The effects of epidural and spinal analgesia on the mode and duration of delivery

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The debate around the effect of epidural or regional analgesia on the progress of labor and the mode of delivery has continued ever since epidural analgesia for labor pain relief was introduced. In the last two decades, numerous studies have been conducted to address this issue. Unfortunately, the results of individual studies have been inconsistent.

Three approaches have been used to study the relationship between epidural analgesia and cesarean delivery or the progress of labor. Firstly, patients who chose epidural analgesia have been compared with patients who did not. Women who choose epidural labor analgesia are at a higher risk of dystocia than women who choose other analgesic options. Patients requesting epidural analgesia are shorter, weigh more, have larger babies, and have slower initial cervical dilation. These are also independent risk factors for cesarean delivery. Because analgesic allocation by patient choice does not yield demographically similar groups, this approach can reveal the association between epidural analgesia and cesarean delivery but cannot determine causation.

Secondly, prospective, randomized clinical trial is the most widely accepted design for clinical studies. However, parturients are currently aware of the benefits of regional analgesia, and it may hence be difficult to convince patients to consent to randomization when they know that one of the treatments offers more effective labor analgesia than the other. A high rate of patient cross-over from intravenous to epidural analgesia, which must be allowed for ethical reasons, has compromised many studies.

Thirdly, another category of observational studies, namely natural experiment studies or impact studies, instead of comparing women with and without epidural analgesia during the same period, compare such factors as the rates of cesarean and instrumental deliveries before and after the use of epidural analgesia was instituted. By design, these studies are retrospective and use historical controls. They allow one to avoid treatment cross-over and to study a sufficient number of patients. Naturally, this approach is not current any more.

Prospective, randomized clinical trials.

Thorp and colleagues reported prolonged first and second stages of labor, a two fold need for oxytocin augmentation, and a 11-fold increase in the number of cesarean sections among women randomized to receive epidural analgesia (1). After that there has been an increasing amount of evidence to the contrary. Numerous studies have reported no difference between epidural analgesia or combined spinal-epidural analgesia and intravenous or intramuscular pethidine during labor with respect to the rate of cesarean delivery or the duration of labor (2,3,4,5).

Meta-analyses

There are few meta-analyses concerning the relationship of epidural analgesia and certain outcomes of labour. Zhang and co-workers reviewed the original studies published in English from 1965 through December 1997 (6). They found seven randomized clinical trials and five observational studies to meet the minimal requirements they had set. They concluded that EA increases oxytocin augmentation 2-fold (definite), EA may not increase the CS risk (probable), EA may slightly increase the instrumental delivery risk (inconclusive), and EA prolongs the duration of labour (unclear). Of seven clinical trials, only four

studies were included in the data synthesis, and one of them was the study by Thorp and co-workers, that has been severely criticized. The observational studies compared women with and without epidural analgesia and, as mentioned earlier, this approach to study the relationship between two objects can reveal the association between them but fails to determine causation. Hence, as the authors recommended, the results of this meta-analysis should be interpreted with great caution.

The Cochrane Pregnancy and Childbirth Group reviewed the studies concerning the effects of epidural analgesia on pain relief and the adverse effects in labour (7). Only randomized trials comparing epidural analgesia with other modes of analgesia not involving regional block were selected. 11 studies involving 3 157 women were reviewed. The time span of over 20 years means that the epidural techniques varied between the studies. Data on the progress of labour were only presented in four studies. Both the first and the second stage were prolonged in the epidural group. The three trials in which relevant data were reported suggest that epidural analgesia predisposes to malposition of the presenting part, possibly because of a failure to rotate. There was a significant increase in the need for oxytocin augmentation in three of the six trials in which this was reported. The use of assisted vaginal delivery was also somewhat increased, if an epidural block was maintained beyond the end of the first stage. There were no significant increases in the caesarean section rate overall or in terms of caesarean section for dystocia. Anyway, the authors suggest that the influence of the new regimens of regional analgesia on the progress of labour needs to be investigated in randomized clinical trials.

Natural experiment studies, impact studies.

There are few impact studies, and they all give similar results (8,9,10,11). In a recent study by Impey and colleagues (11), first 1000 nulliparous pregnancies were analyzed in 3 different years - 1987, 1992, 1994 - over which the epidural rate increased from 10% to 57%. These years were chosen because all the factors known as confounding variables remained as constant as possible during those years. The method of epidural analgesia included a relatively high-dose regimen. Briefly, cesarean and instrumental delivery rates were similar in all the 3 years. Demographic characteristics remained unchanged or altered in a manner that has previously been associated with an increase in intervention. First-stage oxytocin use remained unchanged but oxytocin use in the second stage increased considerably from 1.5% to 7.9%. The total duration of labor was similar in all the 3 years. They also noticed, that administering epidural analgesia early in labor and maintaining the blockade until after delivery do not have an effect on the obstetric outcome.

Different models of regional analgesia during labor have been compared with each other with respect to obstetric outcome, too. Reducing the dose of local anesthetic by combining it with an opioid improves the obstetric outcome (12,13).

The difference between ropivacaine and bupivacaine with respect to the mode of delivery was studied in a prospective meta-analysis (14). Spontaneous vaginal deliveries were more frequent overall with ropivacaine than with bupivacaine (58% vs. 49%) and instrumental deliveries less frequent (27% vs. 40%), while the frequency of cesarean section was similar in the two groups. The intensity of the motor block was lower with ropivacaine.

Only a few studies compare combined spinal-epidural analgesia and low-dose epidural analgesia in view of obstetric outcome. The findings do not support any difference between epidural analgesia and combined spinal-epidural analgesia with respect to the incidence of instrumental or cesarean delivery (15,16). Tsen and co-workers also measured the duration of the first and second stages of labor (16). They found that combined spinal-epidural analgesia is associated with more rapid cervical dilation, while the duration of the second stage did not differ between the groups.

As a conclusion, based on numerous studies, we can say, that regional analgesia during labor has no effect on the rate of cesarean delivery. An association between regional, especially epidural analgesia and dystocia is suspected, but the relationship is by no means causative. The effect of regional analgesia on the duration of labor is unclear. Epidural analgesia may increase the need for oxytocin augmentation and may slightly increase the rate of instrumental delivery. The adverse effects of epidural analgesia with high-dose bupivacaine on the obstetric outcome can be diminished by reducing

the dose of the local anesthetic when using a combination of a diluted solution of the local anesthetic and an opioid. Combined spinal-epidural analgesia may be associated with more rapid cervical dilation in nulliparous patients compared with conventional epidural analgesia. With the recent techniques in regional analgesia, it is not an exaggeration to say that the obstetric outcome is more dependent on obstetric management than regional analgesia.

Which consequency of regional analgesia could be the reason for the claimed adverse effect on obstetric outcome?

Pain is relieved by regional analgesia, but could pain be necessary for normal labor? Substantial evidence indicates that maternal epinephrine and norepinephrine levels increase during painful labor (17) and that effective pain relief decreases epinephrine but leaves norepinephrine unchanged. Laboratory studies suggest that these changes may increase uterine activity (18). Maternal epinephrine may be tocolytic and its reduction therefore able to stimulate uterine contraction (19). In theory, therefore, effective pain relief with regional analgesia should enhance uterine contractions instead of causing dystocia. On the other hand, painless labor is usually short and uneventful, so it seems that pain is not necessary for labor and actually has no beneficial effect on labor.

The motor block related to regional and especially epidural analgesia has been considered the primary mechanism to cause dystocia. Although there is some recent evidence to suggest that the motor block itself does not increase the risk of operative delivery, reduction of the dose of local anesthetic and thereby the motor block has been shown to enhance obstetric outcome. The motor block is assessed in the lower limbs. Whether the motor block in the lower limbs reflects the motor block in the pelvic floor, is totally unknown. Further studies on this subject are needed.

References

1. Thorp JA, Hu DH, Albin RM, ym.: The effect of intrapartum epidural analgesia on nulliparous labor: a randomized, controlled, prospective study. Am J Obstet Gynecol 1993;169:851-8.
2. Phillipsen T, Jensen N: Epidural block or parenteral pethidine as analgesic in labour: a randomized study concerning progress in labour and instrumental deliverys. Eur J Obstet Gynecol Reprod Biol 1989;30:27-33.
3. Clark A, Carr D, Loyd G, ym.: The influence of epidural analgesia on cesarean delivery rates: a randomized, prospective clinical trial. Am J Obstet Gynecol 1998;179:1527-33.
4. Gambling DR, Sharma SK, Ramin SM, ym: A randomized study of combined spinal-epidural analgesia versus intravenous meperidine during labor: impact on cesarean delivery rate. Anesthesiology 1998;89:1336-44.
5. Sharma SK, Sidawi JE, Ramin SM, ym: Cesarean delivery: a randomized trial of epidural versus patient-controlled meperidine analgesia during labor. Anesthesiology 1997;87:487-94.
6. Zhang J, Klebanoff MA, DerSimonian R: Epidural analgesia in association with duration of and mode of delivery: a quantitavive review. Am J Obstet Gynecol 1999;180:970-7.
7. Howell CJ: Epidural versus non-epidural analgesia for pain relief in labour. The Cochrane Library. Cochrane Collaboration; 2000, Issue 1.
8. Gribble RK, Meier PR: Effect of epidural analgesia on the primary cesarean rate. Obstet Gynecol 1991;90:231-4.
9. Lyon DS, Knuckles G, Whiteaker E, Salgado S: The effect of instituting an elective labor epidural program on the operative delivery rate. American J Obstet Gynecol 1997;90:135-41.
10. Fogel ST, Shyken JM, Leighton BM, ym: Epidural labor analgesia and the incidence of cesarean delivery for dystocia. Anesth Analg 1998;87:119-23.
11. Impey L, MacQuillan K, Robson M: Epidural analgesia need not increase operative delivery rates. Am J Obstet Gynecol 2000;182:358-63.
12. Olofsson C, Ekblom A, Ekman-Ordeberg G, Irestedt: Obstetric outcome following epidural analgesia with bupivacaine-adrenaline 0.25% or bupivacaine 0.125% with sufentanil-a prospective randomized controlled study in 1000 parturients. Acta Anaesth Scand 1998;42:284-92.
13. James KS, McGrady E, Quasim I, Patrick A: Comparison of epidural bolus administration of 0.25% bupivacaine and 0.1% bupivacaine with 0.0002% fentanyl for analgesia during labour. Br J Anaesth 1998;81:507-10.
14. Writer WD, ym: Neonatal outcome and mode of delivery after epidural analgesia for labour with ropivacaine and bupivacaine: a prospective meta-analysis. Br J Anaesth 1998;81:713-7.
15. Dresner M, Bamber J, Calow C, ym: Comparison of low-dose epidural with combined spinal-epidural analgesia for labour. B J Anaesth 1999;83:756-60.
16. Tsen LC, Thue B, Datta S, Segal S: Is combined spinal-epidural analgesia associated with more rapid cervical dilation in nulliparous patients when compared with conventional epidural analgesia. Anesthesiology 1999;91:920-5.
17. Cascio M, Pygon B, Bernett C, Ramanathan S: Labour analgesia with intrathecal fentanyl decreases maternal stress. Can J Anaesth 1997;44:605-9.
18. Segal S, Csavoy A, Datta S: The tocolytic effect of catecholamines in the gravid rat uterus. Anesth Analg 1998;87:864-9.
19. Lederman RP, Lederman E, Work BA, McCann DS: The relationship of maternal anxiety, plasma catecholamines, and plasma cortisol to progress in labor. Am J Obstet Gynecol 1978;132:495-500.

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