

SPINAL ANÆSTHESIA, ITS ADVANTAGES AND DISADVANTAGES.

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SUFFICIENT evidence has accumulated during the last two years to allow of a definite opinion being formed of the value of spinal as compared with general anæsthesia in surgical work. Many surgeons have made extensive use of spinal anæsthesia, and have reported their results, favourable and unfavourable, freely, and a survey of some recent work on the subject may be of value to those who have not sufficient material at their disposal to enable them to work out the subject for themselves, or who do not care to use spinal anæsthesia till its superiority over general anæsthesia has been proved.

It is claimed for spinal anæsthesia that it entails less risk to life, and that it is followed by less disagreeable after-effects than anæsthesia induced by chloroform or ether. In order to judge fairly whether these claims are well founded, a study has been made of recent papers by various surgeons, reporting between two and three thousand cases altogether. Before discussing the results with the possible complications and after-effects, attention may be directed to some points in the technique of the induction of spinal anæsthesia.

THE SITE OF PUNCTURE.—The puncture may be made through any of the lumbar interspaces. The majority of surgeons favour the second or third, but Dönitz, writing from Professor Bier's clinic, advises that when a high anæsthesia for abdominal operations is desired, the puncture should be made between the first and second lumbar spines. That there must be some risk of wounding the lower end of the spinal cord at this level is evident, but that should be avoided, according to Dönitz, by withdrawing the stylet from the needle used before piercing the dura, and arresting the needle as soon as it enters the subarachnoid space, as indicated by the escape of cerebro-spinal fluid. The possible risks of such a high puncture do not appear to be in any way counterbalanced by the supposed advantages, for others who habitually puncture at a lower level appear to get as high an anæsthesia without difficulty (Schwarz, Chaput, etc.). The puncture may be made in the middle line or about 1 cm. to the side. As it is desirable to enter the subarachnoid space exactly in the middle line, central puncture is probably to be preferred, for the depth at which the membranes will be entered cannot be accurately foretold, and an obliquely directed needle may easily enter the subarachnoid space to one side or even miss it altogether.

POSITION OF THE PATIENT.—When possible, the patient should

sit with the trunk fully flexed to have the puncture made; when this is not possible, the patient must lie on one or other side with the trunk as fully flexed as possible. In some clinics (Bier, Schwarz) it is the custom to use the Trendelenburg position after making the puncture, when a high anaesthesia is desired, the object being to make the injected solution gravitate towards the head. The efficacy of this method has not been proved, and some even regard it as likely to induce complications. It is by no means generally adopted, the usual custom being to make the patient lie flat immediately after the injection has been made.

DRUG TO BE USED AND ITS SOLVENT.—For some time after its introduction, stovaine, with or without the addition of some adrenal preparation, was very extensively used for inducing spinal anaesthesia. It proved much less toxic and less irritating than cocaine. It has, however, a much more powerful effect than cocaine on motor nerves, and in some cases has actually caused complete paralysis of the respiratory muscles, besides frequently causing relaxation of the sphincter ani with the consequent involuntary passage of faeces on the operating table. The maximum safe dose of stovaine for an adult is given as 6 cgrms. (Dönitz), or 8 cgrms. (Chaput), *i.e.* 1 to $1\frac{1}{3}$ grs. approximately. For operations involving the lower sacral nerve areas 4 cgrms. suffice; for those involving the upper lumbar and lower dorsal areas, the full dose must be employed.

Owing to the undesirable effects of stovaine on motor nerves, a return has been made by many to the use of tropa-cocaine, while Chaput now uses a mixture of 1 part of cocaine and 3 parts of stovaine.

Tropa-cocaine has apparently a less powerful action on motor nerves than stovaine, and is therefore especially to be preferred when large doses for high anaesthesia are required. The maximum safe dose is variously estimated. Schwarz, speaking from an experience of 1000 cases, puts it at 6 cgrms.

A recently introduced drug named novocaine has been also extensively used, and has by many been favourably reported on. Heineke and Lâwen, however, after making a careful comparison of its action with that of stovaine, concluded that complications were more frequent when novocaine was used, while troublesome after-effects, such as headache, etc., were more often observed than after stovaine. The maximum dose of novocaine is about 15 cgrms, about $2\frac{1}{3}$ grs.

There are various ways of dissolving the drug used for injection. Some dissolve it in distilled water with enough salt added to make the solution isotonic with the cerebro-spinal fluid. Others, especially French surgeons, dissolve it in 10 per cent. solution of sodium chloride in such strength that the amount of fluid injected is only a few minims. Others again dissolve it in cerebro-spinal fluid, which is allowed to escape before the injection is made, as

much as 5 or 10 c.c. being used for this purpose, and then returned to the spinal canal. There is, as far as can be judged from reported results, little or no evidence that any one method is better than another, either for producing anæsthesia or preventing undesirable complications or after-effects. Although various minor differences in the technique practised by different surgeons exist, as indicated above, and although many are inclined to lay stress on the strict observance of the particular plan they employ as giving the best results, there is an absence of real evidence of the superiority of one method over others, the main indications being to introduce 4 to 8 cgrms. of stovaine or tropa-cocaine, dissolved in an unirritating solvent, directly into the subarachnoid space just below the spinal cord, with the most rigid precautions as regards asepsis.

RESULTS.—In the majority of cases a complete sensory and motor paralysis of the sacral and lumbar, and, with large doses lower dorsal, nerve areas is produced which allows of the painless performance of any surgical operation within these areas. The anæsthesia lasts longest in the area where it first appears, generally the lower sacral distribution, where it may last one and a half to two hours. In the legs it lasts usually an hour—possibly longer—and in the lower abdomen possibly an hour, but not infrequently less. In apparently about 60 to 70 per cent. of cases the anæsthesia is not attended by complications or followed by disagreeable after-effects; but in a number of cases complications arise during the anæsthesia, or decidedly unpleasant sequelæ follow its use.

ACCIDENTS AND COMPLICATIONS DURING ANÆSTHESIA.—*Deaths.*
—Several deaths have been recorded, wholly or partly attributable to this method of inducing anæsthesia. One is reported by König. The patient was a man, æt. 35, suffering from a fracture of the patella. A week after the injury, 6 cgrms., *i.e.* 1 gr. approximately, of stovaine were injected through the third lumbar interspace in the usual way, for the operation of suturing the patella. A successful anæsthesia resulted, with complete motor paralysis of legs, bladder, and rectum. The paralysis never passed off, and the patient died three months later of cystitis, bed sores, etc. At the post-mortem examination the dura mater was found adherent to the cord from the ninth dorsal vertebra downwards, except for a small space in the lumbar region. The cord was found softened in the lower dorsal and lumbar regions. No infective agent could be found, and cerebro-spinal fluid withdrawn during life after the operation had been found sterile. No satisfactory explanation of this state of affairs was arrived at. A second case is reported by Dönitz, in which an old man, æt. 75, with cancer of the penis, died a few minutes after the injection of 13 cgrms. of tropa-cocaine. A very large dose was used here, because a long operation was anticipated for removing the penis

and inguinal glands. The large dose was obviously the cause of death. A third case is reported by Chaput in a patient, æt. 30, suffering from advanced tuberculosis with a large empyema. Two cgrms. of cocaine with 6 of stovaine were injected, and a "total" anæsthesia resulted. The patient suddenly collapsed and died after the empyema had been evacuated. A fourth death is recorded by Schwarz in the case of an old man with a strangulated hernia. The patient was *in extremis* when the operation was performed, and his death was only to be expected.

Of these four deaths, only that recorded by König can be regarded as a death due to spinal anæsthesia as ordinarily carried out. The dose was not high, the patient was young and healthy, and no serious result was to be anticipated. In the cases noted by Dönitz and Chaput, large doses were used deliberately, as likely to cause less risk than general anæsthesia, the patients were extremely ill, and operation under either form of anæsthesia would in all probability have resulted in death. In Schwarz's case the patient was obviously moribund, and nothing could have saved him.¹

Other deaths are mentioned, at second hand, in some of the papers noted below, but the writer has not had access to the actual reports of the cases themselves, and is therefore unable to refer to them in detail.

PARALYSIS OF RESPIRATION.—Four cases of complete temporary paralysis of the respiratory muscles are recorded, all following the use of stovaine. One case is reported by Dönitz, following a dose of 4 cgrms. of stovaine, in which artificial respiration was necessary for five minutes. Two cases are reported by Greiffenhagen, after doses of 8 and 10 cgrms. of stovaine, in which artificial respiration was necessary for twenty and fifteen minutes respectively. One case is reported by Sandberg, where 7 cgrms. of stovaine caused respiratory paralysis requiring artificial respiration for twenty-five minutes.

COLLAPSE.—A number of cases are noted in which varying degrees of collapse followed soon after the injection of tropacocaine or stovaine. These need not be referred to in detail, but it may be noted that every writer who has had much experience of spinal anæsthesia refers to cases of severe collapse as occurring occasionally, while cases of slight collapse are apparently frequent.

SICKNESS, VOMITING, AND INVOLUNTARY DEFÆCATION are also of frequent occurrence, vomiting being especially apt to occur in abdominal operations when viscera are being handled and pulled upon.

¹ It should be pointed out that the papers referred to by the writer take no note of the numerous deaths which occurred when cocaine was used for spinal anæsthesia. The use of cocaine alone has been abandoned for some time, and reference is only made to deaths following modern substitutes for it.

IMPERFECT ANÆSTHESIA.—Even in the most experienced hands, complete or partial absence of anæsthesia occasionally follows the injection. Thus Deetz reports four failures in 126 operations on the lower extremities, and twenty-three failures in 228 abdominal and pelvic operations. Becker reports ten failures in eighty-seven abdominal operations, two failures in thirty-four operations on the lower limbs, no failures in twenty rectal operations. Chaput states that anæsthesia is apt to be imperfect in nervous and timid subjects, while it may even be replaced by hyperæsthesia in alcoholic subjects and in those suffering extreme pain. He records nineteen failures in 309 cases. In Sonnenburg's clinic, eighteen failures were noted in 114 cases where stovaine was used, eight failures out of seventy-eight cases where stovaine-adrenalin was used, and no complete failures in eighty-two cases where novocaine-adrenalin was used. In a paper published some time ago, Dönitz recorded 4 per cent. of failures in over 300 cases. From these records it is obvious that failures occur in a considerable proportion of cases even in clinics where spinal anæsthesia is constantly used, and it should be borne in mind that a failure probably means that several punctures have been made at different levels in the lumbar region, and various pinchings and prickings carried out by the disappointed and zealous anæsthetist to test whether anæsthesia has followed the injections or not. The feelings of the patient cannot, under such circumstances, be pleasant.

AFTER-EFFECTS.—*Headache*.—The most frequent and troublesome after-effect of spinal anæsthesia is severe and persistent headache. Schwarz records its occurrence in 5 per cent. of his last 300 cases. How often it occurred in the previous 700 he does not state. Deetz in 360 cases had fifty cases with headache (eight of them very severe), and in one case the headache lasted more than six weeks. Chaput states that headache is often very severe, without indicating the percentage of cases in which it is to be expected. All recording a number of cases refer to its occurrence, and an estimate that bad headache follows spinal anæsthesia in 10 per cent. of cases is probably a low one. The headache is sometimes accompanied by severe backache and neuralgic pains in the limbs. Various remedies have been tried for the relief of the headache. The most efficacious appears to be the withdrawal of 5 to 10 c.c. of cerebro-spinal fluid by renewed lumbar puncture; but even this often fails to relieve.

OTHER AFTER-EFFECTS.—*Vomiting* and *fever* are occasionally noted, but are not apparently serious or of long duration when they occur. A more serious, though fortunately rare sequel is the occurrence of paralysis of varying extent. König's case, which resulted in death, has already been noted. Trantenroth reports a case in which an almost fatal collapse occurred, followed by violent headache and a partial paralysis of the right leg, lasting more than

two months. Dönitz refers in his paper to two cases of paraplegia of long standing following spinal anæsthesia, recorded by Bosse. Adam and Roeder record respectively one and two cases of sixth nerve paralysis, and other cases have been reported.

Apart from two cases occurring in Sonnenburg's clinic, and reported by him some time ago, no case of infective meningitis caused by lumbar puncture has, so far as the writer is aware, been recorded. When proper precautions are taken, infection can be prevented, and the danger of infecting the spinal canal is so small that it cannot reasonably be urged as an objection to the use of spinal anæsthesia.

After a perusal of the records on which the preceding statements are based, it is difficult to agree with those who claim that spinal anæsthesia is to be preferred to general anæsthesia either in the interests of the patient or the operator. Serious complications attending its use are not infrequent; troublesome sequelæ are common. Its extent and duration cannot by any means known as yet be accurately controlled. Even in the cases where it succeeds perfectly, the great drawback to its use still remains, that the patient is fully conscious during the operation. Were it used only for minor operations such as those suitable for local anæsthesia, this would be of little importance, but for major operations it is, to many, an insuperable objection to the use of spinal anæsthesia. The mortality in the published records is little, if at all, below that attending the use of chloroform, and greater than that attending the use of ether, when these drugs are carefully administered. The unpleasant sequelæ, although possibly less frequent than those following general anæsthesia, are quite as troublesome and distressing to the patient, if not more so. Unless means are discovered to materially lessen its dangers and to regulate more accurately its duration and extent, it seems doubtful whether spinal anæsthesia will retain the popularity which it has in some quarters attained.

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