Inadvertent Dural Puncture during Epidural Anesthesia by an Epidural Catheter with a Plastic Stylet

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Epidural anesthesia was given to a 72-year-old female patient suffering from cholecystitis due to multiple gallstones, and chronic bronchial asthma. In the course of the procedure we inserted an epidural catheter (Deseret catheter with a plastic stylet) via a 17G Tuohy needle at the L1-2 intervertebral space. Since it was very difficult to insert the catheter through the Tuohy needle, we pushed it forward, applying a considerable amount of force. Following the insertion of the catheter and prior to injection of a test dose of local anesthetic, it was found that cerebrospinal fluid was flowing out through the catheter from a puncture of the dura. In a second attempt, we approached another intervertebral space, this time with a Portex catheter without a stylet, and succeeded in administering the anesthetic by means of a continuous epidural procedure.

Key Words: Epidural anesthesia, Dural puncture, Cerebrospinal Fluid, Deseret catheter with a stylet, Portex catheter

Continuous epidural anesthesia is a major form of conduction anesthesia that has few postoperative complications, particularly neurologic. In the case of operations which require prolonged administration of an anesthetic, this kind of anesthesia can be secured with the use of an epidural catheter, but in the case of short operations, epidural anesthesia can be secured for a sufficient length of time with a single injection of a local anesthetic agent. Inadvertent puncture of the dura upon the insertion of an epidural needle can occur, of course, but dural puncture by an epidural catheter itself has also been reported to occur at times. Recently, we had a case of accidental dural puncture by an epidural catheter in which a plastic stylet was used.

REPORT OF A CASE

A 72-year-old, 42-kg female patient was admitted to our hospital via the emergency room with a diagnosis of gallstones and acute cholecystitis. She had experienced mild dyspnea, frequent coughing, and sputum production for 20 years. She had, also, for several years taken an unidentified bronchodilator which she had obtained from local drugstores.

Her blood pressure was 130/80 mmHg, her pulse rate 80/min., her respiration rate 18/min., and her temperature 37.2°C. On physical examination, direct and rebound tenderness was noted in the right upper quadrant of the abdomen, and Murphy’s sign was positive. Her gallbladder was not palpable, and expiratory wheezing was noted in the entirety of the lung fields.

According to the laboratory findings, the Hgb was 12.7mg%, the Hct 38.4%, and the specific gravity of the urine 1.014. Findings were negative for urinary glucose and protein. Electrolytes were normal, serum protein was 8 gm%, and albumin 3.2 gm%. Total serum bilirubin, alkaline phosphatase, GOT, and GPT were 5.4 mg%, 3.5 I.U., 51 I.U., and 54 I.U., respectively. In the blood gas analysis pH, PaCO₂, PaO₂, actual bicarbonate, and base excess were found to be 7.44, 42 mmHg, 61 mmHg, 28 mML, and 4 mML, respectively. Multiple gallstones and dilatation of the common bile duct were seen in the ultrasonography. The E.K.G. was normal. Minimal pulmonary tuberculosis of an undetermined degree of activity was revealed in the chest film.

Since bronchial spasm can occur during the induction of general anesthesia, we chose to use epidural anesthesia. With the patient lying in the right lateral position, following the sterile preparation of the skin, a 17G Tuohy needle was inserted into the L1-2 interspace at the midline, which was easily identified and using loss-of-resistance as an indicator of correct
position, placed with the opening of the bore aimed cephalad. An attempt made to thread the needle with a 19G Portex catheter (H. Brothers Co.) failed, whereupon a 19G Deseret catheter (Deseret Pharmaceutical Co.) threaded with a plastic stylet was substituted. This catheter also met resistance, and it was necessary to apply considerable force to push it forward at first. After this initial resistance was overcome, however, the threading was completed easily. Following the insertion of the catheter and prior to the injection of a test dose of local anesthetic, it was found that cerebrospinal fluid was flowing out through the catheter from a puncture of the dura. Another interspace, T12-L1, was approached, and this time a Portex epidural catheter without a stylet was used. It was threaded to 3 cm beyond the needle. Upon aspiration no evidence of CSF was found, and 2 ml of 1.5% lidocaine was injected through the catheter as a test dose. As there were no signs of subarachnoid block after 5 minutes, 15 ml of 1.5% lidocaine was injected. Fifteen minutes after the level of anesthesia was confirmed to have reached the level of the 4th thoracic vertebra, the operation was started. Hypotension (75/55 mmHg) developed after 15 minutes. Therefore, 25 mg of ephedrine was injected intravenously, and normal blood pressure was restored and maintained. Right scapular pain developed during the manipulation of the gallbladder. Five ml of 1.5% lidocaine was injected again via the catheter, but there was no relief of the pain. Twenty mg of ketamine was injected intravenously. Forty-five minutes later another 10 ml of 1.5% lidocaine was injected via the epidural catheter. A cholecystectomy and a T-tube cholecodochostomy were performed. The operation time was 1 hour and 5 minutes, and the anesthesia time was 1 hour and 25 minutes. Postoperatively, there was no complications as a result of the puncture, and 8 days later the patient was discharged.

**DISCUSSION**

Although general anesthesia is not absolutely contraindicated in the presence of chronic bronchial asthma, bronchospasm can occur during the induction of it. We elected to use epidural anesthesia to avoid that possibility.

Peridural anesthesia for upper abdominal surgery may be produced in the form of a segmental or total block. The segmental block technique, which required injection at approximately the eighth thoracic segment level and the use of small volumes (10-15 ml) of local anesthetic, affords the advantages of a limited block. Since the lower limits of nerve interruption theoretical-ly reach only the twelfth thoracic segment, the lumbar vasomotor segments are spared. Total peridural block for abdominal surgery is usually achieved by injecting relatively large doses (20-25 ml) of local anesthetic solution into the upper lumbar region. This usually effects anesthesia of the area between the fourth or fifth thoracic and the fifth sacral segments. Since even a limited segmental block produces interruption of most of the vasomotor segments which supply the splanchnic region, a moderate to severe hypotension usually results. Many patients undergoing surgery of the stomach or gallbladder frequently experience discomfort and develop retching, vomiting, hiccups, and, occasionally, cardiovascular and respiratory disturbances. In the event that any one of the above occurs, light general anesthesia can be given concomitantly (Bonica et al. 1957).

The incidence of inadvertent dural puncture by an epidural needle has varied according to the following reports. Bonica et al. (1957), in their review of 3637 cases, have reported 79 dural perforations (2.23%). Lund et al. (1956) reported 36 single and 6 multiple punctures of the dura in 2120 cases (1.9%). Massey Dawkins (1969) has reported 18 dural perforations in 3132 cases (2.5%). Frumin and Schwarz (1957) have reported 9 dural perforations in 128 cases. Henley and Kritchman (1959) have reported 50 lumbar perforations in 460 cases (10.9%). Matteucci (1957) has reported 48 lumbar punctures in 3047 cases (58%).

In the cases in which operations are of short duration, anesthesia can be achieved successfully with a single injection of a local anesthetic agent, but if an operation is expected to be prolonged, anesthesia must be accomplished with intermittent injections of a local anesthetic via epidural catheter. Presently, there are 2 kinds of epidural catheters, one with a stylet and one without. Also, there are 2 kinds of stylets, one made of metal, and the other of plastic.

Kawaguchi et al. (1962) have reported 2 cases out of 148 in which the dura was punctured by an epidural catheter. Lund (1962) has reported 2 cases of dural puncture in 149 cases in which continuous epidural anesthesia was given. Carr and Hehre (1962) have reported 18 cases of a dural puncture made by an epidural catheter in cases in which continuous epidural anesthesia was given. In the reports there has been no mention of the kinds of use of the epidural catheters whether or not they were threaded with stylets. We can readily understand that dural puncture can occur easily if force is used to insert the epidural catheter with a metal stylet when upon insertion into the epidural needle the catheter meets with resistance, but in this case in which the stylet was made of plastic, we confirmed that it is also possible...
to puncture the dura with a catheter threaded with a plastic stylet. Many anesthetists feel that if a small amount of sterile water is injected before the epidural catheter is inserted, the catheter can be passed easily through the epidural needle. In general, it is better to pass a catheter into the midthoracic region rather than the lumbar region. The 45-degree angle of approach necessary to avoid the overhanging thoracic spines brings the side opening of the Tuohy needle directly opposite the middle of the extradural space, whereas in the lumbar region the needle is at a right angle and egress of the catheter is more difficult.

It has been reported by one another that in his experience the incidence of puncture of the dura by the catheter in the lumbar region was 2.8% and in the thoracic region 1.3% (Lund 1962). A probable cause of dural puncture by an epidural catheter probably can be due to the negative pressure from the aspirating syringe, which may pull the dura against catheters whether or not they were threaded with catheter (Robson and Brodsky 1971). Three possible courses of action can be taken following penetration of the catheter into the subarachnoid space by an epidural catheter:

1. Abandon the attempt to give epidural anesthesia and switch to general anesthesia.
2. Reattempt the peridural anesthesia either by withdrawing the needle into the peridural space or by approaching the epidural space at another intervertebral level.
3. Institute continuous spinal anesthesia.

Three courses of action are also possible if continuous lumbar peridural anesthesia is reattempted after perforation of the dura:

1. The needle may be withdrawn from the subarachnoid space into the ligamentum flavum, and the peridural space identified.
2. The needle may be withdrawn entirely from the patient and reinserted into the same interspace, and the peridural space reidentified.
3. The needle may be withdrawn entirely from the patient, and the peridural space entered through another interspace.

Passage of the catheter through the previously made hole occurs most frequently when the needle is withdrawn from the subarachnoid space, and the peridural space reidentified at the same vertebral level (Lund 1962). Carr and Hehre (1962) reported 4 cases out of 18 cases of dural puncture by an epidural catheter, in which the passage of the catheter through the previously made hole was accomplished. Puncture of the dura does not constitute a contraindication to peridural anesthesia. In the cases in which another site was selected, there was no evidence of subarachnoid block due to local anesthetic injection (Lund 1962).

REFERENCES