Epidural Analgesia and Active Management of Labor: Effects on Length of Labor and Mode of Delivery

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Objective: To determine whether cervical dilatation at the time of placement of patient-requested epidural affects cesarean rates or lengths of labors in actively managed parturients.

Methods: The charts of 255 women randomized to active management of labor ($n = 125$) or control protocols ($n = 130$) were reviewed and stratified to early epidural placement (up to 4 cm cervical dilatation) versus late placement (more than 4 cm).

Results: Women with early epidural placement had shorter labors than those with late placement (11.6 ± 4.6 versus 13.2 ± 5.6 hours; $P = .02$). Active management reduced the length of labor compared with controls regardless of epidural timing, with a reduction of 1.4 hours in early epidural placement (10.9 ± 4.7 versus 12.3 ± 4.3 hours; $P = .04$) and 3.6 hours in those with later placement (11.0 ± 3.6 versus 14.6 ± 6.2 hours; $P = .004$). Cesarean rates did not vary significantly (early 14.5% versus late 7.9%; $P = .21$). Early epidural placement did not lengthen the second stage of labor or increase operative vaginal delivery rates.

Conclusion: Early epidural placement did not affect lengths of labor or cesarean rates and was actually associated with shorter labor compared with late epidural placement. Women managed actively in labor, regardless of timing of epidural placement, had shorter labors than controls. (Obstet Gynecol 1999;93:995–8. © 1999 by The American College of Obstetricians and Gynecologists.)

Epidural analgesia may contribute significantly to lengthening labors and increasing cesarean deliveries for dystocia in nulliparas.[1–4] Controversy continues over giving epidural analgesia in early labor or when cervical dilatation is more advanced.[2,5] Active management of labor, introduced by O'Driscoll et al,[6] consistently shortens nulliparous labors.[6–9] The current study was a review of 255 nulliparas who requested epidural analgesia and were randomized to active management of labor or a control protocol. Data were stratified to address whether any effects of labor management were dependent on cervical dilatation when epidurals were given, and whether active management of labor shortened labors and reduced cesarean rates among women who requested epidural analgesia as compared with controls.

Materials and Methods

Our randomized study of active management of labor at the University of New Mexico Health Science Center between August 1992 and April 1996 enrolled 405 term nulliparas who presented to the antenatal testing unit with regular, painful, palpable uterine contractions 5 or fewer minutes apart with cervical effacement of at least 80%. Admitting physicians randomly assigned the women at presentation with a computer-generated list of random numbers. Assignments were kept in sealed, sequentially numbered, opaque envelopes. This was a retrospective review of the labor experience of 255 (63%) who received epidural analgesia at some time during labor. Two women in the original cohort, not included in the present analysis, received epidurals for cesareans, not for relief of labor pain.

Active management of labor consisted of amniotomy within 2 hours of admission and augmentation of labor with oxytocin if there was not 1 cm dilatation per hour in the first stage of labor or 1 cm of descent per hour in the second stage. Cervical examinations were done every 2 hours to document labor progression. If augmentation was necessary, oxytocin infusions were started at 6 mU/minute and increased every 15 minutes, titrating to seven contractions in 15 minutes. The maximum dose of oxytocin was 36 mU/minute. Internal uterine pressure transducers were used as clinically

indicated. Electronic fetal heart rate monitoring, external or internal, was used routinely.

The control protocol consisted of admission to the labor suite based on cervical dilatation of 3–4 cm with regular, painful uterine contractions. If labor did not progress adequately, oxytocin augmentation was begun at 1 mU/minute and increased by 1 mU/minute every 30–40 minutes to achieve and maintain 200 Montevideo units of uterine activity.

Epidural analgesia was administered on patient request, at the discretion of the attending obstetrician and anesthesiologist. Parturients received continuous infusions of 0.08% bupivacaine plus fentanyl 1 μg/mL, or the same dose of bupivacaine with sufentanil 1 μg/mL after an initial bolus of 0.125% bupivacaine with 50 μg fentanyl or 10 μg sufentanil. A small subset of women, 6% in each arm, received only diluted bupavacaine in their epidurals. Three women in each group did not have their epidurals dosed because of difficult placement or suspected intravascular placement, and were included in their original intent-to-treat groups. Epidural infusions were titrated to a T8–T10 sensory level and were continued throughout the second stage of labor. Early epidural placement was defined as placement at a cervical dilatation up to 4 cm, and late placement as more than 4 cm.

Statistical analysis used unpaired t tests for continuous variables and χ^2 analysis for frequency data. Fisher exact test was used when cell size was small. Two-way analysis of variance was used where appropriate to compare active with control groups and dilatation less than 4 cm versus greater than 4 cm. Multivariate logistic regression analysis was used for binary outcomes. Analysis of covariance methods were used for the multivariate analysis of continuous outcomes. Data are expressed as mean ± standard deviation (SD). Significance was $P < .05$.

Results

Two hundred fifty-five parturients received epidural analgesia, 179 in the early and 76 in the late epidural group. The women did not differ in demographic characteristics (Table 1). During labor, comparable numbers of women in each group had oxytocin augmentation (early 121 [68%] versus late 46 [61%]; $P = .31$), internal fetal and uterine monitoring (early 132 [75%] versus late 59 [78%]; $P = .30$), artificial rupture of membranes (early 147 [82%] versus late 66 [87%]; $P = .46$), and thick meconium-stained fluid (early 14 [8%] versus late six [8%]; $P = .88$).

Women in the early epidural group who delivered vaginally had shorter labors than women with late epidural placement (Table 2). Among women who had

Table 1. Demographic Characteristics of Women Receiving Epidurals

Characteristic	Early ($n = 179$)	Late ($n = 76$)	P
Age (y)	20.9 ± 4.2	20.8 ± 4.0	.86
EGA (wk)	39.6 ± 1.2	39.6 ± 1.3	.84
Ethnicity			
Hispanic	115 (64%)	43 (56%)	.06
White	52 (29%)	32 (42%)	.06
Other	12 (7%)	1 (1%)	.001
Weight (kg)	74.1 ± 12.5	75 ± 13.8	.62
Height (cm)	157.3 ± 9.5	158.3 ± 7.8	.33

EGA = estiamted gestational age.
Data are presented as mean ± standard deviation or n (%).

vaginal deliveries, active management of labor was associated with shorter labors than in controls, regardless of epidural timing (Table 2). When stratified by early versus late placement of epidurals and management of labor, early epidural placement was associated with decreased length of labor compared with late placement in the control group only (Table 2). Second stages of labor were not lengthened in women who had early versus late placement of epidurals or when stratified by labor management, although numbers in these subgroups were small (Table 2). In a multivariate analysis, the difference in the total length of labor between the groups with early and late placement of epidurals was maintained when controlling for cofactors, including randomization, modes of delivery, use of oxytocin, patients' ages, estimated gestational ages, and newborn weights.

Women with early epidurals had a higher cesarean rate than those with late epidurals, but the difference

Table 2. Length of Labor in Women With Epidurals Who Delivered Vaginally

Characateristic	Early	Late	P
Total ($n = 223$)			
n	153	70	
First stage (h)	10.1 ± 4.5	11.6 ± 4.9	.02
Second stage (h)	1.3 ± 1.0	1.4 ± 1.9	.50
Third stage (min)	9.6 ± 7.8	9.0 ± 9.0	.70
Total (h)	11.6 ± 4.6	13.2 ± 5.6	.02
Active protocol ($n = 112$)			
n	85	27	
First stage (h)	9.5 ± 4.6	9.4 ± 3.1	.80
Second stage (h)	1.1 ± 0.9	1.5 ± 1.1	.17
Third stage (min)	10.2 ± 8.4	6.6 ± 3.6	.03
Total (h)	10.9 ± 4.7	11.0 ± 3.6	.99
Control protocol ($n = 111$)			
n	68	43	
First stage (h)	10.7 ± 4.2	13.0 ± 5.4	.02
Second stage (h)	1.4 ± 1.1	1.4 ± 2.2	.88
Third stage (min)	9.0 ± 6.6	10.8 ± 10.8	.23
Total (h)	12.3 ± 4.3	14.6 ± 6.2	.03

did not reach statistical significance (early 26 [14.5%] versus late six [7.9%]; $P = .21$). Actively managed women had a lower, but statistically nonsignificant, cesarean rate than controls (active 13 [10%] versus controls 19 [15%]; $P = .34$). The cesarean rate was positively related to age ($P = .003$) and newborn weight ($P = .005$) when adjusting for randomization, need for augmentation, and cervical dilatation at epidural placement. Early or late placement of epidurals did not influence the incidence of operative vaginal deliveries regardless of the labor management group (early 39 [22%] versus late 11 [15%]; $P = .12$). Actively managed women requested epidurals earlier in labor than control women (active 6.2 ± 3.8 versus controls 8.6 ± 5.4 hours; $P < .001$). Women who failed a trial of labor and delivered by cesarean ($n = 32$) had epidurals later in labor than women who had vaginal deliveries (cesarean deliveries 10.3 ± 6.1 versus vaginal deliveries 7.0 ± 4.5 hours; $P = .006$).

There were no adverse neonatal or maternal outcomes in this cohort of healthy nulliparas. One infant in each group had a 5-minute Apgar score less than 7, and 13 infants in the early and four in the late group were admitted to the neonatal intensive care unit for a transition period. Two early-epidural infants had arterial blood gases less than 7.0 pH and were transferred to the regular nursery with otherwise normal postpartum courses. Neither estimated blood loss (early 461 ± 285 versus late 405 ± 205 mL; $P = .12$) nor episiotomy rates (early 66 [43%] versus late 26 [37%]; $P = .46$) varied between the groups.

Discussion

The controversy over the benefits and disadvantages of epidurals continues. Whether epidural offers the most effective pain relief during labor is not questioned[10]; however, the timing of epidurals and their effects on cesarean rates continue to be discussed.[2,11,12] Debate also persists about which labor management protocol to use for women with epidurals. Whether epidurals lengthen the second stage of labor by relaxing the pelvic musculature is debated.[4,12,13]

In the present study, only women who had epidurals were analyzed. Parturients who request epidurals may be different from those who do not, with longer, more painful, and dysfunctional labors. Thus, comparing women who request epidurals with those who do not might introduce a selection bias. For example, in our original randomized cohort of 405, the cesarean rate among women who did not request epidurals was 2.7%, whereas the overall abdominal-delivery rate among women with epidurals was much higher, at 12.5%.[9] In this study, we analyzed the timing of epidural placement and the method of labor management to evaluate their effects on labor and mode of delivery. We found that active management of labor shortened labor regardless of when epidurals were given and that our cohort with early epidural placement had shorter labors than women with later placement.

The benefit of early epidural placement is a reduction in the length of time that parturients experience labor pain. We found that early epidural placement was not associated with longer labor; in fact, women with early epidurals had shorter labors than those with late placement. There were no increases in the length of the second stage of labor in women with early placement or any increase in rates of operative vaginal deliveries, although these subgroups were small.

We also showed significant reductions in lengths of labor in actively managed women who received epidurals as compared with standard protocol management, which chiefly occurred in the first stage. This reduction of labor length held true regardless of when the epidural was placed. The benefit of active management may be its ability to shorten labor despite epidural analgesia. This issue was addressed in two retrospective abstract reports from Dublin comparing experiences in the years 1973 and 1992 and in the years 1987 and 1992. (Boylan P, Robson M, McParland P. Active management of labor, 1973–1992. Am J Obstet Gynecol 1993;168:295; and Robson M, Boylan P, McParland P. Epidural analgesia need not influence the spontaneous vaginal delivery rate. Am J Obstet Gynecol 1993;168:364). These reports concluded that active management was able to overcome the effect of epidural analgesia on labor. However, cesarean rates doubled from 5% to 10% over the course of the study in one of the reports. Active management of labor consistently showed reductions in lengths of labor, but the effects on cesarean rates were not consistent.[7–9] In the present study, we did not observe significant reductions in cesarean rates, although we did see a trend toward lower cesarean rates among actively managed women with epidurals. One thousand four hundred fifty women would be required to show with 80% power a reduction in cesarean rates from 15% in controls with epidurals to 11% in actively managed women with epidurals, which would take approximately 28 years to accrue. A multicenter collaborative study is needed to answer this question definitively. Although no statistically significant differences were seen in cesarean rates in women who had early versus late epidurals, the observed difference (early 15% versus late 8%; $P = .21$) might be clinically significant. To accrue the number of patients required to show that no difference exists would take approximately 14 years at our current delivery rates.

The opinion that epidurals given early in labor are

deleterious to normal labor progress and successful vaginal deliveries[2] was not confirmed in our study. However, our patients with later epidurals showed a trend toward decreased cesarean rates, which was not statistically significant. The reason might be that the number of women who had cesareans in the late cohort was too small to achieve the needed statistical power. Our cutoff of 4 cm dilatation also might have been too advanced to show a difference between early and late epidurals, a problem with other studies.[11,12] Because epidural analgesia is a safe, highly effective pain reliever in labor, it is appropriate to find ways to optimize labor progress and outcome in women who choose it as part of their delivery experience.

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