

HEADACHE AFTER SPINAL ANESTHESIA: EXPERIMENTS WITH A NEW SPINAL NEEDLE *

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IN spite of the progress made in the field of intravenous and nitrous oxide narcosis, spinal anesthesia is probably the most widespread method employed in Sweden, where it has usurped the place of ether narcosis. For example, in Sweden, spinal anesthesia is induced in more than 30,000 cases per year (1), and until such time as an ideal form of narcosis is available, the application of this method is warranted.

In surgical departments that have no anesthetist or in those in which the surgical staff is continually changing, the advantages of spinal anesthesia over other forms of anesthesia are obvious. The anesthetic agent is easy to administer, it usually produces adequate anesthesia with good muscular relaxation, and the entire anesthesia procedure may be attended to before the operation is begun. One great advantage in certain cases is that the patient is conscious and cooperative during the operation. Another feature which makes spinal anesthesia a desirable technic is that it *may* be applied to patients who are not good risks. The reputation of spinal anesthesia has apparently suffered by its having been used for major operations on individuals who are in poor physical condition.

At the Gynecological Clinic, Lund, spinal anesthesia is often employed in cases in which infraumbilical laparotomy and vaginal operations are to be performed. Warnings have been given against the use of this technic for expectant mothers who, according to several workers, are hypersensitive to spinal anesthesia. In cases of auto-intoxication and various types of cancer, the sensitivity is also said to be enhanced. Spinal anesthesia is sometimes avoided in vaginal operations on tissues in which the circulation is abundant, such as the neck of the bladder, owing to the possibility of profuse bleeding. As sensitivity and hypersensitivity to spinal anesthesia obey hitherto unknown laws we deemed it judicious to apply Sebrechts' principle, that is, a biologic dosage of percaïne, the most common drug, administered in repeated injections (4, 5).

Every form of anesthesia has its complications and claims a certain mortality. The adverse features of spinal anesthesia are spinal shock with circulatory and respiratory trouble, or headache following lumbar

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puncture. The dosage of percaine necessary for infraumbilical operations, however, is so small that spinal shock seldom occurs, while headache interferes with the modern practice of shortening the period of postoperative confinement. The occurrence of headache thus has dampened our enthusiasm for the method to a certain extent.

The most often observed and most vigorously discussed complication of spinal anesthesia is postlumbar puncture headache. If the reputation of the method is to be guarded, the recognition of the causes of this undesirable side effect as well as efficacious prophylactic and therapeutic measures are essential. Postanesthesia headache is a common disadvantage of all anesthetic agents and technics (Nygaard: 13 per cent after ether narcosis) (2). No general agreement of opinion, however, has been attained concerning the frequency of headache after spinal anesthesia. Sebrechts contended categorically that headache no longer occurs after this method, while other authors report higher incidences ranging from 30 to 73 per cent. In a large series of cases with brief postoperative confinement Thorsén, of Sweden, (2) found that 24 of every 100 patients had headache, that the incidence was twice as great in men as in women, and that the greatest frequency was in patients under 40 years. At the Gynecological Clinic, Lund, the frequency of headache following lumbar puncture was more than 30 per cent, but this relatively high percentage is probably owing to the fact that the material consisted solely of females, most of whom were under 40 years of age.

The fact that it is a question of two types of headache, as Thorsén (2) has pointed out, one (showing an 80 per cent incidence) with reduced cerebrospinal pressure and the other type (showing a 20 per cent incidence) with elevated cerebrospinal pressure, urges an investigation of the problem. Headache, with reduced cerebrospinal pressure, has been more or less generally accepted as an expression of meningeal inflammation owing to bleeding and so forth, while the genesis of headache with elevated cerebrospinal pressure has not yet been satisfactorily explained. In 1923 Ingvar (2) demonstrated the leakage of fluid as a result of a lesion of the dura, following lumbar puncture. Thorsén, Gordh and others (2) also observed such an escape. Whether this leakage is the principal or subsidiary, primary or secondary cause of reduced cerebrospinal pressure is a controversial question, and a number of other causal factors for reduced fluid pressure have been suggested. The evidence produced by several investigations, however, favors the dural puncture itself and not the anesthetic agent as being responsible for headache following lumbar puncture. On the other hand, it might be argued that headache after suboccipital puncture is not so frequent as after lumbar puncture, a fact suggesting that a positive cerebrospinal pressure and dural defect are obligatory components of the genesis of headache associated with reduced cerebrospinal pressure. This assumption is also in line with Thorsén's conclusion that

the incidence of headache is proportional to the postoperative duration of the head-down position and confinement. Thorsén also found that postlumbar puncture headache disappeared in 75 per cent of the cases after about a week, which is approximately the time necessary for a postlumbar puncture lesion of the dura to heal.

The next question is, how does reduced spinal pressure cause headache? Several explanations have been suggested, for example, dilatation of the cortical blood vessels, modified perivascular pressure in the cortex (3), the drawing of certain pain-sensitive parts in the basal portion of the cranial cavity, and finally, congestion of the cerebrospinal fluid with elevated intracranial pressure owing to obstruction of the foramen occipitale magnum. I am of the opinion that two forms of headache due to reduced fluid pressure in the spinal cord are distinguishable, one with elevated intracranial pressure and one with reduced intracranial pressure.

This theory is supported by the fact that if Queckenstedt's test—compression of veins in the neck causes a rise in the pressure of the cerebrospinal fluid—is performed on patients with a typical headache associated with reduced pressure, some of them will be relieved almost immediately (cases with reduced intracranial pressure) while in other cases the headache will become more intense (cases with preexistent elevated intracranial pressure). The bewildering and contradictory reports in the literature on the good effect obtained in some cases with hypertonic and in others with hypotonic intravenous injections also tend to indicate the occurrence of more than one type of postlumbar puncture headache. Those patients who obtain relief from hypertonic injections presumably have preexisting elevated intracranial pressure and in those patients responding favorably to hypotonic injections the pressure in the whole fluid basin probably is reduced. Bodily position on postlumbar puncture headache also has a similar effect. In some cases the patient feels better as soon as he is in the horizontal position (the intracranial pressure rises at the expense of the cerebrospinal pressure and the leakage is diminished) whereas in other cases, when the headache has once commenced, it will at first persist even if the patient is placed in the head-down position (the obstruction of the foramen occipitale magnum vanishes but slowly). Several patients whom we suspected of having reduced intracranial pressure were, by way of experiment, given $\frac{1}{2}$ liter of water by mouth and they experienced a brief alleviation of the headache (increased venous pressure-increased fluid pressure).

When investigating the etiology of postlumbar puncture headache, the two main types must be distinguished. To measure the cerebrospinal pressure by means of lumbar puncture is injudicious as this is liable to cause further leakage of fluid. The effect of the bodily position on headache associated with reduced cerebrospinal pressure is striking and typical: the headache usually occurs as soon as the patient gets up

for the first time after operation. In many cases the headache increases in severity every time the patient lifts his head. Patients describe their headache as *pressing*, heavy, located to the forehead and around the eyes. It is often attended by a stiffness of the neck, which, however, may occur without the headache. This type of headache responds but very slightly to analgesics.

The less common of the two types, headache associated with elevated cerebrospinal pressure (4 of 131 cases), is of a different nature and is described by the patient as *splitting*. It is unaffected by the position of the body and responds readily to ordinary analgesics. As mentioned previously, this type of headache is usually believed to be ascribed to bleeding or local meningeal inflammation of the punctured region. Pains in the back and conditions reminiscent of dorsal insufficiency are relatively frequent complications after spinal anesthesia (10 of 131 cases) and are presumably also to be attributed to this causal factor.

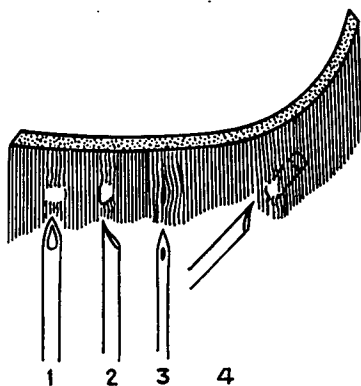


FIG. 1. Dural puncture: 1. Cutting coarse-gauge needle. 2. Same needle, mouth facing one side. 3. Noncutting, fine gauge needle, SJÖVALL design. 4. Tangential puncture.

Since the former type of headache associated with reduced cerebrospinal pressure is a common and troublesome sequel of spinal anesthesia, one is confronted with the question: How is it possible to reduce the severity and incidence of this side effect without undue postoperative confinement of the patient? The problem may be approached from three different angles.

Normalize the Intracranial Pressure.—Intravenous administration of all agents from distilled water to 30 per cent glucose and hypertonic salt solutions have been tried; as a rule these measures produce only transient relief.

Obtund the Pain Receptors.—Here again all feasible pharmacologic agents have been tried but without substantial success although, as pointed out earlier, analgesics have a favorable effect on headache associated with elevated cerebrospinal pressure.

Decrease or Prevent Cerebrospinal Leakage.—Attempts at plugging the puncture in the dura have been described but they seem to be only of theoretical interest and not of practical importance. The significance of the nature of the spinal needle is a controversial question: "No headache after the introduction of a fine needle"—"the gauge of the needle has nothing to do with the headache," and so forth. Observations made at autopsy (2) have shown that thick needles cut a larger number of dural fibers, which are mainly longitudinally arranged, and produce greater leakage, and that less cerebrospinal fluid escapes if the needle is introduced with the beveled edge facing laterally, or if introduced tangentially through the dura.

If the cerebrospinal leakage is believed to be the cause of headache after lumbar puncture, it is logical to use a very fine gauge, noncutting needle of the design we had made at the suggestion of Professor Sjövall. The tapering point of the needle is solid and the mouth is situated on the conic surface about 2 mm. from the actual tip of the needle. The object of the design was to provide a needle that might be introduced like an awl, forcing its way through the dura by pressing the fibers apart without cutting them so that the hole would close by itself on withdrawal of the needle. Moreover, by applying the technic in which use is made of the minor degree of negative pressure in the epidural space to determine whether the point of the needle is in the space, and in which the stilet is removed and the needle is filled with fluid so that the drop at the hub end of the needle is sucked in by the negative pressure, it was easy to locate the epidural space and thus avoid unnecessary dural lesions.

We tried the needle in the following manner. At the Gynecological Clinic, Lund, where brief postoperative confinement is the rule, spinal anesthesia was induced in 131 cases, all except 7 with percaïne, and 12 with intravenous or nitrous oxide anesthesia. The first few days after operation as well as on discharge all patients were questioned concerning any discomfort they might have felt after operation.

The occurrence of postoperative syndromes alone renders it difficult to evaluate headaches and their genesis after operation, and I thought that a follow-up examination by correspondence would not give satisfactory or reliable information. On the day of discharge some of the patients had already forgotten the intense headache they had had a week before. Patients were questioned concerning the history of earlier headaches, migraine, and so forth, but no relationship between such affections and postlumbar puncture headache could be discerned. Eye symptoms alone were not observed in this material. Vertebral

TABLE 1
INCIDENCE OF HEADACHE FOLLOWING SPINAL ANESTHESIA

	Number of Cases	Headache*			Per Cent	Headache**
		Slight†	Severe‡	Total		
Ordinary, cutting spinal needle	77	11	14	25	32, 5 ($\pm 5, 4$)	3
Sjövall's spinal needle	54	5	0	5	9, 3 ($\pm 4, 0$)	1

* Headache associated with reduced cerebrospinal pressure.

** Headache associated with elevated cerebrospinal pressure.

† Disappears after 3 or 4 days, does not confine the patient to bed.

‡ Still present at time of discharge (6 or 7 days after operation), has confined the patient to bed.

difficulty was recorded in 10 cases (8 per cent). A conspicuous feature was loss of appetite during headache.

In 77 cases spinal anesthesia was performed with a spinal needle of the ordinary type (beveled cutting point and stilet) and in 54 cases with noncutting fine gauge needle of Sjövall's design. The incidence of headache is apparent from table 1.

By using the new type of needle the incidence of headache associated with reduced cerebrospinal pressure in this small number of cases was reduced by about two-thirds which thereby makes spinal anesthesia a more attractive method. In cases in which we believed the headache to be due to reduced cerebrospinal pressure we also tried injections of nicotinic acid (sodium salt in 1.15 per cent solution, 10 ml. intravenously), and as a rule substantial although transient relief was obtained. Nicotinic acid seems to be definitely superior to remedies hitherto tried.

SUMMARY

Pending the ideal method of anesthesia and the presence of trained anesthetists at operations, spinal anesthesia must be considered a good method. With the use of small doses of percaïne in infra-umbilical operations, for example, spinal shock is very rare, the only complication of practical significance being postlumbar puncture headache, particularly because it prolongs postoperative confinement of the patient. There are two kinds of such headache, one appearing in association with negative pressure in the entire fluid basin, the other, with positive pressure in the cranium on account of a stoppage of the foramen occipitale magnum. These two types are distinguishable by their reactions to Queckenstedt's test and are treated with hypotonic and hypertonic injections respectively. In cases in which negative intracranial pressure was believed to be present, I obtained better results with the injection of nicotinic acid. The cause of postlumbar headache in association with a negative pressure in the fluid basin is leakage of the

cerebrospinal fluid and may be best avoided by the employment of non-cutting, fine-gauged spinal needles. The use of such needles at the Gynecological Department, Lund, has reduced the frequency of this type of headache from 32.5 per cent to 9.3 per cent in 131 cases of spinal anesthesia.

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ANNUAL MEETING OF THE AMERICAN MEDICAL ASSOCIATION

ATLANTIC CITY, NEW JERSEY—JUNE 11-15, 1951

SCIENTIFIC EXHIBITS

The Scientific Exhibits on anesthesiological subjects which will be presented at the Annual Meeting of the AMA in Atlantic City are listed below:

Intra-arterial Infusion.

Doctors Edward B. Tuohy and William H. L. Dornette, Georgetown University Hospital, Washington, D. C.

Preoperative and Postoperative Respiratory Studies.

Doctors Carl S. Hellijas and Robert T. Maurer, Hartford, Conn.

Routine Endotracheal Anesthesia for Tonsillectomies and Adenoidectomies.

Doctors Seymour Schotz, Richard W. Garlicks and Elizabeth Anderson, Presbyterian Hospital, Philadelphia, Pa.

Management of Intractable Head Pain by Cervical Plexus Block.

Doctors John Adriani and Paul Pentecost, Charity Hospital and Louisiana State University School of Medicine, New Orleans, La.

Trichlorethylene in Clinical Practice.

Doctor C. R. Stephen, Duke Hospital, Durham, N. C.

Continuous Lumbar Epidural Anesthesia.

Doctors F. Paul Ansbro, Francis S. Latteri and Benson Bodell, Brooklyn, N. Y.

Curare Antidotes—The Anticurare Action of Some Neostigmine Derivatives.

Doctors Lloyd D. Seager and Edwin L. Rushia, University of Arkansas School of Medicine, Little Rock, Ark.

(Continued on page 339)