Intrathecal opioids plus bupivacaine: An option to prolong analgesic efficacy when using the combined spinal-epidural technique—A case report

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Providing analgesia in the latent phase of labor can be challenging. Many obstetricians and nurse midwives believe that epidural analgesia initiated too early in the course of labor can prolong labor and result in fetal malpresentation, thus increasing the need for instrumentation.

Many practitioners therefore use the combined spinal-epidural technique with intrathecal opioids during the early portion of first stage labor and initiate epidural analgesia only in the active phase of labor. However, the use of intrathecal opioids has been shown to be less than efficacious in meeting the analgesic needs in a large segment of the patient population, thus requiring initiation of epidural analgesia after only 1 to 2 hours.

A case is reported in which the combined spinal-epidural technique was utilized in a primigravida patient. An intrathecal dose of 15 μg of sufentanil was given with a dilute concentration of bupivacaine at the initiation of analgesia. Analgesia was provided for approximately 5 hours before epidural analgesia was required. The patient delivered by spontaneous vaginal delivery without instrumentation or adverse sequelae to mother or infant.

Key words: Analgesic efficacy, combined spinal-epidural technique, intrathecal opioids, obstetrics.

Introduction
Anesthesia providers administering routine analgesia during labor are often frustrated by the limitations of currently available analgesic techniques. Patients often request analgesia during the latent phase of labor. Epidural analgesia is frequently not utilized in the early course of labor because of the misconception by many obstetricians and nurse midwives that it can result in prolonged labor and fetal malpresentation.

As an alternative, many anesthesia practitioners utilize intrathecal opioids for the control of early labor pain. It has been shown that intrathecal opioids give adequate analgesia during the first stage of labor without a resultant motor blockade or prolongation of labor. However, intrathecal opioids are typically only efficacious for approximately 1 to 3 hours, and supplemental analgesia is often required. A number of different intrathecal opioids have been used for pain control. Morphine was the first to be widely used; however, it soon fell into disfavor because of its slow onset of action. Fentanyl or sufentanil in combination with morphine increases the onset of analgesia because of their lipid solubility and unique action at the spinal cord level. Even this combination, however, was found to provide inadequate analgesia for the entire first stage of labor.

To address this deficiency, researchers began combining concentrations of local anesthetics with intrathecal opioids. Here, a case is presented in which low intrathecal concentrations of local anesthetics were used in combination with sufentanil. This successfully delayed the need for the initiation of epidural analgesia until the patient had...
advanced cervical dilation. The most important parameters when evaluating obstetric analgesic techniques are efficacy, patient satisfaction, time to initiation of supplemental analgesia, incidence of side effects, fetal heart rate patterns, and degree of motor blockade. Therefore, these parameters will be evaluated for the case presented.

Case summary

The patient was a 24-year-old, ASA physical status II, primigravida, 65 inches tall, weighing 75 kg. Her medical history was unremarkable. Hemoglobin, hematocrit, and platelet counts were within normal limits. She had no known drug allergies and reportedly took prenatal vitamins during pregnancy. She attended prenatal classes and planned a natural childbirth.

The patient was admitted at 1:00 AM with a term pregnancy. Mild contractions were felt by palpation occurring every 5 minutes and lasting 20 to 30 seconds. Her contractions diminished in intensity and frequency by 3:00 AM, and an oxytocin infusion was started that was continued until delivery. By 4:30 AM, she was having intense contractions lasting 45 seconds every 3 minutes. The fetal heart rate showed good variability. Her cervical examination showed 3 cm dilation, 100% effacement, and +2 station. It was at this point that she requested analgesia. She reported her pain as a 10 on a 0 to 10 visual analog scale, where 0 = no pain and 10 = the worst pain ever experienced.

The anesthesia department was consulted, and an anesthetic plan was formulated. The patient was examined and given the option of a standard intrathecal opioid block, placement of a small amount of bupivacaine with an opioid intrathecally, or having the intrathecal opioid plus bupivacaine placed with an epidural catheter concurrently, using the combined spinal-epidural (CSE) technique. The patient chose the latter method. This technique was used after informed consent was obtained and after evaluation of the condition of the parturient and fetus by the attending obstetrician. Intrathecal sufentanil was given in a dose of 15 µg in combination with 2.5 mg of bupivacaine.

The patient was placed in a right lateral decubitus position, and her back was prepped with povidone iodine and draped in a sterile manner. Monitoring was performed with a pulse oximeter and a noninvasive blood pressure device, in addition to the internal fetal monitor already in place. The patient was prehydrated with 500 mL of lactated Ringer’s solution. The skin around the area of L3-4 was infiltrated with 1% lidocaine, and an 18-gauge Hustead needle was placed. Using a loss of resistance technique to locate the epidural space. A 41/16-inch, 25-gauge Sprotte needle (Becton Dickinson, Rutherford, New Jersey) was then inserted through the lumen of the epidural needle into the subarachnoid space. Cerebrospinal fluid (CSF) was noted to return through the Sprotte needle, thus confirming adequate placement. An intrathecal opioid dose of 15 µg of sufentanil, 2.5 mg of bupivacaine, 1.0 mL of preservative-free normal saline, and 0.5 mL CSF was then injected, for a total volume of approximately 2 mL. The spinal needle was then withdrawn, and the epidural catheter was inserted approximately 3.5 cm into the epidural space. After negative aspiration for blood and CSF, 3 mL of preservative-free normal saline was injected through the catheter to confirm patency. The catheter was then secured into place, and the patient was placed in a supine position with left uterine displacement.

Pain scores, maternal blood pressure, heart rate, and respiratory rate were recorded at 5-minute intervals for the first 30 minutes and every 30 minutes thereafter. The level of sensory blockade to pinprick and the degree of motor block according to a modified Bromage scale (Table I) were also recorded at the same intervals. The patient was also observed for any side effects, including nausea, vomiting, pruritus, somnolence, respiratory depression, hypotension, and urinary retention. Fetal heart rate and variability were also assessed. Neonatal evaluation included the 1- and 5-minute Apgar scores and umbilical artery and umbilical venous pH at the time of delivery.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Score</th>
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<tbody>
<tr>
<td>Full range of motion of hips, knees, and feet</td>
<td>0</td>
</tr>
<tr>
<td>Movement of feet and knees only</td>
<td>1</td>
</tr>
<tr>
<td>Movement of feet only</td>
<td>2</td>
</tr>
<tr>
<td>Inability to move hips, knees, or feet</td>
<td>3</td>
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Approximately 2.5 minutes after placement of the intrathecal sufentanil-bupivacaine combination, the patient reported her pain as 4 on the 0 to 10 scale. Approximately 10 minutes after the injection, the patient reported painless contractions and assessed them as a 0 on the 0 to 10 scale. The modified Bromage scale score was noted to be 0 at this time and remained at 0 until the initiation of epidural analgesia, approximately 5 hours later. This score of 0 implies no degree of motor blockade and thus should not result in prolongation of labor or
fetal malposition.7 Sensory blockade to pinprick was assessed at approximately T-8. In addition to continuous nursing observation, an anesthesia provider performed hourly assessments to ascertain pain levels, incidents of side effects, and the degree of motor blockade.

The patient reported mild pruritus at each assessment, but stated that this was not causing any stress and, thus, required no treatment. No reports of nausea, vomiting, or somnolence were noted throughout labor. There was no evidence of urinary retention, as the patient had been voiding spontaneously throughout the first stage of labor, and when catheterized according to hospital protocol at the initiation of second stage, only 120 mL was obtained. Blood pressure remained stable, and the systolic pressure decreased only 8 mmHg after the initiation of analgesia. Oxygen saturation remained at greater than 95% on room air oxygen throughout labor. No respiratory depression was noted. The fetal heart rate continued to be 120 to 150 with good variability.

At approximately 5 hours after initial block, the patient began experiencing increased pain and rated her pain as a 7 on the 0 to 10 scale. She had reported her pain as 2 approximately 30 minutes prior to this increased pain. It was ascertained that the patient was approaching the second stage of labor as evidenced by cervical dilation of 9 cm, complete effacement, and 0 station. Her sensory block, according to pinprick was noted at T-12. The epidural catheter was tested for placement by aspiration for blood and CSF followed by injection of 3 mL of 1.5% lidocaine with 1:200,000 epinephrine. No blood or CSF was aspirated, and the patient had a negative response to the test dose. The patient was given 7 mL of 0.125% bupivacaine with 50 μg fentanyl via the epidural catheter. A level of T-9 was established with no significant decrease in maternal vital signs or fetal heart rate. An epidural infusion of 0.0625% bupivacaine with 2 μg/mL fentanyl was initiated at 10 mL/hr.

The patient’s vital signs were assessed every 5 minutes for the first 30 minutes and every 15 minutes thereafter. The modified Bromage score was 1 approximately 30 minutes after epidural dosing and stayed at 1 throughout the remainder of labor. No incidence of nausea, vomiting, or somnolence was reported by the parturient. She reported pain scores ranging from 0 to 5 after initiation of epidural blockade to the time of delivery. The higher pain scores were reported right at the time of delivery. The patient continued receiving the epidural infusion until delivery at 11:15 AM, 6.5 hours after the initiation of analgesia.

The patient spontaneously delivered a 7 lb, 9 oz boy. The pediatricians in attendance gave the neonate Apgar scores of 9 and 9 at 1 and 5 minutes, respectively. The umbilical artery pH was 7.25, with an umbilical venous pH of 7.37.

Overall, the patient reported a satisfactory analgesic experience. Six hours after the epidural catheter was removed, the patient was ambulating and voiding without difficulty. Analgesia was maintained with oral hydrocodone bitartrate (Vicodin®). The patient was discharged to home the following day with no adverse sequelae.

Discussion

Obstetrical anesthesia is one of the most challenging areas of anesthesia because of the need to provide adequate analgesia without prolonging labor or causing severe side effects for the mother or fetus. A number of different techniques are used to control labor pain, all of which can have undesirable side effects that must be dealt with by both anesthesia and obstetric personnel. Parenteral opioids, commonly used for labor analgesia, often cause depression for the mother and the fetus without delivering adequate analgesia.8,9 Lumbar epidural block is considered the most effective anesthetic method. As previously stated, early initiation of lumbar epidural analgesia is associated with an increase in the duration of first and second stages of labor, as well as the likelihood of fetal malposition and need for instrumentation.10

In the early 1980s, several investigators studied intrathecal morphine as a single spinal injection of 0.5 to 2 mg for labor analgesia.11,12 This technique attracted much interest because of its apparent ease of administration and the perception that close supervision by an anesthesia provider was not necessary. Unfortunately, analgesia onset was slow (15 to 60 minutes), and it required 1 to 2 hours to reach peak effect with a variability in duration of efficacy. Even with higher doses, it was noted that analgesia was often incomplete and required supplemental analgesia.

This resulted in a decrease in the use of subarachnoid morphine until 1989 when Leighton et al described the use of intrathecal morphine in combination with fentanyl.13 These investigators reported that this combination provided “rapid onset of profound, prolonged analgesia.” However, intense analgesia from this technique was only noted to last for 2 to 4 hours, and patients who did not deliver within this time frame often required the use of epidural analgesia. Arkoosh and associates recently reported little difference between the quality and duration of labor analgesia produced by subarachnoid administration of sufentanil 10 μg or fentanyl 25 μg, with morphine 0.25 mg, and in addi-
tion stated that this analgesia cannot be relied on throughout labor. The use of morphine for labor analgesia has also fallen into disfavor because of the incidence of side effects, including pruritus, nausea, vomiting, urinary retention, and protracted respiratory depression. It was noted in recent studies that subarachnoid morphine produced significantly more pruritus than did epidural morphine or intrathecal fentanyl or sufentanil. This pruritus had been attributed to its unique action in the spinal cord where it suppresses noxiously induced reflexes and causes excitatory effects at the spinal cord that manifest as hyperalgesia and pruritus.

The CSE technique was first described in 1981 by Brownbridge as an anesthetic technique for cesarean section in which two separate injections were given. It was later modified by Coates who outlined a needle-through-the-needle single interspace technique. The CSE technique offers several advantages over other procedures because it can be initiated early in the labor to facilitate analgesia in the laboring parturient. This is especially useful in the primigravida patient, in whom early initiation of epidural analgesia can reportedly slow the progress of labor. Because only intrathecal opioids are given initially, there is typically no degree of motor blockade, hypotension, or urinary retention. However, it should be noted that this technique can result in all the side effects normally seen with epidural analgesia, thus, all parturients should be closely monitored with maternal and fetal monitoring. Also, it should be noted that there is an increased risk of postdural puncture headache because the dura is being penetrated by the spinal needle. In addition, there have been cases reported of metallic particles in the subarachnoid space when using the needle-through-the-needle approach for the CSE technique. Prolongation of the first and second stage of labor has not been reported with the technique described in this article, nor have an increase in fetal malposition and need for instrumentation been reported.

Use of the combined technique in which only intrathecal opioids were used was initially very popular. This was because it exposed the parturient and the fetus to minute concentrations of medications and allowed the parturient the freedom to ambulate without any degree of motor blockade. However, many practitioners complained that the intrathecal opioids were not effective without the addition of local anesthetics, and epidural analgesia was often required after only a short time, leading to increased patient dissatisfaction. The most frequent intrathecal opioids include morphine, fentanyl, and sufentanil. Fentanyl and sufentanil have the distinct advantage of rapid onset, typically providing analgesia for 60 minutes and 90 to 120 minutes, respectively.

In an attempt to increase the speed of onset and the duration of analgesia, various drug combinations with potential synergism have been investigated. A number of investigators have reported intrathecal administration of very low concentrations of local anesthetic in combination with fentanyl or sufentanil for analgesia during labor. Vergauttern and associates first reported the use of spinal sufentanil in combination with epidural bupivacaine in rats, with favorable results. The first studies to use low-dose intrathecal bupivacaine (5 mg) in labor were reported by Stacy et al. They reported significant motor blockade in approximately 40% of their patient population. Campbell et al reported that the duration of analgesia achieved by intrathecal bupivacaine alone was 70 ± 34 minutes by sufentanil alone was 114 ± 26 minutes, and the combination of 2.5 mg of bupivacaine and 10 µg of sufentanil was 148 ± 27 minutes. They reported no evidence of motor weakness, excessive somnolence, or fetal heart rate abnormalities.

The patient described in this case report required the use of epidural analgesia 5 hours after the initiation of intrathecal medication administration. The combined technique enabled initiation of epidural analgesia before the patient began to experience severe pain. A more dilute solution of local anesthetic was used, thus avoiding many of the potentially serious side effects of local anesthesia. This patient was given 15 µg sufentanil in combination with 2.5 mg bupivacaine. She achieved adequate analgesia for a period of approximately 300 minutes, or approximately twice as long as that reported by Campbell et al, with no occurrence of nausea, vomiting, somnolence, hypotension, or motor blockade. The length of analgesia seen in this case report could possibly be explained by the greater amount of sufentanil given intrathecally and the synergistic effect of combining the local anesthetic with an opioid. Intrathecal fentanyl has been shown to synergistically enhance the antinociceptive effect of subsequently administered bupivacaine in dogs.

For this patient, the CSE technique resulted in good analgesia without an increase in the duration of labor. Based on the parameters for evaluation of obstetrical analgesia, the CSE was a satisfactory and successful anesthetic technique. The CSE offers a viable alternative for treating the parturient early in the course of her labor without the resultant motor blockade and potential prolongation of labor that is attributed to lumbar epidural analgesia. This can theoretically translate into increased cost con-
tainment and overall greater patient satisfaction. A word of caution is warranted because this is a report of only one case in which excellent analgesia was attained with no significant incidence of side effects. The results from this one case study were remarkable and may not be completely achieved with every case.

REFERENCES


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