

A 26 GAUGE LUMBAR PUNCTURE NEEDLE: * ITS
VALUE IN THE PROPHYLAXIS OF HEADACHE
FOLLOWING SPINAL ANALGESIA FOR
VAGINAL DELIVERY †

BARNETT A. GREENE, M.D.

Brooklyn, New York

Received for publication August 26, 1949

THIRTY seven years ago Hoyt (1) reported his innovation of a "double needle" technic of lumbar puncture to reduce the incidence of post-puncture headache by minimizing the size of the dural opening. The idea did not take hold in this country and the "double needle" became commercially unavailable in the United States for lack of demand (2). Abroad, however, the idea was accepted and the equipment was improved and found valuable by Antoni, Dattner, Kennedy and others (3).

Today the need for minimal dural punctures is greater than ever before. Early ambulation following operation and parturition increases the incidence of headache after spinal anesthesia. The assumption of the erect position before the dural opening has closed augments the leakage of spinal fluid and allows the reduced volume of cerebrospinal fluid to manifest itself as subnormal intracranial pressure with headache as the result. In obstetrics the complication is even more common and severe. Intra-abdominal pressure is greatly reduced after delivery and therefore the patient lacks the usual support to intraspinal fluid pressure provided by a normally tonic abdominal wall. Blood loss and dehydration are more marked and less treated among postpartum patients than among routine surgical cases. The effect on water balance is to decrease the availability of water for the production of cerebrospinal fluid at a rate sufficient to reproduce the estimated daily loss of 240 cc. of spinal fluid through a dural puncture of average size (3). The puerperal convalescent is especially prone to complain of postspinal headache not only because, as a woman, she is more likely to feel and express the complaint but also because she usually does not expect to have any serious discomfort after the first or second day of the puerperium. For these reasons the incidence of headache following spinal analgesia for vaginal delivery has been reported to be greater than in any other group of hospital patients,

* The author is grateful for the cooperation of Mr. Oscar Schwidetzky, Director of Research, Becton, Dickinson and Company, Rutherford, New Jersey, who devised and manufactured the needles used in this study.

† From the Departments of Anesthesiology, Unity, Brooklyn Women's, and Adelphi Hospitals, Brooklyn, New York.

ranging from 15 to 30 per cent depending on the diameter of the spinal needle, the earliness of postpartum ambulation and the type of patient (4).

While there is still no universal agreement on the etiology of post-puncture headache, the "leakage theory" is the explanation which is best supported by a wide variety of experimental and clinical evidence (5) and most readily lends itself to practical evaluation. All investigators who have performed lumbar puncture with very fine needles confirm the minimal aftereffects of minute puncture wounds of the dura mater as first noted by Ravaut (6) in 1914. Lack of confirmation of these results and consequent confusion and disagreement have been reported only by those who have used the one commonly available fine needle, that is, the 22 gauge, and who have failed to control their studies with regard to a subtle but very important variable, hydration. Adequate hydration favors the regeneration of spinal fluid at a rate able to make up for a large dural leak (7). Inadequate hydration may aggravate the effect of even a small dural leak (8).

To evaluate the factors of needle diameter and hydration a series of parturients delivered vaginally under spinal analgesia was studied. These patients were anesthetized and followed by the same personnel; all received nupercaine-glucose intraspinally. The series was subdivided by chance into groups to be punctured with different sizes of spinal needle. A part of each group punctured with a given needle size was especially hydrated by ordering the oral intake of 2500 cc. of fluids during the first three postpartum days and by injecting 10 units of posterior pituitary extract subcutaneously every twelve hours for four doses during the first two days postpartum. The antidiuretic effect of posterior pituitary extract was utilized to increase the body store of hypotonic fluid and so favor cerebrospinal hydration. Those who were not specially hydrated were permitted to take fluids only as desired. The results are presented in table 1.

TABLE 1

Group	No. of Patients	Percentage Incidence of Headache		
		Mild	Marked ^b	Total
20 Gauge without hydration ^a	17	18.0	23.0	41.0
20 Gauge with hydration ^a	18	11.0	22.3	33.3
22 Gauge without hydration	93	8.0	18.0	26.0
22 Gauge with hydration	108	6.5	3.5	10.0
24 Gauge without hydration	192	6.0	2.0	8.0
24 Gauge with hydration	149	0.7	1.3	2.0
26 Gauge with modified hydration ^a	700	0.4	0.0	0.4

^a This group was discontinued prematurely at the request of the obstetricians.

^b A marked headache was defined as one lasting three or more days.

^c Hydration modified as described in the text.

These findings confirm the value of reducing the diameter of the spinal needle and of hydrating the patient. It is evident, however, that oral hydration is not of sufficient influence to balance a leak as large as that produced by a 20 gauge needle. Hydration is more effective when the needle is of 22 or 24 gauge. The important factor is the diameter of the needle. Even the 24 gauge needle, however, requires the aid of vigorous hydration to reduce the headache to a minimal incidence (9). Therefore, there is need for the 26 gauge size.

Since the 26 gauge needle became available spinal analgesia for vaginal delivery has been performed only with this needle. Convinced of the value of hydration, however, I have continued to order all postspinal parturients to drink 2500 cc. of fluids during each of the first three days of the puerperium. (No unusual difficulty with breast engorgement has been observed despite the large proportion of patients who do not nurse their infants. This is possibly owing to the regular prophylactic use of estrogenic drugs by the obstetricians to inhibit lactation in mothers who are not to nurse their babies.) In view of the minimal size of the 26 gauge dural puncture, the aid of posterior pituitary extract is no longer considered necessary. With the 26 gauge needle, therefore, hydration by oral means only is used.

APPARATUS

The 26 and 24 gauge needles are so flexible that they must be inserted through an introducer which should extend deeper into the tissues than the 3 cm. long Sise (10) "tack" or introducer, devised for use with a 22 gauge needle, which really does not require any introducer. The introducer which I use for the 26 gauge needle is simply a spinal needle, 5 cm. long, 21 gauge (0.8 mm. outside diameter), complete with its own stilet. The width of this needle is the same as Dattner's introducer but smaller than the introducers of Hoyt; Kennedy and Antoni which are 17, 19 and 20 gauge, respectively. The introducer, 5 cm. in length, can reach the ligamentum flavum or the interspinous ligament of any patient but the most obese and allows the inner needle to project well beyond the point of the introducer. Hoyt's two needles differed in length by only 6 mm. and therefore predisposed to frequent accidental puncture by the introducer. With my "double needle" technic the dura has been punctured inadvertently by the 21 gauge introducer only five times in over 700 cases performed by six anesthesiologists and residents, all of whom were acquiring their first experience with this method. Incidentally, none of the patients accidentally punctured with the 21 gauge introducer developed a headache, probably because they were prophylactically hydrated with posterior pituitary extract, oral fluids and, in 2 cases, by a liter infusion of glucose in water.

The 26 gauge needle is the finest size practicable for lumbar puncture. Its outside diameter is 0.46 mm., the same as Dattner's and

Antoni's inner needles but much smaller than Hoyt's which was 0.8 mm. (21 gauge). The latter was not sufficiently fine to diminish the incidence of headache significantly so as to warrant the more exacting technic of a "double needle" system of lumbar puncture, especially when accidental puncture with the introducer was likely because the inner needle projected only 6 mm. beyond the introducer. The 26 gauge needle of my "double needle" projects 2.7 cm. beyond the introducer as in the Dattner "double needle." The 26 gauge needle does not require an obturator but a simple wire stilet prevents the needle from being plugged by a bit of tissue as it passes beyond the introducer.

The hubs of these two needles accept the Luer type syringe whereas the Hoyt and Dattner needles require a record syringe. The "double needle" apparatus is less complicated and more economical than the Dattner or Antoni models which must be imported from abroad.

TECHNIC

A thin, cooperative patient may be punctured while lying on her side. The sitting position is preferable, however, because it is then easier, especially in an obese patient, to direct the introducer exactly in the midline and perpendicular to the plane of the back. Also, the intraspinal subarachnoid fluid pressure is higher in this position and therefore the fluid escapes more readily. Spinal fluid may be aspirated to dissolve crystals of anesthetic drugs but this requires several minutes. It is therefore simpler to use prepared spinal anesthetic solutions. The ampules of 10 per cent glucose and 1:200 nupercaine hydrochloride are suitable for this purpose; better yet is the new 2 cc. ampule of 5 per cent glucose solution containing 2.5 mg. of nupercaine hydrochloride per cubic centimeter.

The 21 gauge needle, with its stilet in place, is introduced through a skin wheal and subcutaneous track made by injecting 1 or 2 cc. of 1 to 2 per cent procaine hydrochloride with a hypodermic needle. The introducer is pushed through the subcutaneous tissues until a plane of increased resistance (the interspinous ligament or the ligamentum flavum) is felt. After a little experience this sensation is readily recognized. The point of the needle is then within 1 cm. of the dura. The stilet is removed; the 26 gauge needle, with or without its wire obturator in place, is passed through the introducer to puncture the dura mater easily. In early attempts with the double needle technic there is a tendency to stop the introducer just short of the ligament or to push it too far and puncture the dura. The correct technic is soon acquired, however; anesthesia and obstetric residents have all learned it promptly. When the introducer is not sufficiently deep, the 26 gauge needle meets with great resistance. In that case, one may continue in either of two ways: (a) push the two needles forward together as one unit and puncture the dura with the projecting inner fine

needle while the outer needle serves to prevent the shaft of the inner needle from bending, or (b) remove the inner needle, replace the stilet in the outer needle, push the needle farther until the characteristic resistance is met and finally try again with the inner fine needle. When the end of the inner needle easily passes beyond the point of the introducer it is quite probable that the former is in the subarachnoid space. Spinal fluid comes out so slowly, however, that one should watch the hub of the needle for a few seconds, perhaps rotating it and even applying suction with a syringe, before concluding that the point has not entered the spinal canal.

After the anesthetic solution has been injected, the inner needle is withdrawn slowly. The introducer is left in situ for a moment to permit inspection for an inadvertent puncture of the dura by the introducer, revealed by a brisk flow of spinal fluid.

The recognized rules of technic for minimizing postpuncture headache should not be overlooked even when using the 26 gauge needle. The dura should be punctured only once. The bevel of the needle should slit the dura parallel to the predominantly longitudinal fibers of the dura. Spinal puncture should not be used in a migrainous patient (one of the four headaches with the 26 gauge needle occurred in such an individual). Vigorous parenteral correction of obvious pre-existing deficiencies of water or blood should be begun during or soon after the puncture. If the 21 gauge introducer is accidentally inserted into the subarachnoid space, hydration by mouth or, better yet, by infusion with a liter of 5 per cent glucose in water, not saline, is the most effective prophylactic measure for the patient who is to sit up or get out of bed soon after lumbar puncture.

SUMMARY AND CONCLUSIONS

The "double needle" method of lumbar puncture is revived in view of the need to prevent the high incidence of postpuncture headache encountered in the increasing use of spinal analgesia for vaginal delivery followed by early ambulation. A simple and inexpensive "double needle," consisting of a 5 cm., 21 gauge introducer and a 10 cm. 26 gauge lumbar puncture needle, is presented as the most practicable means of minimizing the dural leakage, the fundamental cause of postpuncture headache.

The occurrence of headache following spinal analgesia for vaginal delivery has decreased from 26 per cent with a 22 gauge needle to 0.4 per cent in a series of 700 patients punctured with a 26 gauge needle.

REFERENCES

1. Hoyt, R.: Apparatus for Withdrawing Spinal Fluid Without Postpuncture Reaction, *J. A. M. A.* 78: 428-429 (Feb. 11) 1922.
2. Schwidetzky, Oscar.: Personal communication to the author.
3. Franksson, C., and Gordh, T.: Headache after Spinal Anesthesia and a Technique for Lessening its Frequency, *Acta chir. Scandinav.* 94: 443-454 (Sept. 10) 1946. Kennedy,

- A. J.: Spinal Anesthesia: Clinical Experiences in 430 Cases, and a Technique to Eliminate Postoperative Headache, *M. J. Australia* 19: 1, 40-45 (Jan. 9) 1932.
- Anton, N.: Om Lumbalpunktion, *Svenska läk-sällsk. förhandl.* 20: 529, 1923.
- Erskine, D., and Johnson, A. G.: Lumbar Puncture in Out-patients, *Lancet* 2: 371-373 (Aug. 13) 1938.
- Dattner, B.: Die Ambulatorische Lumbalpunktion. *Wien, klin. Wchnschr* 40: 450-453 (Apr. 7) 1927.
- Dattner, B.; Thomas, E. W., and Wexler, G.: The Management of Neurosyphilis. New York, Grune & Stratton, 1944, pp. 21-27.
- Allen, H. W.: Headache Following Lumbar Puncture, *Brit. M. J.* 2: 349 (Aug. 25) 1934.
- Harrison, I. W.: Note on Lumbar Puncture with the Dattner Pattern of Needle, *Brit. J. Ven. Dis.* 13: 173-176 (July) 1937.
4. Andros, G. J.; Dieckmann, W. J.; Ouda, P.; Priddle, H. D.; Smitter, R. C., and Bryan, W. M., Jr.: Spinal Anesthesia in Obstetrics, *Am. J. Obst. & Gynec.* 55: 806-820 (May) 1948.
- Weintraub, F.; Antine, W., and Raphael, A. J.: Postpartum Headache after Low Spinal Anesthesia in Vaginal Delivery and Its Treatment. *Am. J. Obst. & Gynec.* 54: 682-686 (Oct.) 1947.
- Cullen, W. G., and Griffith, H. R.: Postpartum Results in Spinal Anesthesia in Obstetrics, *Current Researches in Anesth. & Analg.* 26: 114-121 (May-June) 1947.
- Snell, H. A.: Spinal Analgesia and Anesthesia in Obstetrics, *New York State J. Med.* 48: 2590-2594 (Dec. 1) 1948.
5. Wolff, H. G.: Headache and Other Head Pain. New York, Oxford University Press, 1948, pp. 98-126.
- Thorsen, G.: Neurological Complications After Spinal Anesthesia and Results from 2493 Follow-up Cases, *Acta chir. Scandinav.* (Supp. 121) 95: 1-272 1947.
6. Ravaut, P.: Comment Dépister La Syphilis Nerveuse, *Ann. méd.* 1: 49-64, 1914.
7. Kubic, L. S.: Intracranial Pressure Changes During Forced Drainage of Central Nervous System, *Arch. Neurol. & Psychiat.* 16: 319-324, 1926.
- Solomon, H. C.: Raising Cerebrospinal Fluid Pressure with Special Reference to Effect on Lumbar Puncture Headache, *J. A. M. A.* 82: 1512-1515 (May 10) 1924.
8. Masserman, M. J.: Cerebrospinal Hydrodynamics; Effects of Intravenous Injection of Hypertonic Solutions of Dextrose, *Arch. Neurol. & Psychiat.* 35: 296-303 (Feb.) 1936.
9. Green, B. A.; Goldsmith, M., and Lichtig, S.: Prevention of Headache After Spinal Analgesia for Vaginal Delivery by Use of Hydration and a 24 Gauge Needle, *Am. J. Obst. & Gynec.* 58: 709-717 (Oct.) 1949.
10. Sise, L. F.: Lumbar Puncture Technique, *Am. J. Surg.* 5: 577-580 (Dec.) 1928.

(Continued from page 463)

- 403 "Disturbed Physiology in Oxygen Want" Meyer Saklad, M.D.
- 404 "Pre-operative Evaluation and Medication" Lawrence Schuhmacher, M.D.
- 405 "Physiology of the Respiratory System" Robert D. Dripps, M.D.
- 406 "Blood and Plasma Substitutes" Thomas H. Seidon, M.D.
- 407 "Influence of Position on Vital Capacity" Harvey C. Slocum, M.D.
- 408 "Functions and Management of Inhalation Therapy Service" Charles M. Barbour, Jr., M.D.
- 501 "Clinical Aspects of Intravenous Pentothal Anesthesia" R. Charles Adams, M.D.
- 502 "Saddle Block Anesthesia" John Adriani, M.D.
- 503 "Pain and Block Therapy" F. A. Duncan Alexander, M.D.
- 504 "Use of Curare Preparations in Anesthesia" Stuart C. Cullen, M.D.
- 505 "Academic and Clinical Aspects of Shock and Its Treatment" Donald E. Hale, M.D.
- 506 "Anesthesia for Thoracic Surgery" Lloyd H. Mousel, M.D.
- 507 "Pharmacology of Barbiturates" O. Sidney Orth, M.D.
- 508 "Pediatric Anesthesia" M. Digby Leigh, M.D.
- 601 "Concentrations of Gaseous Mixtures during Inhalation Anesthesia" Albert Faulconer, Jr., M.D.
- 602 "Sympathetic Ganglion Blocks" E. A. Rovenstine, M.D.
- 603 "Choice of Anesthetic Agent" Henry S. Ruth, M.D.
- 604 "Adrenolytic and Sympatholytic Drugs" Scott M. Smith, M.D.
- 605 "Explosion Hazards and Their Control" George J. Thomas, M.D.
- 606 "Cyclopropane Anesthesia" Ivan B. Taylor, M.D.
- 607 "Continuous Spinal Anesthesia" Edward B. Tuohy, M.D.
- 608 "Inhalation Anesthesia for Obstetrics" P. P. Volpitto, M.D.