SPINAL EPIDURAL BLOCK

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In 1885 Corning discovered that he could produce anesthesia in dogs without piercing the dura. Apparently nothing further was done until 1921 when Pages reported that the epidural space could be entered in the lumbar and thoracic regions. In 1927, Heldt and Moloney reported that a negative pressure existed in the epidural space and Gutierrez corroborated this and carried on the work. Dogliotti, in 1931, reported what he thought was an original procedure and popularized epidural block in Europe. Since then epidural block has been used with considerable success in Europe and South America, but it has been sadly neglected by the anesthetists and surgeons in the United States because of the difficulty and so-called dangers in technic. This impression is not correct and, because epidural block is of great value in the relief of intractable pain, this work has been carried out. Interest recently has been directed toward the epidural space, using the caudal route for the relief of the pain of labor. It is the purpose in this paper to deal only with spinal epidural block.

Gutierrez attempted to simplify the technic by making use of the so-called negative pressure present in the epidural space, reported by Heldt and Moloney. Most of the methods employed today still make use of this myth, for there is no negative pressure in the epidural space. Eaton was the first to report this finding in 1939, but apparently this report has been overlooked. I have repeated his work and am able to confirm his findings and establish without a doubt that the so-called negative pressure is an artefact.

The epidural space is a potential space. It lies between the dura that surrounds the spinal cord and the dural or periosteal lining of the spinal canal. It extends from the foramen magnum above to the sacrococcygeal ligament below. There is no communication between the intradural or subarachnoid space and the extradural or epidural space. It is filled with a venous plexus, fatty tissue and supporting connective tissue. The spinal canal is a fixed space and the cord and its membranes are compressible and displaceable to a certain degree. It is this displacement or pushing away of the dura by the point of the entering needle with the resultant localized increased volume of the

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epidural space at that point that gives the false impression that a negative pressure exists in this space.

To demonstrate this an apparatus was made consisting of a special needle and water manometer. A 20-gauge spinal needle is filed so that it has a blunt and smooth end. The stilet projects just beyond the end of the needle and has a sharp beveled point. The water manometer is a U-shaped capillary tube, 1/8 inch in diameter, fitted with a glass connecting tip and a piece of rubber tubing that can be removed easily for sterilization. Colored water is drawn into the manometer so that it reaches an equal level in both arms in the upright position. When this apparatus is attached to the needle in position, a closed system results, so that any change in pressure in the needle is manifested by changing levels of the fluid. A rise in the fluid level in the arm to which the needle is attached indicates a vacuum or so-called negative pressure, whereas a fall of the fluid level in the same arm means an increased pressure.

After the patient is prepared as for spinal anesthesia, the needle is introduced through the skin and interspinous ligament at the third or fourth interspace until the resisting ligamentum flavum is reached. The needle is advanced with gentle pressure until a slight give is felt. The point should now be in the epidural space. The stilet is removed and the manometer is connected to the needle, the connecting tip and rubber tubing having been sterilized by boiling. There should be no change in the fluid level. The needle is now slowly advanced, and as this is done the fluid level in the arm attached to the needle will be seen to rise. This is due to the pushing of the dura by the needle end, causing a so-called negative pressure phenomenon. The more the needle is advanced the greater this rise in fluid level. This observation in itself disputes the existence of a negative pressure since, if it existed, the amount of negative pressure recorded would be maximum at the time of the puncture, and no further increase would occur on advancing the needle. The needle is then disconnected, the fluid levels become equal, and the needle is again attached to the manometer. No change in the fluid level occurs, but as the needle is advanced slightly the rise in the fluid level again occurs. As the needle is advanced there will come a time when it will puncture the dura, even though the end of the needle is blunt. When this occurs there is an abrupt change, and the fluid level drops rapidly, demonstrating an increased pressure owing to escape of spinal fluid, and if one waits, it will be seen entering the manometer.

This procedure was repeated using spinal needles of varying sizes and points of varying bluntness. It was found that the smaller the bore and the sharper the point, the less pressure it takes to puncture the dura, and vice versa; the blunt, large bore needle tends rather to push the dura away than to puncture it. The rise of fluid averaged 2
cm. with the thin sharp needle to 13 cm. with the 18-gauge blunt needle, and 17 cm. using the specially constructed round-end needle.

As a result of these observations, it was thought that any method which would tend to push the dura away from the needle point and decrease the possibility and risk of entering the subarachnoid space would simplify the procedure of epidural block. Following the suggestion of Dr. John Abajian, the following method has been successfully carried out without a mishap.

A blunt 20-gauge spinal needle is used. The patient is placed in the lateral position, with the back arched, and the site of the injection determined and marked. The usual skin preparation is carried out. The tip of the left index finger is placed on the inferior tip of the spinous process just above the space to be used, and the skin and interspinous ligament are infiltrated with 1 per cent procaine hydrochloride. With the index finger still in place and used as a guide, the needle is introduced through the skin and interspinous ligament. As the needle pierces this ligament there is a slight resistance and then a give. No further resistance is felt until the ligamentum flavum is reached. Sufficient pressure is used to just engage the tip of the needle in the ligament. The stilet is removed, and a 5 cc. syringe with sterile saline solution is attached to the needle. Pressure on the plunger at this time meets with resistance, and with this pressure maintained by the thumb, the needle is slowly advanced through the ligamentum flavum. As the needle enters the epidural space there is a sudden give to the plunger, and the saline solution enters the epidural space, thus pushing the dura away from the point of the needle. The syringe is now carefully disconnected from the needle and a few drops of saline solution may be seen to drop for a few seconds, but it stops promptly. It is essential that puncture of dura be ruled out, and this is done by injecting about 10 cc. of 1 per cent procaine and waiting five minutes. If there is no sign of spinal anesthesia in the toes or feet, one may be assured that the needle is not in the subarachnoid space, and it is safe then to inject the appropriate solution in sufficient dose, being careful not to disturb the needle.

Epidural block is a simple and safe procedure that can easily be mastered using this technic. It should be a part of the armamentarium of every anesthetist and surgeon. Its field of use in giving relief of pain in cases of sciatica, diabetic neuritis, sacro-iliac sprain, and inoperable cancer is enormous. The few reports found in the literature testify as to its value. It is hoped that this paper will stimulate an interest in the use of epidural block for relief of pain.

**Summary**

There is no negative pressure in the epidural space.
The needle should have a large bore and blunt bevel point.
A simple technic for epidural block is presented.
REFERENCES


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Thursday, December 9

9:30 A.M. to 12 Noon

“The Mechanism of the Action of Volatile Anesthetics”

John C. Krantz, Jr., Ph.D., Sc.D., Chairman, Professor of Pharmacology, University of Maryland.
C. Jelleff Carr, Ph.D., Associate Professor of Pharmacology, University of Maryland.
Henry S. Ruth, M.D., Professor of Anesthesiology, Hahnemann Medical College and Hospital, Philadelphia.
Mary Louise White, M.D., Yale University.

2:00 to 4:30 P.M.

“Spinal Anesthesia”

Edward B. Tuohy, M.D., Chairman, Professor of Anesthesiology, Georgetown University.
Urban Eversole, M.D., Director of Anesthesia Section, Lahey Clinie, Boston.
L. F. Schuhmacher, M.D., The Hermann Hospital, Houston.
Stevens J. Martin, M.D., Director of Anesthesia, St. Francis Hospital, Hartford.
Theodore A. Guenther, M.D., Instructor in Anesthesiology, Georgetown University.

Thursday, December 9

Evening Session

8:00 P.M.

“Recent Aspects of the Anoxia Problem”

Cecil K. Drinker, M.D., Sc.D., Chairman, Formerly Professor of Physiology, Harvard University.
Carl F. Schmidt, M.D., Professor of Pharmacology, University of Pennsylvania.
James L. Whittenberger, M.D., Assistant Professor of Physiology, Harvard University.
Harold E. Himwich, M.D., Chief, Clinical Research Branch, Medical Division, Army Chemical Center, Maryland.
Henry K. Beecher, M.D., Henry Issiah Dorr Professor of Research in Anesthesia, Harvard University.

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