Negative aspiration for cerebral spinal fluid does not assure proper placement of epidural catheter

Inadvertent subarachnoid injection of a local anesthetic during the conduct of epidural anesthesia may have a devastating effect on the patient. The incidence of dural puncture with an epidural catheter has been reported to range from 0.5% to 0.9%. This case report demonstrates that, despite negative aspiration of cerebral spinal fluid from the catheter, subarachnoid injection of a local anesthetic can occur.

Key words: Bupivacaine, dural headache, epinephrine, headache, microcatheters.

An anesthesia consult for lumbar epidural analgesia was submitted for a healthy 34-year-old gravida 5, para 3 female. She had had an uncomplicated 39-week pregnancy and was in her active phase of labor. The patient was 66 inches tall and weighed 74 kg. Her blood pressure varied from 116/70 to 135/90. An infusion of 1500 mL lactated Ringer’s solution was given prior to initiation of the block. The patient was placed in a left lateral decubitus position, and her lower back was prepped with povidone-iodine (Betadine®) solution, which was allowed to dry. The skin was anesthetized at the L3-4 interspace, and a 17-gauge Hustead needle was inserted. The epidural space was identified using a loss of resistance technique with 2 mL of air. Following negative aspiration for blood and cerebral spinal fluid (CSF), a 2-mL test dose of 0.25% bupivacaine was injected. After approximately 3 minutes, with no alterations in blood pressure or pulse and no changes in motor or sensory abilities, an epidural catheter was inserted in a caudal direction approximately 4 cm beyond the bevel of the epidural needle. The catheter was affixed to the patient’s back, and she was then allowed to assume a semisitting position.

Aspiration of the catheter proved negative for CSF and blood, and 5 mL of bupivacaine 0.25% was subsequently injected. Within 2 minutes, the patient lost motor control of her lower extremities, and 5 minutes later she complained of heaviness in her chest and tingling in her little fingers, indicating a sensory loss to at least a C8 level. Her blood pressure decreased to 90/49, and oxygen was supplied by face mask at 10 L/min. Left uterine displacement was achieved with a hip roll, and epinephrine, 10 mg, was intravenously administered. Her blood pressure returned to pre-epidural values and remained stable for the remainder of her labor. Her vital signs, as well as fetal heart rate and uterine contractions, were electronically monitored for the duration of her labor.

Three and one-half hours following the injection of bupivacaine, the patient’s motor and sensory abilities returned to the point where she could actively participate in the delivery of a healthy 7 lb, 2 oz male whose Apgar scores were 8 at 1 minute and 9 at 5 minutes. No forceps were required for her delivery.

The epidural catheter was removed following
the delivery, and 2 days later the patient was discharged from the hospital without sequelae.

Discussion

The fact that CSF could not be withdrawn through the catheter and that no response occurred to a test dose of local anesthesia suggests that the high motor and sensory blockade may have been the result of injecting a local anesthetic into the epidural space during a contraction. This concern is arrested, however, by Sivakumaron and associates, who demonstrated that uterine contraction does not significantly influence the spread of local anesthetics in the epidural space.1 Moreover, the rapidity with which motor and sensory blockade occurred seems to indicate that intrathecal injection of bupivacaine through an epidural catheter took place.

The incidence of inadvertent subarachnoid catheterization during continuous epidural anesthesia has been reported to range from 0.5% to 0.9%.2,6 Although it would have been prudent to avoid the possibility of high spinal anesthesia by injecting the test dose through the catheter, negative aspiration of CSF through the epidural catheter, as well as a negative response to a test dose of local anesthetic, does not necessarily ensure proper placement of an epidural catheter.

In a series of 3,132 epidural anesthetics, Carr and Hehre reported 18 inadvertent arachnoid membrane punctures with an epidural catheter and in 13 of these cases, CSF could not be aspirated.3 Determination of subarachnoid placement of the epidural catheter was made only after spinal anesthesia ensued followed the test dose of local anesthesia. In a case report by Corke and Brown, high spinal anesthesia occurred in a laboring parturient despite a negative aspiration for CSF and a negative response to a test dose of local anesthetic.7 At the time of delivery, which was 1 hour and 45 minutes following their injection of 10 mL of bupivacaine 0.5% into the subarachnoid space, measurements were made of the bupivacaine concentration in the maternal vein, umbilical vein, and artery. Drug concentrations were 0.09 μg/mL and 0.04 μg/mL for the maternal vein and umbilical vein, respectively, and were not detectable in the umbilical artery blood.

Scanlon and associates examined neurobehavioral responses and drug concentrations in newborns after maternal epidural anesthesia with bupivacaine.8 In their report, the researchers found that with a mean dose of 112 ± 7 mg (± standard error), the concentration of bupivacaine in the maternal venous blood, umbilical vein blood, and umbilical artery blood at the time of delivery was 0.41 ± .05 μg/mL, 0.11 ± .02 μg/mL, and 0.27 ± .01 μg/mL, respectively. Neurobehavior in all infants examined 2–4 hours after delivery was found to be either normal or superior. In considering the case presented by Corke and Brown, in lieu of the findings of Scanlon and associates, it is unlikely that the dose of bupivacaine injected by this author would have had any adverse effects of the neonate. Therefore, no attempt was made to document blood levels of bupivacaine for this patient at the time of delivery.

The use of a local anesthetic containing epinephrine as an epidural test dose for obstetric patients is controversial. Various authors recommend injection of 15 μg epinephrine9–11 and, indeed, Moore and Batra have found an average 30 beats per minute increase in heart rate following an intravenous injection of 15 μg epinephrine in unpremedicated nonpregnant volunteers.12 Nonetheless, epinephrine was omitted from the test dose because of its questionable reliability in producing tachycardia in pregnant patients. Beta 1 and 2 activity appear to be diminished in pregnant women at term.13–15

The study by DeSimone and colleagues suggests that a circulating beta inhibitor to catecholamines occurs during pregnancy,13 while the study by Nisell and associates also suggests that pregnancy is associated with an attenuated vascular response to circulating catecholamines.14 Furthermore, failure to elicit tachycardia with a test dose of epinephrine does not assure proper placement of the epidural catheter. Reports have indicated failure to obtain blood from an epidural catheter upon syringe aspiration and gravity drainage or to elicit tachycardia with a 3-mL test dose of lidocaine and epinephrine 1:200,000, even though vascular placement of the epidural catheter was later verified.15,16

The effects of epinephrine on uterine blood flow are also controversial. While some authors have demonstrated a 14%–50% reduction of uterine blood flow in pregnant ewes17,18, studies by Albright and associates19 have shown that 1:200,000 epinephrine does not alter intervillous blood flow in laboring women, despite a reduction in mean blood pressure of 11 torr.

The fact that this patient had not developed a postdural puncture headache does not seem surprising in light of various studies and case reports which reveal that the incidence of headache from continuous spinal anesthesia with 19- to 24-gauge standard epidural catheters ranges from 0% to 18%.20,21 This is comparable to the overall incidence of postdural puncture headache following single-dose spinal anesthesia, which ranges from 6% to
11% with 25- and 26-gauge needles and 36% with 22-gauge spinal needles. It is interesting to note that the recent resurgence of the use of microcatheters for continuous spinal anesthesia has really not decreased the overall incidence of postdural puncture headache. Hurley and Lambert report about a 3% incidence of headache in 60 obstetric and general surgery patients using 32-36-gauge polyimide catheters. Meanwhile, Drasner reports the occurrence in approximately 13%, using 28-gauge spinal catheters in a group of 30 patients ranging in age from 23 to 90 years, and Moote reports the incidence at 12% using 20-gauge catheters.

Conclusion

This case report demonstrates that inadvertent epidural catheter insertion or migration into the subarachnoid space can occur, and despite a negative response to a test dose of a local anesthetic and negative aspiration for CSF through the catheter, high spinal anesthesia may occur. This report also discusses the controversy surrounding the use of epinephrine as part of the test dose. Although advocated by some clinicians, this author as well as others refrain from using epinephrine in the pregnant population because of its unreliability as a marker for intravenous injection of local anesthesia.

REFERENCES


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