ETIOLOGY AND TREATMENT OF POSTSPINAL HEADACHES

JOHN E. KRUEGER, M.D., V. K. STOEITING, M.D., AND J. P. GRAF, M.D.

Indianapolis, Indiana

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Postspinal headache constitutes one of the commonest objections to the use of spinal anesthesia. This postoperative complication, although relatively benign in its effect on the patient’s general condition, may be distressing enough to keep an active patient confined to bed for several days.

Lumbar puncture headaches have been recognized for many years and there have been many conflicting reports and theories about the cause of this complication. Sicard (1) stated in 1902 that they were caused by leakage of cerebrospinal fluid, but this theory is still not universally accepted. This is the most logical and encompassing theory, however, since it explains most of the observed facts about these headaches. The excellent and thorough studies of Thorsén (2) are quite convincing that postpuncture leakage of cerebrospinal fluid is the main cause of postspinal headaches.

Spinal fluid may actually leak out of the subarachnoid space following dural puncture. Thorsén (2) has demonstrated at postmortem examination and at laminectomy on living patients the existence of persistent dural puncture holes following lumbar punctures. He also demonstrated that lampblack injected subarachnoidally could later be found extradurally. Neurosurgeons frequently find extradural collections of fluid on doing laminectomies following diagnostic lumbar punctures. Greene (3), in 1926, demonstrated that the dural fibers run predominantly lengthwise and that a beveled needle causes more leakage if inserted across the line of the fibers than if it is inserted parallel to them. Thorsén (2) stated that most patients (84 per cent) with postural postspinal headaches have a hypotension of the cerebrospinal fluid.

Antoni (4), in 1923, suggested the use of a smaller lumbar puncture needle in order to decrease the leakage of the spinal fluid and thus reduce the cause of postspinal headache. The small needle required a refinement of technic since it was placed through a larger caliber introducer which led only into the extradural space.

Greene et al. (5), in 1949, presented an excellent study of this factor and reported an amazing reduction in the incidence of headache by

* From the Department of Anesthesiology, Indiana University Hospitals, Indianapolis, Indiana.

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using 24 and 26 gauge needles. They reported even further reductions of headaches by careful attention to the hydration of the patient with emphasis being placed on adequate water intake plus the use of the antidiuretic property of postpituitary extract.

Thorsén (2) has demonstrated that there is a direct causal relationship between early ambulation and incidence of headache. This is predicated on the increase in lumbar spinal fluid pressure in the upright position, thus causing more leakage through a puncture hole that has not yet sealed.

This report concerns a study now being conducted on all patients receiving spinal anesthesia at the Indiana University Medical Center. An effort is being made to lower the incidence of postspinal headaches and hence to make this type of anesthesia more acceptable for cases in which it is indicated.

During the first nine months of the study, data were collected on 673 patients receiving spinal anesthetic agents. An attempt was made to correlate the incidence of headaches with the age of the patient, type of surgical procedure, anesthetic drug, size and shape of needle, level of skin anesthesia, trauma in performing the tap and the mental attitude of the patient.

The anesthetic drugs used were procaine, metycaine, pontocaine and nupercaine. During the series, at least four different types of needles were used to make the dural tap. The patient's course was followed closely after operation and all complaints of headache were carefully checked. Care was taken to avoid suggesting to the patient that he might have a headache. Headache was found to be a common postoperative complaint in patients having had either spinal or general anesthesia. Changes in intensity of the headache with positional change of the patient was the final criterion for determining whether or not the headache was postspinal in nature. All headaches which were initiated or intensified by the upright position and were partially or completely relieved by a flat or Trendelenburg position were considered to be of the postspinal type. Postspinal headache is usually viselike or throbbing in character and may be localized frontally, orbitally or occipitally. Many patients complained of pain below the occiput. These individuals usually thought this type of pain was muscle strain or myositis. The headache developed during the first three or four days and did not always appear immediately when the patient assumed an upright position. It usually took from two hours to two days for postspinal headaches to develop after the patient assumed the upright position.

Results

The incidence of headaches in this series of patients was 10.7 percent or 72 headaches in a total of 673 anesthesias. The following charts and figures show the apparent influence of several factors on the incidence of headaches:
**TREATMENT OF POSTSPINAL HEADACHES**

### Headaches per 100 Patients of Each Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Headaches per 100 Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 20 yrs. 86 Pts</td>
<td>14.0</td>
</tr>
<tr>
<td>20-35 yrs. 381 Pts</td>
<td>13.1</td>
</tr>
<tr>
<td>36-50 yrs. 79 Pts</td>
<td>8.8</td>
</tr>
<tr>
<td>Over 50 yrs. 127 Pts</td>
<td>2.4</td>
</tr>
</tbody>
</table>

**Fig. 1.**

*Age.*—There appears to be an inverse relationship between age and postspinal headache (fig. 1). The greatest incidence of headache occurred in patients under 35 years of age.

*Type of Surgery.*—There was a much higher incidence of headache in obstetrical patients than in patients having general surgical procedures (fig. 2).

The difference in the incidence of headaches in the two groups may be explained by the following factors:

1. The general surgery group includes many poor risk patients who are bedfast for several days after operation, thus decreasing early leakage of spinal fluid.

### Headache Incidence & Type of Case

<table>
<thead>
<tr>
<th>Type of Case</th>
<th>Headaches per 100 Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>OB. Cases 383</td>
<td>13.8%</td>
</tr>
<tr>
<td>General Surg. 290</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

**Fig. 2.**
2. The use of narcotics and analgesics in patients having general surgical procedures might be expected to dull any headache that might be present.

3. The operative pain, general malaise and lack of cerebral acuity from arteriosclerosis, all help to prevent a postspinal headache from being noticed or reported. These factors are not so prevalent in obstetrical patients as in patients who have general surgical procedures.

4. Most of the general surgery patients received 5 per cent dextrose in distilled water intravenously in the operating room (such is not the case with our obstetrical deliveries) and fluid balance was checked on the wards, so that dehydration did not occur.

Trauma.—Faulty technic in performing the lumbar puncture is a causative factor in many patients who have postspinal headaches. An attempt has been made to correlate traumatic lumbar punctures with the incidence of postspinal headaches. Any undue trauma consisting of more than one dural tap, a bloody tap or a puncture which elicited paresthesias was recorded. The latter two were included because a second spinal puncture was done before the drug was injected. In this study, traumatic spinal punctures produced a 70 per cent increase of postspinal headaches.

In figure 3 the increased incidence of postspinal headaches following traumatic punctures is compared with the incidence following atraumatic taps.

Needle Size.—Many authors have reported a definite inverse relationship between the size of the needle and the incidence of postspinal headache. They have advocated the use of smaller gauge needles to decrease the chance of postpuncture leakage of fluid. When using these smaller needles, however, a more complicated technic is necessary. A number 24 gauge needle or smaller requires an introducer to form a pathway down to or through the ligamentum flavum. Whitacre (6) has introduced a special spinal needle that can be used without an introducer. This number 20 gauge needle has a tapered point with the orifice appearing on the side of the shaft above the point.
The point spreads the dural fibers rather than cutting them as might occur with the regular beveled spinal needle.

Figure 4 shows the incidence of headaches occurring with various sized needles in this study. The significance of this variation is even more marked when the incidence of headaches is reviewed in the obstetrical group.

The Whitacre needle was used only in the obstetrical patients. There was a significant reduction in postspinal headaches when this needle was used.
Influence of Apprehension on Incidence of Headache

<table>
<thead>
<tr>
<th>Apprehensive Patients</th>
<th>79</th>
<th>13.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable Patients</td>
<td>594</td>
<td>9.9%</td>
</tr>
</tbody>
</table>

FIG. 6.

No significant relationship was evident between the drug used and the number of postspinal headaches.

Level.—The level of analgesia did not produce any significant changes in the number of postspinal headaches.

Fear.—Many workers believe that a psychological element contributes to the incidence of postspinal headache. It was noted during this study that many patients on the same ward simultaneously complained of postspinal headaches. At other times many weeks elapsed before any patients complained of this complication. In an attempt to ascertain whether mental attitude might play a part, our staff recorded whether or not a patient was apprehensive or feared a spinal anesthesia. The results, while not markedly significant, showed some correlation between postspinal headaches and the mental attitude of the patient. This correlation may perhaps be the result of a lower pain threshold in the anxious patient.

TREATMENT

Many forms of treatment have been advocated for the relief of postspinal headache including the use of vasopressors, vasodilators and various solutions of varying tonicity. Many of the recent reports have emphasized the importance of maintaining fluid balance with a slight positive load of water in order to prevent postspinal headaches. Weed (7) (1919) and Cushing (8) (1920) reported that the addition of a hypotonic solution to the body, whether intravenously or by way of the gastrointestinal tract, increased the cerebrospinal pressure. An hypertonic solution decreased the volume and pressure of the cerebrospinal fluid.

Reese (9), in 1936, reported a technic for complete drainage of spinal fluid in various myopathies with replacement of the fluid by intravenous administration of hypotonic saline solution. In the present study the following regimen has been used in 37 patients suffering from postspinal headaches. An intravenous infusion of 500 to 1000 cc. of 5 per cent dextrose in 0.45 per cent sodium chloride containing
100 mg. of nicotinic acid was given intravenously.† Nicotinic acid was used to act as a peripheral vasodilator and increase the blood flow through the choroid plexus. It was thought that this might stimulate faster formation of cerebrospinal fluid. The patient was kept flat in bed for a period of twelve hours in order to decrease the pressure of cerebrospinal fluid at the site of the puncture in the dural sac. The first 4 or 5 patients were kept in about 15 degrees Trendelenburg position for twelve hours, but because of the extreme discomfort of this position it was discontinued and the patient was kept flat. The treatment was repeated in 3 cases but in all of the others a single treatment was given. The results obtained were classified as follows: poor if the patients showed no improvement in the postspinal headaches; fair when the headache was stopped or relieved, but recurred before the patient left the hospital; good if the headache was permanently re-

<table>
<thead>
<tr>
<th>Average Duration of Treated and Untreated Headaches</th>
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<tbody>
<tr>
<td>Av. Duration of Treated Headaches 39</td>
</tr>
<tr>
<td>2.3 Days</td>
</tr>
<tr>
<td>Av. Duration of Untreated Headaches 38</td>
</tr>
<tr>
<td>4 Days</td>
</tr>
</tbody>
</table>

Fig. 7.

lied, but not stopped immediately and excellent if the headache disappeared after treatment and did not recur. Of the patients receiving this treatment 6 were classified as obtaining poor, 6 fair, 8 good and 17 excellent results.

Figure 7 shows the average duration of postspinal headaches in untreated patients as contrasted with patients receiving the treatment.

It is obvious that the infusion of hypotonic solution had some beneficial effect in terminating these headaches. It should be pointed out that in most of the patients treated the headaches were of a severe nature, while the untreated group included many with mild headaches. This fact makes the results even more significant.

† The 5 per cent glucose in 0.45 per cent saline solution was furnished by the Baxter Laboratories, Inc., Morton Grove, Illinois.
Comment

Postspinal headaches are related directly to the leakage of cerebrospinal fluid through the dural puncture hole. If the rate of fluid loss exceeds the rate of formation, postspinal headache may be expected to appear. The various measures taken to prevent or cure such headaches are based on this fact. The use of smaller needles, care in performing the tap, inserting the beveled needle parallel to the dural fibers and keeping the patient flat are all measures which have been used to decrease rate of leakage. Adequate hydration of the patient is necessary to provide a store of "free-water" on which the choroid plexus can draw to form new spinal fluid to replace that lost by leakage. If the rate of formation of fluid can be stimulated to the point where it equals the loss, no true postspinal headache will appear.

Working on this principle, we are now preparing a report on the incidence of headaches following the use of the Whitacre pencil-point needle plus enforced hydration of the patient by increased water intake and the antidiuretic principle of posterior pituitary extract. This regimen is used during the first three postoperative days, when the dural hole is relatively fresh and more spinal fluid leakage may be expected.

Summary

The relationships between the incidence of postspinal headache and age of patient, type of surgery, anesthetic drug, size and shape of needle, level of skin anesthesia, trauma in performing the tap and the mental attitude of the patient are given.

A simple but effective method for treating postspinal headache is described.

Postspinal headaches are directly related to the leakage of cerebrospinal fluid through the dural puncture hole, and occur when the rate of leakage of the fluid exceeds its rate of formation.

References

6. Whitacre, R. J.: From an Address given before the Anesthesia section of the Indiana State Medical Association, Indianapolis, Indiana, April, 1950.

INTERNATIONAL CONGRESS OF ANESTHESIOLOGY

An International Congress of Anesthesiology, organized by the French Association of Studies on Anesthesia and Anesthesiology, under the patronage of the Council on Coordination of International Congresses of Medical Sciences, will be held in Paris, September 20-22, at the Nursing School of La Salpêtrière, 47 Boul. de l'Hôpital. The congress will be open to all persons interested in anesthesia. The scientific program includes:

Graphic Recording of Physiological Functions in the Course of Anesthesia, by M. Cara, Paris.

Natural Curare Derivatives, by M. Van de Walle, Louvain.

Synthetic Curare Compounds; Theoretical Report; Clinical Applications, by M. Bovet, Rome, and M. Huguenaud, Paris.


Information as to registration may be obtained from the Office of the Secretary of the Congress, 12, Rue de Seine, Paris 6e, France.