also removed. On this occasion he took stovaine quite well. Ten days after the operation he developed a septic temperature, and it was obvious a few days later that the kidney was intensely inflamed; indeed, we found at the operation it had become gangrenous. Eighteen days after the first operation 0.06 stovaine adrenaline was injected into the first lumbar space and the kidney removed, and a large perinephritic abscess evacuated. Just before the completion of the

operation the patient suddenly collapsed and died, though everything possible was done, including even massage of the heart through the abdominal incision.

At the necropsy the heart was in a state of fatty degeneration, with a widely dilated right side, full of fluid blood, and the left kidney contained several pyaemic abscesses.

In the first place the kidney should have been removed at the first operation, and no second operation would have been necessary. Then by an error of judgement we gave him stovaine in the very case where it is not wise to give it, a patient weak from a continued septic fever and pyaemia, and death was entirely due to a sudden collapse, perhaps stovaine-induced, acting on a fatty septic heart. We have had no further fatalities.

The After-effects of Stovaine Anaesthesia.

After a variable time, generally within an hour or two at most, movements of the legs may be made and sensation returns. Pain in the legs is often complained of, and later headache and backache. The legs may sometimes give more trouble than anything else, but usually recover within two days. I have never seen any serious effects from stovaine, though fever, headache, giddiness, backache and retention of urine may persist for some days. Once the dangers at the time of the actual injection itself are over no further trouble is likely to occur.

THE CASE FOR AND AGAINST STOVAINE ANAESTHESIA.

In considering the case for stovaine one is naturally bound to compare it for efficiency and safety with chloroform anaesthesia, and in general terms I think we must look on stovaine as a valuable alternative to (ether or) chloroform in operations on certain definite areas, but as never destined to replace them. It is true that the accidents of stovaine are generally more alarming than dangerous, but when they *do* occur there is a dreadful feeling of helplessness, which is particularly perturbing. We have certain danger signals with chloroform which are well recognized and can be immediately replied to, and moreover the administration of the anaesthetic can be immediately discontinued; whereas in stovaine the danger gives very little warning, if any, and the damage is done and cannot be undone, as, though it is recommended, the withdrawal of a quantity of cerebro-spinal fluid in such an emergency is hardly practicable. It is true that only a very small proportion of cases give rise to the least anxiety, but a method must be judged by its possibilities of danger when the question of a human life is concerned. Profound lowering of blood pressure, heart failure, and "air hunger" are the more serious possibilities to be faced, and these can only be avoided by careful selection of cases, the proper grading of doses to suit individual patients and conditions, and the most careful adoption and retention of appropriate positions, to prevent the dissemination of the drug beyond the limits of safety within the spinal canal.

With increased experience naturally there is a greater certainty and security about our results, but we have not yet that perfect trust and confidence we should have in our anaesthetic in the case of spinal anaesthesia with stovaine (in the solutions we have been accustomed to employ).

Briefly, we have, then, in stovaine a reliable anaesthetic for all operations below the costal margins, but one must not expect too much of it, or employ it without careful consideration, especially in cases where any form of general anaesthetic would be dangerous. Moreover, the fallacy that after the injection is given and anaesthesia established it is no longer necessary to trouble about the patient, must be once and for all dismissed. Just as much care must be exercised in the administration of the drug and in the management of the patient after injection as with chloroform, and when this is done the feeling of satisfaction, after an extensive operation under this form of anaesthesia, when the stovaine has acted perfectly and the after-effects have been almost *nil*, must be experienced to be thoroughly appreciated.

If a somewhat pessimistic note has unconsciously crept into these observations, I am, on the whole, content to leave it so, as a well-intentioned protest against the impression that stovaine is entirely devoid of all danger, and that at worst its only drawback is failure, partial or complete, to produce the requisite degree of anaesthesia.