CORRESPONDENCE

Anesthesiology
1996; 84:1524

Epidural Catheter Insertion and Satisfactory Analgesia

To the Editor:—D'Angelo *et al.*[1] found that women who had epidural catheters threaded 2 cm into the epidural space had the lowest incidence of unilateral analgesia, but the catheters were dislodged and replaced more frequently than those threaded 4, 6, or 8 cm. They also found that threading catheters 6 cm minimized the risk of intravenous cannulation and catheter dislodgment, but women in the 6-cm group had a greater incidence of unilateral analgesia that required catheter manipulation to correct. They concluded that the length of epidural catheter insertion should "vary with the anticipated duration of labor or mode of delivery." They recommended threading epidural catheters 2 cm for a woman likely to experience a short labor and 6 cm when prolonged labor or cesarean section is likely.

This conclusion is based on the assumption that one can predict obstetric outcome—something I am not aware anyone can do. Based on their results, I would have concluded that all epidural catheters should be threaded 6 cm. I would not thread a catheter 2 cm knowing that it has a high failure rate, hoping that labor is short and that the woman will not need a cesarean section. Also, if one could predict that the duration of labor would be short, I would use a combined technique with intrathecal opioid.

The authors also concluded that, if unilateral analgesia occurs, catheter manipulation can be effective and may be more time-efficient than epidural catheter replacement. One can only reach this conclusion if the time to achieve satisfactory analgesia is short, which was not documented in their study. If it took 65 min in the 8-cm group to achieve patient comfort with catheter manipulation, which is the maximum time allotted by the authors to achieve analgesia with catheter manipulation, I would conclude that the epidural anesthetic should have been replaced. Also, this study does not address whether catheter manipulation was the variable that led to a successful anesthetic or whether giving more medication was the important variable. Indeed, it has been questioned whether catheter position is responsible for inadequate analgesia.[2]

Although not stressed in their article, any conclusions should be applied only to open-tip (single-orifice) epidural catheters. We published a prospective, randomized, double-blind study that defined the optimal catheter length that should be threaded for the woman in labor using multiorifice catheters (Perifix, B. Braun, Bethlehem, PA).[3] We threaded the epidural catheters 3, 5, or 7 cm into the epidural space and administered a 3-ml test dose of 0.25% bupivacaine followed by 10 ml 0.25% bupivacaine. We found that catheters threaded 5 cm provided the highest quality of analgesia with the lowest complication rate. It is difficult to compare the results of our study with those of D'Angelo *et al.* because of the difference in catheters and medications used. However, it would appear that, with both open-end and multiorifice catheters, the optimal length for insertion of an epidural catheter is 5–6 cm and not 2–3 cm as previously recommended.[4,5]

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(Accepted for publication March 6, 1996.)

Anesthesiology
1996; 84:1524–5

In Reply:—The management of epidural catheters for laboring patients can be quite labor intensive; Michael *et al*[1] reported a 33% incidence of inadequate analgesia after insertion of uniport epidural catheters. Our study was designed to determine which insertion length minimizes insertion-related complications and the effectiveness of epidural catheter manipulation when associated with intravenous cannulation or unilateral sensory analgesia after insertion. In practical terms, can the time spent inserting and manipulating uniport epidural catheters be minimized?

We concluded that uniport epidural catheters could be inserted either 2 or 6 cm within the epidural space based on the anticipated duration of labor.[2] Beilin argues that he cannot predict obstetric outcome and therefore would have concluded that all epidural catheters should be inserted 6 cm within the epidural space. I would

argue that, although one cannot precisely predict the duration of labor for a given patient, the multiparous patient presenting in active-phase labor with a history of previous uncomplicated vaginal deliveries, on average, would deliver more quickly than the prima gravida or the multiparous patient presenting in latent-phase labor. In our study, we found that inserting uniport epidural catheters 2 cm minimizes insertion-related complications[2]; however, as Beilin notes, epidural catheters inserted 2 cm within the epidural space are more likely to subsequently dislodge. Although true, catheter dislodgment occurred in only 16 of 200 epidural catheters inserted 2 cm within the epidural space and dislodged an average 6.5 h after insertion, significantly longer than the reported mean 3.2-h duration of active-phase labor in the multiparous patient.[3] Therefore, based on these findings and despite Beilin's argument, I recommend inserting uniport epidural catheters 2 cm in the multiparous patient presenting in active-phase labor. In all other patients, I would insert epidural catheters 6 cm within the epidural space. In addition, as Beilin suggests, I would consider a combined technique in these patients but would insert the uniport epidural catheter 2 cm within the epidural space after the subarachnoid injection.

Beilin questions our conclusion that epidural catheter manipulation may be more time-efficient than epidural catheter replacement because 65 min was required to achieve patient comfort in one patient in whom the epidural catheter was inserted 8 cm within the epidural space. Beilin also suggests that we should have either administered additional local anesthetic before catheter manipulation or automatically replaced epidural catheters associated with inadequate analgesia. However, as previously stated, one purpose of our study was to determine the effectiveness of catheter manipulation. Because catheter manipulation was effective in 91% of epidural catheters inserted >2 cm associated with unilateral analgesia and 50% of catheters inserted intravenously functioned well after catheter manipulation, I believe our recommendations regarding catheter manipulation are justified. I agree that 65 min to achieve patient comfort is an excessive amount of time. However, 783 other patients became comfortable in <65 min. In addition, clinical practice is not dictated by strict research protocol, and our clinical practice uses earlier, more aggressive catheter manipulation. Finally, regarding administration of additional local anesthetic before catheter manipulation, we know of no series that has randomly investigated the efficacy of administering additional local anesthetic in the presence of unilateral analgesia. However, we have observed that this practice, if ineffective, will delay achieving patient comfort that Beilin and we oppose. I believe the findings of our study can be applied in clinical practice. Currently, I insert epidural catheters 6 cm within the epidural space. If analgesia is inadequate 10–15 min after local anesthetic administration, I withdraw the catheter 3–4 cm and administer local additional anesthetic. If the patient is not comfortable within 10 min after additional drug administration, the epidural catheter is removed and replaced. As a result, the patient is either comfortable or the epidural catheter is replaced within 20 min of initial placement. This practice, I would argue, is expedient for the anesthesiologist and the patient.

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(Accepted for publication March 6, 1996.)

Anesthesiology
1996; 84:1525–7

Antagonism of Residual Mivacurium Blockade: Setting the Record Straight

To the Editor:—The studies of Hart *et al.*[1] and Szenohradsky *et al.*[2] raise a number of issues regarding antagonism of mivacurium blockade. The following comments may be helpful.

The above studies were conducted using the original technique of Miller and Cronnelly,[3–5] in which an infusion of relaxant is given to maintain a steady-state level of paralysis. An antagonist is given without changing the rate of relaxant infusion to compare ease of antagonism of various relaxants and/or potency and duration of effect of the antagonists. The technique may have been constructed originally to obtain purely pharmacodynamic measurements, in the absence of any kinetic factors. The problem with the model is its questionable clinical relevance, especially with respect to its application to mivacurium.

Kinetic factors are of prime importance in any evaluation of antagonism of residual nondepolarizing blockade. What clinicians need to know is how much antagonist is necessary to restore normal function within a period of time pertinent to practice. In this respect, the studies of Hart *et al.*[1] and Szenohradsky *et al.*[2] may be misleading.