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Treatment of Incomplete Analgesia after Placement of an Epidural Catheter and Administration of Local Anesthetic for Women in Labor

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Background: **Approximately 15% of women still have pain after placement of an epidural catheter and administration of local anesthetic for labor analgesia. Two techniques frequently used to treat this pain were compared: (1) withdrawal of the catheter 1 cm and repeated dosing with additional local anesthetic, and (2) repeated dosing with additional local anesthetic without any catheter manipulation.**

Methods: **Fifteen minutes after placement of a multiple-orifice epidural catheter 5 cm into the epidural space and administration of 13 ml 0.25% bupivacaine to the parturient in labor, the adequacy of analgesia was assessed. All women who had incomplete analgesia were randomized (first intervention) to receive an additional 5 ml 0.25% bupivacaine (local-anesthetic-only group) or to receive 5 ml 0.25% bupivacaine after first withdrawing the epidural catheter 1 cm (catheter-manipulation group). If after 15 min the woman still had pain, then (second intervention) the catheter was withdrawn 1 cm and an additional 5 ml 0.25% bupivacaine was administered to the local-anesthetic-only group, whereas 5 ml 0.25% bupivacaine was given to the catheter-manipulation group without further catheter manipulation. The success rate of the second intervention was assessed 15 min later.**

Results: **Seventy-eight women were enrolled in the study, 39 to each group. In the local-anesthetic-only group, 29 (74%) women were successfully treated with the first intervention and the remaining 10 (100%) were successfully treated with the second intervention. In the catheter-manipulation group, 30 (77%) were successfully treated with the first intervention and 7 (100%; 2 patients were not studied because of investigator error) were successfully treated with the second intervention (P = NS).**

Conclusions: **Administration of additional local anesthetic without first withdrawing the epidural catheter will effectively treat most women for whom analgesia is incomplete after the placement of an epidural catheter during labor. (Key words: Complications; obstetrics; pain; regional anesthesia.)**

EPIDURAL anesthesia is a popular mode of pain relief for women in labor. However, 10-15% of all epidural anesthetics result in incomplete pain relief.[1] The residual pain is often localized to one or two dermatomes on one side of the abdomen and is probably due to inadequate spread of local anesthetic within the epidural space.[2] Different treatment methods have been recommended for this residual pain: (1) administration of supplemental doses of local anesthetic after withdrawing the epidural catheter 1 cm,[3] (2) administration of supplemental doses of local anesthetic without withdrawing the epidural catheter,[4] and (3) immediate replacement of the epidural catheter.** Those who suggest that the anesthesiologist should administer supplemental doses of local anesthetic, with or without withdrawing the epidural catheter, contend that attempts should be made to obtain adequate analgesia without subjecting the patient to another procedure, such as epidural catheter replacement. On the other hand, those who suggest immediate replacement of the epidural catheter argue that administration of more local anesthetic, with or without repositioning of the

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catheter, is unlikely to succeed and will only prolong the woman's discomfort. None of these treatment recommendations are based on scientific study, nor have any of these treatment protocols been compared with each other. If the success rate of the first two options is acceptable and can be accomplished quickly, then it would make sense not to subject the woman to another procedure.

The purpose of this study was to determine the effectiveness of supplemental administration of local anesthetic with or without withdrawing the epidural catheter when patients experience inadequate analgesia after epidural catheter insertion and administration of local anesthetic, and to determine which of the two has a greater success rate.

Methods

The protocol was approved by our institutional review board, and written, informed consent was obtained from each parturient before the epidural catheter was placed. Women in active labor who were having contractions at least once every 5 min, who had no contraindication to epidural analgesia, and who requested epidural analgesia were enrolled in this prospective, randomized, and blinded study. Women with spinal column disorders including scoliosis and herniated discs, and women who had undergone spinal surgery were excluded from participation.

All epidural catheters were placed with the woman in the sitting position. Using an 18-gauge Hustead needle, the epidural space was identified *via* a midline approach at the L2–3 or L3–4 interspace using the loss-of-resistance-to-air technique. After the epidural space was located, a 20-gauge multiple-orifice catheter (Perifix; B. Braun Medical, Bethlehem, PA) was threaded through the cranially directed tip of the epidural needle to a depth of 5 cm into the epidural space. No local anesthetic was injected through the epidural needle before epidural catheter placement.

While the woman was still sitting, attempts to aspirate blood or cerebrospinal fluid *via* the catheter were made using a 3-ml syringe. If there was no aspirate, a 3-ml test dose of 0.25% bupivacaine without epinephrine was administered through the catheter. The presence of clinical signs of an intravascular injection were sought for the following 2 or 3 min by asking the woman if she felt dizzy, had tinnitus, or had a metallic taste in her mouth. If there were no signs of an intravascular injection, the catheter was secured with a Tegaderm (3M Health Care, St. Paul, MN) transparent dressing and the woman was placed in the supine position with left uterine displacement. Five minutes after the test dose, if there were no clinical signs of subarachnoid injection as evidenced by the woman's ability to move her legs and the absence of hypotension, an additional 10 ml 0.25% bupivacaine was administered in two divided doses 5 min apart. If the epidural catheter had been placed into the intravascular space, the catheter was removed and the procedure was repeated at a different interspace. If the catheter had been placed in the subarachnoid space, the patient was withdrawn from the study.

The adequacy of analgesia was assessed 15 min after the last dose of local anesthetic had been administered. Analgesia was assessed by asking the woman if she felt any pain at the peak of a contraction. If she said that she still had pain, she was asked to point to the location of the pain and to quantify the amount of pain by using a verbal 0 to 10 score, with zero being "no pain" and 10 being the "worst pain imaginable." She was instructed to indicate only if she had pain, not if she felt pressure. The presence and location of any nonanesthetized area was confirmed by the anesthesiologist using an alcohol swab to look for differences in cold perception. Confirmed unsatisfactory sensory blockade was classified as complete (failed epidural) if the patient had no areas of sensory blockade, and incomplete if the woman had "missed segments" localized to one side.

If the woman did not state that she had any pain or if she had a failed epidural catheter, she was not enrolled in the study. If the woman said that she had pain and it was classified by the anesthesiologist as incomplete, she was entered into the study and was randomized to one of the two treatment groups. All women were turned to the lateral decubitus position with the painful side in the dependent position. The woman (first intervention) received 5 ml 0.25% bupivacaine (local-anesthetic-only group), or the anesthesiologist first withdrew the epidural catheter 1 cm, so that 4 cm of epidural catheter remained in the epidural space, and then administered 5 ml 0.25% bupivacaine (catheter-manipulation group). In both cases, the anesthesiologist "manipulated" the tape on the woman's back before injection of the local catheter so that she was blinded to her group assignment. The randomization sequence used was generated by a table of random numbers. If the random number was odd, the patient was assigned to the local-anesthetic-only group, and if the random

number was even the patient was assigned to the catheter-manipulation group. The results of the randomization were sealed in opaque envelopes and opened sequentially by the anesthesiologist only after the woman developed incomplete analgesia.

Fifteen minutes after the first intervention, the woman was assessed by a second anesthesiologist who was blinded to the woman's group assignment to determine the success of the treatment. This anesthesiologist asked the woman if she still had pain, asked her to quantify the pain on the same 0–10 scale, and to localize the pain. If the woman did not say that she had pain, the study was complete. If the woman still stated that she had pain, the study was continued in a blinded manner by the first anesthesiologist. If the woman was in the local-anesthetic-only group, the anesthesiologist (second intervention) withdrew the catheter 1 cm so that 4 cm of epidural catheter remained in the epidural space and then administered another 5 ml 0.25% bupivacaine. If the woman was in the catheter-manipulation group, then the anesthesiologist administered 5 ml 0.25% bupivacaine without further catheter manipulation. In either case, the anesthesiologist manipulated the tape on the woman's back before injecting the local catheter so that she remained blinded to her group assignment. Fifteen minutes after the second intervention, the woman was again evaluated as described before by the second anesthesiologist and the study was complete. Further treatment, if necessary, was at the discretion of the anesthesiologist.

Statistical Analyses

Data were analyzed with chi-square tests to compare the success rates between the groups. Probability values <0.05 were considered significant.

Results

Six hundred thirty-nine women were enrolled and 78 (12.2%) who had incomplete analgesia 15 min after 13 ml 0.25% bupivacaine was given were studied. Thirty-nine women were randomized to the local-anesthetic-only group and 39 to the catheter-manipulation group. Mean height and weight and median initial pain scores, after 13 ml bupivacaine but before the first intervention, were similar in the two groups of patients. In all women and within each group, right-sided incomplete analgesia (n = 63) occurred more often than left-sided incomplete analgesia (n = 15) (table 1).

Table 1. Patient Characteristics and Initial Pain Scores

	Local Anesthetic Only	Catheter Manipulation
Height (cm)*	165 ± 8	164 ± 7
Weight (kg)*	73 ± 20	73 ± 21
Pain score before 1st intervention†	5.5 (2–9)	5.0 (2–8)
0 or 1	n = 0	n = 0
2 or 3	n = 9	n = 9
4 or 5	n = 13	n = 14
6 or 7	n = 12	n = 14
8 or 9	n = 5	n = 2
10	n = 0	n = 0
Incomplete analgesia		
Right-sided	33	30
Left-sided	6	9

* Data are mean ± standard deviation.

† Data are median (range).

Overall, 59 of 76 (75.6%) of the women were successfully treated after the first intervention, 29 of 39 (74%) in the local-anesthetic-only group and 30 of 39 (77%) in the catheter-manipulation group (P = NS). The 95% CI for the 3% difference between these success rates (77% *vs.* 74%) is 9 (confidence limits, −6% to 12%). Thus our sample size was sufficiently large to demonstrate that withdrawing the epidural catheter does not produce a clinically important improvement in success compared with administering local anesthetic alone (*i.e.*, at most 12%). Because of investigator error, the second intervention was not performed in two women in the catheter-manipulation group. In the local-anesthetic-only group, all 10 women were successfully treated after the second intervention; in the catheter-manipulation group, all seven remaining women were successfully treated after the second intervention (table 2). One woman, 5 h after the study protocol was complete, required replacement of the epidural catheter. She was originally randomized to the catheter-manipulation group.

Discussion

The cause of unblocked dermatomes after the placement of an epidural catheter and administration of local anesthetic is unknown. Proposed theories include slow injection of small volumes of local anesthetic, the presence of an epidural septum, midline adhesions, placement of the epidural catheter through an intervertebral

Table 2. Treatment Success Rates in Each Group

	Local Anesthetic Only	Catheter Manipulation
Number of patients	39	39
Success after initial intervention	29/39 (74%)	30/39 (77%)
Number of patients requiring 2nd intervention	10	7*
Pain score before 2nd intervention		
0	n = 29	n = 30
1	n = 0	n = 0
2 or 3	n = 4	n = 4
4 or 5	n = 3	n = 1
6 or 7	n = 2	n = 4
8	n = 1	n = 0
9	n = 0	n = 1
10	n = 0	n = 0
Success after 2nd intervention	10/10 (100%)	7/7 (100%)
Replaced catheters	0	1

* Two patients were not studied due to investigator error.

foramen, and placement of the epidural catheter into the anterior epidural space.[5] Asato and Goto[2] performed radiographic studies on seven women during labor who had incomplete analgesia after placement of an epidural catheter. They found that a suboptimal position of the epidural catheter was responsible for all the cases of inadequate analgesia. In four of the cases the epidural catheter was placed in the anterior epidural space, and in three of the cases the catheter had migrated out through an intervertebral foramen. They suggested that administration of more local anesthetic may have treated the inadequate analgesia in women whose catheters were in the anterior epidural space. However, administration of additional local anesthetic would probably not improve the analgesia if the catheter had migrated out through an intervertebral foramen unless attempts at repositioning the catheter were first made.

In this study we found a 12% incidence of incomplete analgesia. The rate of inadequate analgesia varies from study to study, depending on the type of catheter used[6] and the depth that the catheter is threaded into the epidural space.[7] Our finding of 12% is consistent with that found in other studies.[1,7] In this study, we also found that the patient's right side was the predominant side on which incomplete analgesia occurred (81%). This is consistent with the results of Ducrow,[8] who also found that incomplete analgesia occurred more commonly on the right side (79%) than on the left (21%). Reasons for this finding are unclear but may be related to the fact that all patients were placed with left uterine displacement immediately after the epidural catheter was secured. However, we believe this unlikely to be the mechanism because it is controversial whether patient position affects the quality of epidural analgesia.[9,10] Another hypothesis for the greater incidence of right-sided incomplete analgesia is that epidural catheters tend to deviate to the left more often than to the right. Indeed, Gielen *et al.*,[11] in a radiographic study of epidural catheters, found that the catheter deviated to the left more often than to the right.

The two techniques evaluated in our study, administration of more local anesthetic without first withdrawing the epidural catheter, and administration of more local anesthetic after withdrawing the epidural catheter, both had high success rates with the first intervention, 74% and 77%, respectively. After the second intervention, both groups achieved a 100% success rate. Our results indicate that it was an increase in the volume of local anesthetic that corrected the incomplete analgesia during the first intervention and not withdrawal of the epidural catheter. This would also appear to be the case after the second intervention, but we cannot state this definitively from our data.

In our study population, only one epidural catheter was replaced for inadequate analgesia, and that occurred 5 h after the study was completed. Because it occurred so long after the protocol was completed, we do not consider that this was related to the study protocol and believe that it might have occurred even if the catheter had been replaced at the beginning of the study.

This study did not assess the best treatment option if a woman has no areas of sensory blockade after the placement of an epidural catheter and administration of local anesthetic (failed epidural). A failed epidural may occur if the catheter is not in the epidural space, there is a mechanical problem with the catheter, or the dose of local anesthetic is inadequate.

Our study did not evaluate immediate replacement of the epidural catheter when incomplete analgesia occurs. This option was not included because our clinical experience has been that most patients who develop incomplete analgesia can be managed without catheter replacement. Potential complications associated with catheter replacement can be avoided if analgesia can be otherwise obtained. On the other hand, if analgesia is delayed, and certainly if it is never achieved, then it would have been worthwhile to

replace the catheter immediately. We found that approximately 75% of women had complete analgesia with the first intervention and all had complete analgesia with the second intervention. In our protocol, the longest period that a woman waited for complete analgesia (after diagnosis of the problem) was an additional 30 min (and most only waited 15 min). The exact time it takes to replace and repeat the dose of anesthestic for an epidural catheter varies, but 15–30 min is a reasonable estimate.

In conclusion, if after placement of an epidural catheter and administration of local anesthetic to a woman during labor and analgesia is incomplete, we recommend that the next step be administration of additional local anesthetic without catheter replacement or manipulation.

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