1956

Prevention and treatment of spinal headache

Jesse Crump
University of Nebraska Medical Center

THE PREVENTION AND TREATMENT OF SPINAL HEADACHE

Jesse Crump

Submitted in Partial Fulfillment for the Degree of
Doctor of Medicine

College of Medicine, University of Nebraska

April 2, 1956

Omaha, Nebraska

TABLE OF CONTENTS

THE PREVENTION AND TREATMENT OF SPINAL HEADACHE

INTRODUCTION

The use of lumbar puncture for spinal anesthesia and for diagnostic purposes is routine today. However, in a certain percentage of lumbar punctures complications occur, and of these, headache is one of the most common and one of which the patient is most aware and most fearful. A spinal headache may be defined as a moderate to severe headache which occurs several hours to several days after a lumbar puncture and as a result of it. These headaches may last for a few hours or a few days or rarely for a period of months. They are distinctly different from the usual postoperative headache. It is the purpose of this paper to review some of the methods used in the prevention and treatment of the spinal headache.

HISTORY

Wetchler and Brace (1) have reviewed the development of spinal anesthesia. Quinke first described a technique of lumbar puncture in 1891. This same year Bier and Tuffer using spinal anesthesia for surgical procedures first recorded spinal headache as a complication of lumbar puncture. In 1901 Tuffer

reported an incidence of spinal headache of 40% in a series of 60 patients receiving spinal anesthesia for surgery. The most satisfactory treatment of these cases was a head down position..

Torsen (2) in a summary of 50,000 cases in 1947 reported an incidence of spinal headache of 18%.

Kaufman (3) summarized the reports of 29 workers and 93,409 cases over a period of 45 years prior to 1950 and found an average incidence of spinal headache of 11.5%.

The incidence of headache has been found to be generally higher in young people and in obstetrical patients than in others.

CAUSES OF PAIN IN ALL TYPES OF HEADACHE

Wolff (4) lists six basic mechanisms for the cause of pain in headache:

1.. Traction on, or displacement of, the venous sinuses or their contributing veins;
2. Traction on the middle meningeal artery;
3. Traction of the large arteries at the base of the brain and their main branches;
4. Distention and dilatation of the intracranial arteries;
5. Inflammation involving the pain-sensitive structures at the base and the convexity of the brain;

6. Direct pressure on the cranial and cervical nerves.

According to Franksson and Gordh (5) and McGoogan and Horner (6), the first four mechanisms can produce a typical type of headache described as "band like" pain, often dull and persistent. The fifth mechanism characteristically produces a headache described as "splitting" according to Franksson and Gordh (5). Kunkle (7) and Shumacher (8) believe that the sixth mechanism promarily produces pain referred to the areas supplied by the respective nerves.

Dripps and Vandam (9) have tried to explain the variability in incidence of headaches in young and old people. They feel that the following mechanisms must, to a great extent, determine why some people get spinal headaches and some do not:

1. There is a relative insensitivity to pain in some individuals. The pain threshold may vary enough so that pain sufficient to cause headache in one person may not disturb another. Numerical reduction in the number of pain fibers in any given area is seen in older people and this may be important in the reduced incidence of headache reported in older people.

2. Downward displacement of the brain may spare sensitive structures in some individuals.
3. Prompt sealing of the dural opening may occur through arachnoid herniation or fibrinous coagulum.
4. Spinal fluid leakage may be slow enough so that the choroid plexus can maintain a normal volume of spinal fluid..

TYPES OF SPINAL HEADACHE

Spinal headaches are usually one of two distinct types although a mixture of the two types may be seen. The most common type of spinal headache is the hypotensive type while the hypertensive type is less frequently seen.

The hypotensive type of headache is associated with lowered spinal fluid pressure in most cases; hence the name. This type of headache has the characteristic "band like" pain associated with traction and displacement of pain sensitive structures in the head or dilitation and distention of intracranial arteries according to Franksson and Gordh (5) and McGoogan and Horner (6) and Kunkle (7). This is the type of headache known classically as "spinal headache" and is the one most feared by patients and doctors after

lumbar puncture.

Torsen (2) describes the headache as bilaterally identical and usually located behind the eyes and across the forehead. It may extend to the occipital region and into the neck. Patients with mild cases of headache may complain of a heavy, compressing sensation. The pain is dependent upon body position, being increased with the head raised and alleviated with the head lowered. The pain does not respond to analgesics or sedatives. In patients with severe cases, stiff neck, nausea and vomiting, dizziness, scotomata and cranial nerve pareses may be seen.

Torsen reports that 80% of cases with this type of headache show lowered spinal fluid pressure on repeat lumbar taps. Kunkle (7) states that an identical type of headache may be experimentally produced in human subjects by withdrawal of spinal fluid with the subject in the upright position. The headache may then be abolished by restoration of the spinal fluid.. They have found this headache dependent more upon spinal fluid volume than intracranial pressure. Franksson and Gordh (5) have shown that the dural puncture may remain patent for two weeks or longer after lumbar puncture. At the same time they demonstrated that the

normal negative epidural pressure often becomes positive after lumbar puncture, presumably from leakage of spinal fluid into the epidural space. Torsen (2) found frequent examples of collapsed dural sacs with patent dural holes at the site of lumbar puncture on autopsies of patients who had received lumbar punctures up to eleven days previous to their death. In all of these cases the cause of death was not related to the lumbar puncture.

The loss of spinal fluid produces headache through resultant venous distention and brain "sag" according to Kunkle (7) and Dripps and Vandam (9) and most other authors.. The venous distention and brain "sag" produce traction on, or displacement of, the pain sensitive structures in the head to cause the headache. The venous distention and brain "sag" are increased with the head elevated to produce intensification of the pain. The mechanism of brain "sag" also explains many of the associated symptoms of pain and stiffness in the neck, visual and auditory disturbances and cranial nerve pareses due to pressure placed on cranial nerves by the weight of the brain and associated structures, and pressure placed on the cervical nerves by downward displacement of the spinal

cord.

Wolff (4) has listed dilitation and distention of intracranial arteries as a basic mechanism for the pain of headache. MeGoogan and Horner (6) feel that this is an important cause of headache identical to that caused by brain "sag" resulting from lowered spinal fluid volume. The type of pain, dependence upon body position and lack of response to analgesics and sedatives are all the same as in the headache caused by brain "sag." They believe that the distention and dilitation of these arteries may be associated with the lowered intracranial pressure seen after lumbar puncture. Kunkle (7) did not believe that the lowered pressure itself caused the arterial distention but observed that it probably accompanied lowered spinal fluid volume. This mechanism explains the similar pattern of dependence upon body position of the headache since the intracranial fluid volume is less with the head raised.

Other causes of intracranial arterial dilitation have been implicated as a cause of spinal headache. Deutsch (10) feels that a reflex vasomotor spasm of intracranial arteries may occur as a neurogenic

reflex from puncture of the dura. Shannon (11) believes that histamine may be released as a result of irritation of the choroid plexus and meninges by foreign material introduced into the spinal fluid. Schumacher (8) has shown that histamine produces dilitation of intracranial arteries. Reflex or histamine induced dilitation of intracranial arteries per se would not be expected to vary much with changes in body position since lowered spinal fluid pressure is not the underlying cause of this dilitation.. It might be expected, however, that a head down position would alter the tension and displacement of other pain sensitive elements enough to give partial or complete relief of pain. This mechanism may explain some of the cases of headache that show all of the symptoms of headache related to spinal fluid loss including position sensitivity but show no decreased spinal fluid pressure on repeat lumbar puncture. The incidence of this type of headache is about 20% according to Torsen (2). Arterial dilitation from histamine or neurological reflex may also explain why some of the patients with this type of spinal headache get no improvement from a head down position. The occurrence of excessive loss of spinal fluid

resulting in brain "sag" too great to be relieved by head down position, might however be expected to occur also and produce a headache not relieved by head down position.

Hypertensive type of headache occurs less frequently after lumbar puncture than does the hypotensive type of headache.. According to Torsen (2) and Franksson and Gordh (5), this type of headache is described by the patient as "splitting." It does not respond to changes in body position but usually does respond to analgesics and sedatives. The headache may occur unilaterally and most frequently occurs in parietal and temporal areas of the head. It is difficult to differentiate from other types of headache occuring postoperatively even when no lumbar puncture was done..

Torsen (2) believes the cause of this headache is meningeal irritation or choroid plexus irritation from blood or other foreign substances introduced into the spinal fluid at the time of lumbar puncture. He believes that the increased spinal fluid pressure is secondary to vasomotor reaction or increased venous pressure occurring as a result of the meningeal and choroid plexus irritation. Kunkle (8) reports

that increased spinal fluid pressure does not cause headache in experiments on human subjects and he does not believe that increased spinal fluid pressure is the cause of the hypertensive type headache, but that the headache is related to direct irritation of pain sensitive structures.

PREVENTION OF SPINAL HEADACHE

Prevention of spinal headache is best directed toward the most common cause of spinal headache. This is the decrease in volume of spinal fluid which may occur after lumbar puncture.. This problem is best solved by approaching it from two directions. The first important step is minimizing the loss of spinal fluid from the intradural space and the second step is maintaining an adequate production of spinal fluid to replact the deficit that may otherwise occur..

Franksson and Gordh (5) have shown that the loss of spinal fluid from the intradural space may be 240 millliliters in 24 hours through a puncture hole the size of a #20 needle with a normal lumbar pressure of 100 to 200 millimeters of water. Normal production of spinal fluid is 100 to 500 millliliters in 24 hours. Measures which decrease the lumbar spinal fluid pressure and produce smaller holes in the dura can be

expected to reduce the loss of spinal fluid. These together with measures which allow the choroid plexus to maintain adequate production of spinal fluid can be expected to minimize the total deficit of spinal fluid and thereby prevent many spinal headaches..

The standard technique of keeping the patient flat for a time after lumbar puncture maintains a lowered spinal fluid pressure at the site of the dural puncture and can thus be expected to reduce the loss of spinal fluid. Most often the patients are kept flat or at least in bed after a lumbar puncture for reasons not related to the prevention of headache, but Gallagher and Campbell (12) in a large series of patients receiving lumbar puncture for diagnostic purposes have encouraged early ambulation. They feel that the incidence of headache has not been increased, but at the same time they have taken measures to place as small a hole in the dura as possible. Franksson and Gordh (5) have obtained similar results and they feel that if the hole through which the spinal fluid must leak is small enough that it will make little difference if the spinal fluid pressure at the site of puncture is elevated or not. Glesne (13) has summarized reports by Underwood on 500 cases in which the incidence of

TABLE I

Investigator	Needle Size	Results	No. of Cases
Huston and Lebhertz (15)	#24	2.8% 0.8% severe	1,000
Franksson and Gordh (5)	0.5 mm. 1.0 mm.	0% 13%	100 362
Bowman (16)	0.5 mm. 1.0 mm.	0.6% 37.0%	632 118
Hansen (17)	0.5 mm. pencil pt. 1.0 mm.	No difference, less severe with small needle.	
Gallagher and Campbell (12)	Dattner Single	14.8% 27.5%	500 500
Haraldson (18)	0.5 mm. pencil pt. Control	9.3% 32.5%	131
Wetchler and Brace (1)	#25	0.6% All relieved with aspirin.	500
Harris and Harmel (19)	#24 #20 #18, 19	3.59% 8.22% 23.80%	529 511 21
Hart and Whitacre (20)	#20 pencil pt. #20	2% 5%	3,489 2,070
Herbert (21)	#20 #18	6.43% 9.40%	5,763 500
Kaufman (3)	#25	0.4%	1,000
Greene (22)	#26	0.4%	
Krueger (25)	#20 #20 pencil pt.	21.7% 7.3%	
Ekstrom (31)	0.5 mm.	5.0%	1,745

INCIDENCE OF SPINAL HEADACHE WITH THE USE OF VARIOUS NEEDLES.

headache was not increased without bed rest, and reports by Levine of 2,000 cases with less than 1% headache without bedrest after lumbar puncture.

Creation of as small a hole as is practical is the next obvious factor to limit the loss of spinal fluid. Green (14) in 1926 demonstrated the advantages to be gained by the use of small needles for lumbar puncture. He also pointed out the advisability of inserting the needle with the bevel parallel to the longitudinal fibers of the dura in order to part them rather than cut them when the puncture was made. Pencil point needles have been designed to part the fibers of the dura rather than cut them.

Many needles of different sizes have been used by various workers in an attempt to reduce the incidence of spinal headache.. The results of some of these workers are shown in table I.

From this it is obvious that the majority of workers have reported markedly reduced incidences of spinal headaches with the use of needles of size smaller than #20.

Certain refinements of technique have been suggested to further decrease spinal fluid loss. Avoidance of multiple punctures of the dura has been

suggested by Hart and Whitacre (20) as important in reduction of spinal fluid loss. Greene (14) recommends that care be taken to keep the patient motionless and the spinal needle motionless while the needle is in the dura to prevent tearing a larger hole in the dura. Huston and Lebhertz (15) suggest that a tangential puncture of the dura and arachnoid may produce less leak of spinal fluid since the holes will not be coincident, and there will be a tendency for intact arachnoid to herniate through the dural opening. This may plug the hole sufficiently to significantly reduce the leakage of spinal fluid. Torsen (2) has verified this on autopsy.

Maintenance of adequate production of spinal fluid requires adequate hydration. Many workers have reported reduced frequency and severity of spinal headaches when special efforts were made to adequately hydrate patients after lumbar puncture. Shaw (23) gave saline and water intravenously to 563 patients after lumbar puncture and obtained an incidence of headache of 0.9%. A control group of 100 patients received no specific parenteral hydration after lumbar tap and had an incidence of headache of 7%. In both groups #22 gauge needles and identical techniques were

used..

Krueger (24) has used hypotonic parenteral hydration (5% glucose with $\frac{1}{2}$ N saline) in conjunction with antidiuretic extract of posterior pituitary for the prevention of spinal headaches. He feels that the excess water retained in the body will provide material for spinal fluid production. The incidence of headache was lowered from 10% to 16% down to 6.8%. In a later report Krueger (25) reports the incidence of headache lowered from 7.3% without hydration to 4.0% with hydration using #20 gauge pencil point needles..

Greene (22) in a survey of the literature reports that all investigators not obtaining a lowered incidence of spinal headache with small needles, neglected to adequately hydrate the patients after the lumbar puncture. He feels that hydration in conjunction with the use of small needles is very important. If the loss of spinal fluid from the intradural space is rapid enough, hydration will make little difference since the choroid plexus will not be able to keep up with the loss even at maximum output.

Greene (22) used a regimen of hydration of 2,500 cc. oral intake for 3 days after lumbar puncture and

TABLE II

Needle size	Method	Incidence of Headache
20 gauge	No hydration	41%
20 gauge	Hydration	33%
22 gauge	No hydration	26%
22 gauge	Hydration	10%
24 gauge	No hydration	8%
24 gauge	Hydration	2%
26 gauge	Hydration*	0.4%

*Hydration modified to exclude pituitary extract.

THE INCIDENCE OF HEADACHE WITH VARIOUS SIZE NEEDLES WITH AND WITHOUT HYDRATION. Greene (22).

10 units of posterior pituitary extract subcutaneously every 12 hours for 4 doses. A summary of his data is presented in table II.

Epidural injections of saline have been used to lower the incidence of spinal headache. Mehl (26) reports an incidence of headache of 3% in 100 patients in which 10 to 15 cc. of normal saline were injected into the epidural space as the spinal needle was being withdrawn after administration of spinal anesthesia. During this study a control group of 138 patients had a 9.3% incidence of headache. It was felt that saline injected into the epidural space not only would fill the space that spinal fluid would potentially leak into, but also that the reversal of normal epidural pressure from negative to positive would help discourage spinal fluid leakage through the dural puncture.

Shannon (11) has used Benadryl in prevention of spinal headache and reported the incidence to be lowered from 9.4% for the previous 12 months, to 1.7% for 300 patients in this series. He feels that the antihistiminic action of Benadryl helps protect the choroid plexus from allergic reactions to blood, anesthetic agents and histamine. Marx and Hershey (27)

have used Dramamine with a lowering of headache incidence from 6% to 0% in two groups of 50 patients each. They feel that the antihistaminic and antinausea properties of this drug help to prevent spinal headaches..

Psychological factors have often been blamed as a precipitating factor in spinal headaches. Dripps and Vandam (9) feel that their patients definitely respond to psychologic suggestion. Kunkle (7) in his studies on spinal headache made it a rule never to ask the patients directly about headache if he could avoid it. He felt that even this suggestion could cause headache in some persons. Krueger (25) noted a lower pain threshold in anxious patients and a somewhat higher incidence of spinal headache in these patients also. He felt that the lower pain threshold was probably a major cause of the increased incidence of headaches.

Kunkle (7) and Greene (22) feel that a person with migraine headaches is more disposed to spinal headaches, and that elective spinal anesthesia should not be given to these people, other factors being equal.

Spinal headaches with continuous spinal anesthesia administered through a small ureteral catheter have

varied in incidence with different authors. Cann and Wycoff (28) have reported an increased incidence of 30%. Touhey (29) reports no increase in spinal headaches by this method. His incidence of 3% to 5% compares with his usual incidence of spinal headache using ordinary needles. Both investigators used #15 gauge needles and #4 ureteral catheters. Cann and Wycoff used opaque X-ray catheters. Touhey however, used nylon catheters, which may be an important factor since nylon is known to be inert and to produce little tissue irritation.

TREATMENT OF SPINAL HEADACHE

The treatment of spinal headache may be aimed toward alteration of the pain threshold in some manner so that the patient is no longer aware of the headache, or correction of the cause of the headache to remove the source of pain.

The hypertensive type of spinal headache usually responds favorably to analgesics and sedatives which is the most common method of altering the pain threshold. The most common postoperative headaches will also respond to analgesics and sedatives, and in view of the frequency of these headaches, analgesics and sedatives should logically be tried first on any postoperative

headache whether lumbar puncture was done or not.

The hypotensive type of spinal headache usually does not respond to analgesics or sedatives and some other type of treatment must be used to obtain relief. The obvious remedy is to correct the cause of the pain in some manner. The favorable response which this headache exhibits when the head is lowered is one of the simplest and most effective methods of treating most of these headaches. Lowering the head to a position level with or below the body eliminates the effect of gravity to displace the brain downward. Such relief of the brain "sag" removes tension from the supporting structures of the brain and alleviates this source of pain. At the same time the intracranial pressure is raised since the spinal fluid can now flow back into the head. This increased pressure causes less distention of the cerebral veins and thereby eliminates some of the pressure and displacement to which they are subjected. The elimination of brain "sag" also eliminates many associated symptoms caused by pressure of the brain on cranial nerves, and symptoms caused by pressure on cervical nerves.

Another method of reducing brain "sag" is the replacement of the lost volume of spinal fluid

thereby "floating" the brain from the cranial floor. There are several approaches to this problem which have been effective in relieving spinal headache.

Hanahan and Redding (30) have advocated the use of abdominal binders and found it satisfactory in most cases of spinal headache especially when used in conjunction with bed rest. They feel that abdominal compression causes increased venous pressure which is transmitted to the vertebral venous plexus and causes it to dilate. This dilitation within the bony confines of the vertebral canal causes compression of the dural sac and thus forces spinal fluid back into the head to "float" the brain. This method is especially advised for use in postpartum patients since they tend to have relaxed abdominal musculature. The benefits obtained from dural sac compression by dilated veins of the vertebral venous plexus must offset the deleterious effects of increased distention of the cerebral veins which Kunkle (7) has shown to cause increased headache.

Torsen (2) and Ekstrom (31) have used injections of intradural saline to directly replace lost spinal fluid. Torsen injected 5 to 50 ml. of saline in 22 patients with headache and obtained favorable results

in 20 of the patients. Ekstrom injected about 35 ml. of saline intradurally into each of 17 patients who had typical spinal headache without good response to routine Trendelenberg position. Of these 16 had decreased spinal fluid pressure and 1 had increased spinal fluid pressure when the repeat lumbar puncture was done. Immediate relief of the headache was obtained in 15 of the 17 cases. In 2 cases the headache subsided gradually. In 3 cases the discomfort returned in a day or so. Torsen also mentions the frequency with which the headache returns soon afterward. It is felt that continued leakage of spinal fluid from the original lumbar puncture, plus additional leakage from the second lumbar puncture performed in order to introduce the intradural saline, is the cause of the return of the headache in many cases.

Mehl (26) has used injections of saline epidurally rather than intradurally for the relief of spinal headache. In 3 patients with spinal headache 40 cc. of saline were injected epidurally. Immediate, permanent relief of symptoms was obtained by 2 patients and the other was relieved with codeine and epigastric pressure. This therapy effectively accomplishes the

same results as does the intradural injection of saline since the epidural injection is made within the bony vertebral canal and causes compression of the dural sac to force spinal fluid toward the head. Two advantages are realized with this treatment which are not possible with intradural injection. First, the dura is not punctured again and there is no second hole through which spinal fluid may escape. Second, the pressure of the epidural space is reversed from its normal negative value to a positive value and this tends to discourage spinal fluid leakage through the original dural puncture.

The volume of spinal fluid may be replaced by increased production of spinal fluid by the choroid plexus sufficient to overcome the rate of loss through the dural puncture. Adequate body water is required for spinal fluid production, and oral or parenteral hydration has successfully been used to provide body water and alleviate spinal headaches. In this respect, prophylaxis has been better than treatment. Torsen (2), Haraldson (18), Krueger (24, 25) and Shaw (23) have used hydration with other treatment in cases of spinal headache and they feel that the hydration definitely shortens the duration and severity of the headache.

Pfeffer (32) has used hydration in conjunction with buccal tablets of desoxycorticosterone acetate (DOCA) on 35 patients with spinal headache which did not respond to routine therapy. Of these, 30 obtained complete relief and 3 obtained partial relief. The 2 patients who were not relieved by this treatment were relieved with codeine. Dosage of DOCA used was 2 mgm. every 4 to 6 hours. Pfeffer feels that the sodium and water retaining properties of DOCA enhance the effects of hydration to produce an increased positive water balance in the body.

Deutsch (10) has used 5% ethanol in equal parts of 5% glucose in distilled water administered intravenously and given slowly enough to avoid intoxication. In 15 cases, 10 obtained lasting relief with one infusion of 1,000 cc. and 4 obtained permanent relief with the second infusion of 1,000 cc. He feels that in addition to the hydration supplied by the parenteral fluid, that the ethanol causes a shift of water from the intracellular to extracellular space to provide more fluid for spinal fluid production. He also feels that the dilitation of the choroid plexus obtained with the ethanol helps increase spinal fluid production. Haraldson (18) too, thinks

that vasodilators are of some help in producing increased spinal fluid production, and he has used nicotinic acid along with parenteral hypotonic solutions with what he feels are better results than with parenteral solutions alone. Torsen (2) and Marx and Hershey (27) have not found vasodilators to be of much help in treatment of spinal headache.

McGoogan and Horner (6) have used Cafergot in 25 cases of spinal headache with complete relief in 16, partial relief in 7 and no relief in 20. They felt that cerebral artery dilitation was an important factor in spinal headache and therefore used Cafergot for its vasoconstricting properties. The reason why cerebral artery dilitation would exist is not clearly understood. Kunkle (7) thought that it was present in spinal headache but could not definitely state why. He did not feel that the reduced intracranial pressure was the cause but thought that it was present with lowered intracranial spinal fluid volume. He thought that histamine might be responsible. This opinion is shared by Schumacker (8) and Shannon (11). Deutsch (10) has also proposed a possible neurogenic reflex cause of cerebral vasomotor disturbances.

SUMMARY

The incidence of spinal headaches after lumbar puncture is reported to be between 11% and 18% in large groups of unselected patients. Successful efforts have been made to reduce this incidence to less than 1%. The most effective method has been a combination of the use of small spinal needles used with precautions to create as small a hole as possible in the dura, avoidance of multiple punctures, and provision of adequate oral or parenteral hydration afterwards.

Additional benefits may be realized with the prophylactic use of epidural saline injections, antidiuretic preparations, and antihistamines. Prolonged bed rest after a lumbar puncture has not been felt to be of much value when the precautions mentioned above were taken. Most workers feel that headaches should not be suggested to the patient.

Effective treatment of spinal headaches has also been found. Of primary importance are the use of analgesics and sedatives and maintenance of horizontal of slight Trendelenberg position. Abdominal compression has been found beneficial also.

Institution of adequate hydration is important

if this has been neglected. The use of DOCA or posterior pituitary extracts has been recommended to hasten hydration through their antidiuretic properties. Epidural saline usually relieves refractory headaches. The use of vasodilators such as ethanol or nicotinic acid has been efficacious. A vasoconstrictor such as Cafergot has also been found beneficial.

The incidence of headaches with the use of ureteral catheters has been normal to increased. There is some evidence to suggest that nylon catheters are to be preferred over opaque X-ray catheters for this purpose.

The incidence of headaches in general is higher in young people and in obstetrical patients. This is probably due to the greater elasticity of the supporting structures of the brain in young people which allows more brain "sag", and it may also be related to the higher incidence of minor operations in young people which do not require close supervision of postoperative hydration. Hydration is often neglected in obstetric patients by oversight or by deliberate intention with the feeling that dehydration is of value in decreasing breat discomfort.

CONCLUSION

The incidence of spinal headaches can be reduced. The most effective methods combine the use of small needles and careful technique to create a small hole in the dura, avoidance of multiple punctures, and provision of adequate hydration. Epidural saline, antihistaminics, antidiuretics, bed rest and avoidance of suggestion are of value also.

Treatment of spinal headaches is best instituted with the use of analgesics and sedatives and maintenance of a horizontal or slight Trendelenberg position. Abdominal compression should be tried if these methods are not completely effective. Adequate hydration should be undertaken if not already attained. Antidiuretics such as DOCA and posterior pituitary extract help establish levels of body water. Epidural saline usually relieves refractory headaches. Vasodilators such as ethanol or nicotinic acid may help. Likewise vasoconstrictors such as Cafergot may be of help.

The incidence of headache with continuous spinal anesthesia through ureteral catheters may or may not be increased. There is some evidence to show that nylon catheters are to be preferred over opaque X-ray catheters.

BIBLIOGRAPHY

1. Wetchler, B. V. and Brace, D. E.: A Technique to Minimize the Occurrence of Headache After Lumbar Puncture by Use of Small Bore Spinal Needles, Anesthesiology 16:270-282 (Mar.) 1951.

2. Torsen, G.: Neurological Complications After Spinal Anesthesia, Acta Chir. Scand. Vol. 95, Suppl. 121, pp. 1-272, 1947.

3. Kaufman, J.: Spinal Anesthesia Using 2 Inch, 25 Gauge Needle Minimizing Headaches, Military Surg. 107:285-287 (Oct.) 1950.

4. Wolff, H. F.: Headache and Other Head Pain. New York, Oxford, 1948.

5. Franksson, C. and Gordh, T.: Headache After Spinal Anesthesia and a Technique for Lessening Its Frequency, Acta Chir. Scand. 93:443-454 (Sept.) 1946.

6. McGoogan, L. S. and Horner, G. M.: Saddle Block Anesthesia in Obstetrics: Treatment of Postpartum Spinal Headache, Ob. and Gyn. 5:70-73 (Jan.) 1955.

7. Kunkle, C. E.; Ray, B. S., and Wolff, H. G.: Experimental Studies on Headache: Analysis of the Headache Associated with Changes in Intracranial Pressure, Arch. Neurol. and Psych. 49:323-358 (Mar.) 1943.

8. Shumacher, G. A.; Ray, B. S., and Wolff, H. G.: Experimental Studies on Headache: Further Analysis of Histamine Headache and Its Pain Pathways, Arch. Neurol. and Psych. 44:701-717 (Oct.) 1940.

9. Dripps, R. D. and Vandam, L. D.: Hazards of Lumbar Puncture, J. A. M. A. 147:1118-1121 (Nov.) 1951.

10. Deutsch, E. V.: The Treatment of Post Spinal Headache, Anesthesiology 13:496-499 (Sept.) 1952.

11. Shannon, T. R.: Antihistaminic Drug in the Prevention of Spinal Headache, N. Y. Jour. Med. 50:1259-1260 (May) 1950.

12. Gallagher, E. and Campbell G. C. H.: Lumbar Puncture Headache: Its Prevention and Treatment, Lancet 2:278-279 (Oct.) 1954.

13. Glesne, O. G.: Lumbar Puncture Headaches, Anesthesiology 11:702-708 (Nov.) 1950.

14. Greene, H. M.: Lumbar Puncture and Prevention of Post Puncture Headache, J. A. M. A. 86:391-392 (Feb.) 1926.

15. Huston, W. J. and Lebherz, T. B.: Spinal Anesthesia for Vaginal Delivery with Special Reference to Prevention of Post Partum Headache, Am. Jour. Ob. and Gyn. 63:139-145 (Jan.) 1952.

16. Bowman, K.: Spinal Anesthesia and Hypotension Headache, Acta Chir. Scand. 102:110-112, 1951.

17. Hansen, H.: Headache Following Spinal Anesthesia, Acta Chir. Scand. 104:481-484, 1953.

18. Haraldson, S.: Headache After Spinal Anesthesia: Experiments with a New Spinal Needle, Anesthesiology 12:321-327 (May) 1951.

19. Harris, L. M. and Harmel, M. H.: The Comparative Incidence of Postlumbar Puncture Headache Following Spinal Anesthesia Administered Through 20 and 24 Gauge Needles, Anesthesiology 14:390-397 (July) 1953.

20. Hart, J. R. and Whitacre, R. J.: The Pencil Point Needle in Prevention of Post Spinal Headache, J. A. M. A. 147:657-658 (Oct.) 1951.

21. Herbert, C. L.; Teterick, C. E., and Ziembar, J. F.: Complications of Spinal Anesthesia: An Evaluation of Complications Encountered in 5,765 Consecutive Spinal Anesthesias, J. A. M. A. 142:551-557 (Feb.) 1950.

22. Greene, B. A.: A 26 Gauge Lumbar Puncture Needle: Its Value in Prophylaxis of Headache Following Spinal Analgesia for Vaginal Delivery, Anesthesiology 11:464-469 (July) 1950.

23. Shaw, W. F.: Prevention of Post Spinal Headaches by Parenteral Hydration, N. Y. Jour. Med. 51:2905-2908 (Aug.) 1952.

24. Krueger, J. E.; Stoelting, V. K., and Graf, J. P.: Etiology and Treatment of Post Spinal Headaches, Anesthesiology 12:477-485 (July) 1951.

25. Krueger, J. E.: Etiology and Treatment of Postspinal Headache, Curr. Researches in Anesth. and Analgesia 32:190-198 (May) 1953.

26. Mehl, L. B.: Epidural Injection of Normal Saline as a Means of Prevention of Spinal Headache, Amer. Jour. Ob. and Gyn. 68:1105-1108 (Oct.) 1954.

27. Marx, G. F. and Hershey, S. G.: Prophylaxis of Postspinal Analgesia Headache Following Vaginal Delivery, N. Y. Jour. Med. 52:1906-1908 (Aug.) 1952.

28. Cann, J. E. and Wycoff, C. C.: Continuous Spinal Anesthesia: A Modification of the Ureteral Catheter Technique, Anesthesiology 9:288-295 (May) 1948.

29. Touhey, E. B.: Continuous Spinal Anesthesia: A New Method Utilizing a Ureteral Catheter, Surg. Clin. of No. Am. 25:834-840 (Aug.) 1945.

30. Hanahan, D. W. and Redding, T.: Post-spinal Anesthesia Headaches, Amer. Jour. of Ob. and Gyn. 61:173-177 (Jan.) 1951.

31. Ekstrom, T.: Treatment of Headache After Spinal Anesthesia with Intraspinal Injection of Physiological Saline Solution, Acta Chir. Scand. 101:450-456, 1951.

32. Pfeffer, R. I.: Treatment of Postspinal Headache with Buccal Tablets of Desoxycorticosterone Acetate, Amer. Jour. of Ob. and Gyn. 65:21-23 (Jan.) 1953.