THE USE OF PERIDURAL AND SUBARACHNOID INJECTIONS OF SALINE SOLUTION IN THE TREATMENT OF SEVERE POSTSPINAL HEADACHE *

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Received for publication March 24, 1949

Following spinal and continuous spinal anesthesia for surgery and following saddle block analgesia for obstetrics, severe postlumbar puncture headache is the most annoying complication from the standpoint of both patient and physician. The headache is characteristic in that it is invariably aggravated by sitting or standing, and is relieved by lying down. The incidence is usually around 20 per cent as reported by various authors (1, 2, 3). Underwood (4) reported an incidence of 19 per cent of incapacitating headache following diagnostic lumbar puncture performed with a 22-gauge needle in 500 cases. He found no reduction in the incidence when the patients were kept at bed rest following the puncture. These headaches may be mild, regressing within one or two days, or they may be prolonged, severe, and resistant to therapy. It is toward this latter type that we have directed our attention.

Besides the constant relationship to body posture, certain other aspects of the headache have been noted. The onset varies from an hour or so to several days following lumbar puncture. The location is often occipital or bifrontal, but may be any place within the calvarium. Other variable features include nuchal rigidity, aggravation of headache by rapid head-shaking or jugular compression and partial alleviation by compression of the common carotid artery, or compression of the abdomen manually or with binders (5). Explanation of the pathologicophysiologic factors responsible for the headache should account for these findings. MacRoberts (6) (1913) suggested that the headache might be due to leakage of cerebrospinal fluid through the puncture wound. In 1923 Jacobaeus and Frumerie (7) reported 2 cases of severe postspinal headache in which manometric studies revealed a lowered cerebrospinal fluid pressure; they restored the pressure to normal values by subarachnoid injection of


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fluid with relief of headache. They concluded that the lowered pressure was due to leakage of the fluid. Their findings have been repeatedly confirmed by many authors (1, 2, 3, 8). Nelson (3) confirmed the work of Jacobaeus and Frumerie and added another link to the chain of evidence by examining the lumbar meninges of a patient who died eleven days after a diagnostic lumbar puncture. He found a tract penetrating the meninges, presumably from the spinal needle. Even more conclusive evidence that a leakage does occur was found by Pool (9) as an incidental observation while performing myeloscopic examination on living patients. He stated: "The myeloscope has frequently revealed large collections of epidural fluid when ordinary lumbar puncture has been done within the previous two to four days. This demonstrates that leakage of spinal fluid can continue for some time after ordinary lumbar tap." We have confirmed this observation of Pool by finding fluid in the peridural space in 3 of our patients. Kunkle, Ray and Wolff produced immediate headaches similar, if not identical, to the usual lumbar puncture headache by draining cerebrospinal fluid from normal human subjects. They also studied 9 cases of headache resulting from ordinary lumbar puncture, comparing the characteristics of these with the "drainage" headaches. It was their suggestion that a diminished cerebrospinal volume results in dilatation of and traction on pain-sensitive intracranial vascular structures. They concluded that lumbar puncture headache is probably secondary to a prolonged leakage of fluid.

Pickering (11) studied 11 cases and concluded that the primary cause of headache following lumbar puncture is a diminution of volume of cerebrospinal fluid of the order of 30 to 50 cc. He relieved the headache in 100 per cent of cases by subarachnoid injection of fluid to restore the pressure, but stated that it returned usually within one or two hours. Ahearn (1), on the other hand, treated 14 patients who had severe, postspinal headache with intrathecal injections, and reported more favorable results. Five had "immediate and complete cures. Eight had return of headache from a 10 to 30 per cent degree for one to three days." One patient had full return of symptoms.

Pickering agrees with Kunkle, Ray and Wolff that the shrunken cerebrospinal fluid volume probably results in a compensatory dilatation of the vascular channels of the central nervous system, largely cerebral, and a "falling in" of the dura mater of the spinal tube, this being less rigidly fixed than the dura of the cranium. These changes produce a shift of the neuraxis relative to its coverings thus distorting the meninges and initiating the headache. The efficiency of the cerebrospinal fluid system as a "shock-absorber" mechanism is lowered and when the person assumes an upright position the weight of the brain produces tension on the tentorium and meningeal structures particularly about the base of the brain. Rapid shaking of the head would be expected to produce abnormal deformation of the supporting
meningeal structures by the same mechanical effect. Compression of the jugular veins, by further increasing venous engorgement within the cranium, would be expected to aggravate the pain, unless compensated by a concomitant rise in cerebrospinal fluid pressure. Carotid artery compression should decrease the amplitude of pulsation of the vessels of the circle of Willis, tending to decrease painful stimuli. The relief observed on abdominal compression may very well be the result of compression of the inferior vena cava, with consequent engorgement of the peridural and meningeal veins of the spine. This would be expected to result in a relative increase of the vertebral cerebrospinal fluid pressure, and tend to prevent the shift of the brain caudad.

At the suggestion of Dr. Robert A. Hingson we instituted peridural injection of saline solution to produce a splinting "head of pressure" in the peridural space, attempting to prevent leakage through the subarachnoid-peridural fistula long enough for a fibrin seal to occlude the aperture. Our first patient was treated on September 7, 1948; the response was instantaneous and permanent.

Case 1.—A white woman, age 15, primigravida, was delivered under low spinal anesthesia on August 25, 1948, by elective low forceps after a five and a half hour labor. She was discharged on the third postpartum day asymptomatic and in good condition. On the following day a severe frontal headache and soreness of the neck muscles developed which were aggravated by movement of the head and were absent when she lay down. These symptoms persisted for thirteen days and were of such intensity that she was unable to carry on her household activities. On September 7, 1948, she was readmitted for therapy. A plastic catheter was inserted into the caudal canal and an initial dose of 30 cc. of saline solution injected into the peridural space. Ten minutes later the patient was allowed to get up and she volunteered the information that her headache was entirely gone. She was given an additional 30 cc. of saline solution through the catheter one hour later and sent down to the ward. Her relief was complete and permanent. The catheter was removed on the following day, no further injections being needed.

Since that time we have studied this method, using both indwelling continuous caudal and peridural catheters and also single injections into the lumbar peridural space through an ordinary spinal needle. A total of 22 patients have been treated with promising results. Tables 1 and 2 summarize data concerning puncture and headache, and table 3,
Table 2

<table>
<thead>
<tr>
<th>Av. Onset Postoperation Days</th>
<th>Severity</th>
<th>Predominant Location</th>
<th>Neck Soreness Present</th>
<th>Aggravation on Standing or Sitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8</td>
<td>12</td>
<td>9</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Lumbar Peridural</th>
<th>Caudal</th>
<th>Immediate Relief</th>
<th>Complete Relief-No Return</th>
<th>Slight Return Symptoms Mild</th>
<th>Procedure Worth While</th>
<th>Av. Amount Normal Saline Solution Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>10</td>
<td>21</td>
<td>10</td>
<td>12</td>
<td>22</td>
<td>82 cc.</td>
</tr>
</tbody>
</table>

treatment. With one exception dramatic relief was obtained within a matter of three to five minutes. The patient who was the one exception had relief after approximately two hours. Ten had no return whatsoever and were considered cured by the procedure. The remainder were benefited greatly but had slight return of symptoms, usually after eighteen to twenty hours. Two mechanisms appear to be at work in this procedure: compression of the spinal dura by fluid in the peridural space, with increase of spinal subarachnoid pressure, which gives the immediate relief observed, and increased peridural pressure with cessation of the flow of the fluid through the needle puncture sufficiently long to allow the reparative processes to occlude the fistula. That injection of fluid peridurally does elevate subarachnoid pressure was demonstrated in one patient. A needle was inserted into the subarachnoid space and a spinal manometer attached. Another needle was then inserted into the peridural space one interspace lower. Ten cubic centimeters of normal saline solution was injected into the peridural space. A prompt rise of approximately 100 mm. pressure was observed in the manometer. The pressure then fell slowly over a period of about one minute to a level 30 mm. above the original reading. This phenomenon was repeated with the injection of each 10 cc. of saline solution, about 30 mm. pressure being gained each time. It would be extremely interesting to know the time interval between the injection of fluid into the peridural space and its complete absorption.

Our studies were particularly interesting in view of the recent illuminating reports by Ahearn (3). Indeed, we had occasion to test his results on one of our more resistant cases, in which only partial relief was obtained from caudal injection of saline solution.

Case 2.—A 31-year-old primigravida was delivered on November 25, 1948, under saddle block anesthesia after a normal labor of seven hours. Forty-eight hours later she noted a moderately severe headache which was worse in
the occipital region and was associated with neck soreness. This was mild for three days but became very severe on the night of November 30, 1948. The patient would lie still in bed and complain of pain on the slightest activity. On December 2 a caudal injection of saline solution was given with almost complete relief after 100 cc. had been injected over a period of three and a half hours. On December 3 an additional dose of 20 cc. was given and the patient said that her headache was 70 to 80 per cent relieved. The catheter was removed. However, her relief was temporary. A catheter was then placed in the subarachnoid space and as a therapeutic measure, 15 cc. of spinal fluid containing red blood cells was withdrawn. This accentuated the headache to intolerable proportions. The immediate reinjection of 25 cc. of saline solution promptly relieved all her symptoms. On December 4 her symptoms were still present, so 20 cc. of saline solution was injected into the subarachnoid space. The patient noted almost complete relief. This was repeated on the following day and the patient stated that she felt 50 per cent better. On December 6, 1948, she was comfortable at rest and the next day the catheter was removed. The remaining symptoms steadily disappeared and the patient had no further trouble.

The amount of saline solution injected into the peridural space varies greatly with the individual patient treated. The average total dosage in our series was 82 cc. Our general schedule when using the catheter method of administration consists of an initial dose of 20 cc. to 30 cc. The patient is then allowed to sit up and the usual result is that the headache is completely gone. The patient is then rechecked in one hour. Often slight discomfort will again be present at this time, and an additional 30 cc. is injected. In a number of our cases this has been all that is required to cure the headache. The catheter is left in place, however, taped to the patient’s side and the distal end closed.
with a sterile Luer-Lok cap. On the following day the patient is examined and questioned again as to discomfort. Further injections are given if needed. In only the most stubborn cases was this found necessary.

If the mechanism of production of postspinal headache depends upon leakage of spinal fluid, it would seem reasonable that the size of the puncture of the dura is of prime importance. This was pointed out in 1925 by Alpers (2). Recently, Mr. Oscar Schwietersky suggested the use of a very fine needle passed through a more rigid sheathing needle for support as far as the peridural space. We have used an ordinary 20-gauge caudal needle, inserting it to the peridural region. Through this is passed a number 24 spinal puncture needle for the actual entry into the subarachnoid space. These needles are shown in figure 1. Since the institution of this technic as a routine in saddle blocks and low spinal anesthesias in obstetrics, a reduction in the incidence of postlumbar puncture headache has been noted on this service.

Summary and Conclusions

There is good evidence in support of the "leakage" theory as the primary cause of postspinal headache:

A patent needle tract through the dura has been demonstrated at autopsy eleven days after lumbar puncture.

Myeloscopy has revealed accumulations of fluid in the epidural space two to four days after lumbar puncture.

The cerebrospinal fluid pressure (and probably volume) is generally lowered in patients with postspinal headache.

The headache can be relieved immediately by subarachnoid injection of fluid in amounts up to 50 cc.

It can be relieved temporarily by abdominal compression.

The headache can be relieved, and frequently cured, by peridural saline injection.

Twenty-two patients with typical, severe, postspinal headache were treated by peridural saline injections with gratifying results.

Peridural injection in our opinion, is preferable to subarachnoid treatment since it obviates repuncturing dura.

A technic for prevention of headache by the use of a 24-gauge spinal needle is outlined.

Further clinical trial of these technics is indicated.

References

COMMUNICATION FROM THE AMERICAN BOARD OF ANESTHESIOLOGY, INC.

Received for publication November 25, 1949

The officers of this Board, elected at the annual meeting in Denver, Colorado, October 19, 1949, are:

Charles F. McCuskey, M.D., President.
R. J. Whitacre, M.D., Vice President.
Curtiss B. Hickcox, M.D., Secretary-Treasurer.

During this meeting, Dr. Ralph M. Tovell, representing on the Board the Section on Anesthesiology of the American Medical Association, resigned and, as provided for in our Constitution, Dr. Stuart C. Cullen was elected to complete the term, which will terminate on December 31, 1951.

Dr. R. J. Whitacre was elected to a full term as representative from the American Society of Anesthesiologists, Inc., to serve to December 31, 1955. At this meeting, the following changes covering applications were made:

1. The fee will become $125 as of January 1, 1950, to be paid in two instalments if so preferred, $50 with the application and $75 upon completion of requirements for the written examination.

2. An additional fee of $15 will be required for an additional examination in any Part, for candidates applying after January 1, 1950.

3. Applications must be filed with the Secretary at least six months prior to the date of examination.

4. Written examinations will be held only once a year hereafter, on the third Friday of each July.

5. Oral examinations will be held in April and October each year.

Curtiss B. Hickcox, M.D.,
Secretary-Treasurer