

## ORIGINAL ARTICLES

## Epidural Analgesia and Severe Perineal Laceration in a Community-based Obstetric Practice

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**Background:** This study assessed whether epidural analgesia was an independent risk factor for severe perineal laceration.

**Methods:** A retrospective cohort study analyzed 2,759 patients at St. Francis Regional Medical Center who had vertex, spontaneous or induced, singleton, live, vaginal deliveries of neonates of at least 36 weeks' gestation. Patients with diabetes or severe cardiac disease were excluded. Outcomes measured were third- or fourth-degree perineal lacerations.

**Results:** Overall rate of severe perineal laceration was 6.38% (n = 176). Epidural analgesia was given to 634 (22.98%) women. Among women who had epidural analgesia, 10.25% (65 of 634) had severe perineal lacerations compared with 5.22% (111 of 2,125) of the women who did not have epidural analgesia. After controlling for major variables in a logistic regression analysis, epidural analgesia remained a significant predictor of severe perineal injury (odds ratio [OR] = 1.528, 95% confidence interval [CI] = 1.092–2.137). When instrument use was included in the model, epidural analgesia was no longer a statistically significant, independent predictor of severe perineal injury. (OR = 1.287, 95% CI = 0.907–1.826). Instrument use was found to be a strong predictor of severe laceration (OR = 3.245, 95% CI = 2.162–4.869). A logistic regression model examining predictors of instrument use found that epidural analgesia does significantly predict instrument use (OR = 3.01, 95% CI = 2.225–4.075).

**Conclusion:** Epidural analgesia is associated with an increase in severe perineal trauma as a result of an associated threefold increased risk of instrument use. Instrument use in vaginal delivery more than triples the risk of severe perineal laceration. (J Am Board Fam Pract 2003;16:1–6.)

Perineal trauma during vaginal delivery can have serious consequences. Long-term adverse effects of severe perineal laceration include chronic fecal incontinence, dyspareunia, perineal pain, and rectovaginal fistula. Severe laceration, such as a tear extending into the deep transverse perineal muscles and fibers of the anal sphincter (third degree) or rectal mucosa (fourth degree), is generally considered to occur with 5% of vaginal deliveries.<sup>1</sup> Some degree of perineal laceration, however, has been reported in up to 35% to 75% of all vaginal births.<sup>2</sup> A recent study found that 31% of female British obstetricians would choose cesarean delivery without any clinical indication because of concern about

severe perineal damage.<sup>3</sup> Any factor that increases the real or perceived risk of perineal trauma is important.

Although increasingly popular, epidural analgesia has not been extensively studied as a risk factor for perineal damage. In some areas, epidural analgesia is administered in more than 70% of patients for vaginal delivery.<sup>4</sup> A determination of whether epidural analgesia is a risk factor for severe laceration has important consequences for decisions about delivery and potential long-term effects on maternal health.

A MEDLINE search of journal articles from 1970 to the present using terms related to this issue found only six studies exploring the association of epidural analgesia with severe perineal laceration. The results of these studies are conflicting. Three studies found epidural analgesia to be either protective or not associated to perineal laceration.<sup>5–7</sup> A potential explanation for this result is that epidural

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analgesia causes the perineal muscles to relax, allowing for a more controlled delivery of the fetal head. Conversely, the three other studies reported that epidural analgesia is associated with higher rates of laceration.<sup>4,8,9</sup> Explanations for this finding have included increased use of operative delivery methods, lengthened second stage of labor, and increased amounts of fetal malposition (occiput posterior and transverse) during delivery when epidural analgesia is used.<sup>8,10,11</sup> With the conflicting results of these studies, it is highly relevant to explore whether epidural analgesia carries an increased risk of perineal tear using data relevant to a community-based practice.

## Methods

Data were obtained from the medical records of all vaginal deliveries between June 1996 and June 2000 at St. Francis Regional Medical Center, a community hospital in Topeka, Kansas, a city of approximately 170,000 people. Anesthesia is available at all times. Obstetric specialists, family physicians, family practice residents, and nurse-midwives staff this community hospital. Consultations with obstetric specialists are not mandatory. A total of 3,074 women were delivered vaginally during the study period. Current analyses were limited to 2,759 patients for whom complete information was available and who had vertex, spontaneous or induced, vaginal deliveries of singleton, live babies of at least 36 weeks' gestation. Patients with diabetes or severe cardiac disease were excluded because of potential changes in management of second stage of labor with these conditions.

The major outcome variable was an indicator for third- or fourth-degree perineal lacerations as defined by American College of Obstetricians and Gynecologists: a tear extending into the deep transverse perineal muscles and fibers of the anal sphincter (third degree) or rectal mucosa (fourth degree). Other study variables, such as year of birth, number of pregnancies, number of births, vaginal birth after cesarean section, use of episiotomy, type of analgesia (epidural, local, or none), degree of laceration, specialty of the delivering physician (family physician, obstetrician-gynecologist, or nurse-midwife), birth weight, use of inducing agents, maternal age, and use of instrument aides (vacuum, forceps, or none) were taken from literature review and included in the analysis.<sup>5,6,8,9</sup> Race of the mother was

**Table 1. General Patient Population Characteristics.**

Variable	Project Result No. (%)
Total patients	2,759
Nulliparous	1,059 (38.38)
Induction or augmentation	1,299 (47.08)
Vacuum assisted delivery	160 (5.8)
Forceps delivery	46 (1.67)
Episiotomy	609 (22.07)
Severe laceration in nulliparous patients	120 (11.3)
Total severe lacerations	176 (6.38)
Epidural analgesia	634 (22.98)
Severe laceration* and epidural analgesia	65 (10.25)
Severe laceration* without epidural analgesia	111 (5.22)

\*Severe lacerations defined as third or fourth degree by standards set by the American College of Obstetricians and Gynecologists.

eliminated as a potential confounder by previous studies.<sup>4</sup>

Statistical analysis was completed using the SAS software package, version 6.12. Logistic regression (univariate and multivariate) was used to evaluate associations while controlling for possible confounding variables. All tests were performed at the two-sided,  $\alpha = .05$  level. The results of data analyses are reported as odds ratios (OR), with 95% confidence intervals (CI). These reported ratios all had *P* values of less than .05.

## Results

The overall rate of severe perineal (third- and fourth-degree) laceration was 6.38% ( $n = 176$ ) (Table 1). Epidural analgesia was given to 634 (22.98%) women, 65 (10.25%) of whom had severe perineal lacerations compared with 111 (5.22%) women with severe lacerations who did not have epidural analgesia (Table 2). The characteristics of women who had epidural analgesia differed from those who did not. Women who had epidural analgesia were more likely to be nulliparous, have their labor induced by oxytocin, and have instruments used during their delivery (Table 2). Logistic regression to examine the association of epidural analgesia with severe lacerations, while controlling for potential confounders of episiotomy, parity, induction, maternal age, and birth weight, found epidural analgesia to be a significant predictor of severe perineal injury (OR = 1.528, CI = 1.092–2.137) (Table 3).

**Table 2. Clinical Characteristics According to Epidural Analgesia Use.**

Variable	Epidural Analgesia (n = 634) No. (%)	No Epidural Analgesia (n = 2,125) No. (%)
Maternal age		
<21 years	158 (24.96)	490 (23.19)
22–34 years	425 (67.14)	1,384 (65.50)
>34 years	50 (7.90)	239 (11.31)
Birth weight (>4 kg)	49 (7.73)	179 (8.42)
Nulliparous	341 (53.79)	718 (33.79)
Multiparous	293 (46.21)	1,407 (66.21)
Instrument use	106 (16.72)	100 (4.71)
Episiotomy	168 (26.50)	441 (20.75)
Severe laceration	65 (10.25)	111 (5.22)
Induced labor	401 (63.25)	898 (42.26)

We then examined the rate of obstetric intervention according to use of epidural analgesia (Table 2). Use of epidural analgesia was associated with significantly increased operative vaginal delivery. The proportion of operative vaginal deliveries was 16.7% (106 of 634) in women who had epidural analgesia compared with 4.7% (100 of 2,125) in women without epidural analgesia.

A second logistic regression model was constructed to evaluate the effect of higher incidence of instrument use during delivery for women who had epidural analgesia (Table 3). When increased use of instruments was added into the model, epidural analgesia remained a risk factor for severe laceration with an odds ratio of 1.287 but with a statistically insignificant 95% confidence interval of 0.907 to 1.826.

To determine whether increased use of instruments during delivery was the explanation for the

observed increase in severe perineal lacerations associated with epidural analgesia, the data were stratified by use of operative vaginal delivery. When the data were separated in this way (Table 4), there were significant differences between the two populations regarding the incidence of severe perineal laceration and use of epidural analgesia. Of the women who did not have an instrument-assisted delivery, severe laceration occurred in 7.77% (41 of 528) of women who had epidural analgesia. Laceration occurred in only 4.49% (91 of 2,025) of women who had neither epidural analgesia nor an instrument-assisted delivery. In contrast, for women who had an instrument-assisted delivery, there was very little difference in the incidence of severe laceration with or without epidural analgesia (22.64% and 20.0%, respectively).

Table 3 shows that use of instruments was a strong predictor of severe laceration (OR = 3.245, 95% CI = 2.162–4.869). Table 5 explores the predictors of instrument use. The logistic regression model shows that epidural analgesia is indeed a strong predictor of instrument use (OR = 3.01, 95% CI = 2.225 to 4.075). Whereas the results in Table 4 appear to show that epidural analgesia is an independent cause of severe lacerations, when instrument use was controlled for in a regression model, epidural analgesia did not show a statistically significant increase in risk for severe tear.

## Discussion

The purpose of this study was to determine whether epidural analgesia was an independent risk factor for severe perineal laceration during vaginal delivery at a community-based obstetrical practice. The most recent study to explore this issue was by Robinson et al<sup>4</sup> in a tertiary maternity hospital

**Table 3. Multiple Logistic Regression Analysis: Odds Ratios of Confounders with Severe Laceration.**

Variable	Project Without Instruments in Model Odds Ratio (CI)	Project with Instruments in Model Odds Ratio (CI)
Epidural analgesia	1.528 (1.092–2.137)	1.287 (0.907–1.826)
Induced labor	1.486 (1.077–2.051)	1.411 (1.018–1.956)
Nulliparous	3.904 (2.771–5.501)	3.468 (2.447–4.915)
Any instrument	—*	3.245 (2.162–4.869)
Birth weight (>4 kg)	2.355 (1.465–3.788)	2.194 (1.353–3.556)
Maternal age	<i>t</i> Test procedure eliminated correlation	<i>t</i> Test procedure eliminated correlation

CI = confidence interval.

\*Not included in model.

Note: Episiotomies were controlled for in this model.

**Table 4. Number of Severe Lacerations in Patients, by Instruments Use and Epidural Analgesia.**

Type of Delivery	Epidural Analgesia		No Epidural Analgesia	
	Total Patients No.	Patients with Severe Laceration No. (%)	Total Patients No.	Patients with Severe Laceration No. (%)
Instrument used	106	24 (22.64)	100	20 (20.0)
No instrument used	528	41 (7.77)	2,025	91 (4.49)

setting in 1999. They found initially that epidural analgesia was associated with increased rates of severe laceration in a population of nulliparous women, but after controlling for use of instruments during delivery, the association was no longer significant. This study also found that epidural analgesia was associated with an increased use of instruments during delivery, which led to the conclusion that epidural analgesia led to an increased use of operative delivery, and that the instruments, in turn, caused an increase in severe perineal laceration.

Our current analyses agree with these results (Table 3). The Robinson et al study,<sup>4</sup> however, did not include a logistic regression model to determine risk factors for use of instruments in vaginal delivery. In addition, the Robinson et al study, like many, was performed at a tertiary maternity hospital. In contrast to the tertiary hospital setting of that study, the community hospital population of this study had a significantly lower incidence of instrument use (7.47% vs 16.6%), episiotomy (22.07% vs 47.6%), severe laceration (6.38% vs 14.0%), and epidural analgesia (22.98% vs 70.9%).

A study by Janssen et al in 2001<sup>10</sup> found that tertiary level maternity hospitals are associated with higher rates of epidural analgesia, cesarean delivery, and instrument-aided delivery. Thus, the findings by Robinson et al<sup>4</sup> might not be applicable to community hospitals.

In 1988 Legino et al<sup>8</sup> found that 22% of women who sustained a severe perineal laceration received

epidural analgesia. Only 7% of women who did not have severe perineal trauma had epidural analgesia, however. The study did not put forth any explanation for the observed higher rates of severe perineal laceration in the epidural analgesia group.

Conversely, Walker et al<sup>6</sup> in 1991 found no significant interaction between the incidence of epidural analgesia and the use of forceps, episiotomy, or parity. Further, the study concluded that use of epidural analgesia does not appear to be related to the incidence of perineal laceration in a population of nulliparous and multiparous patients. Combs et al<sup>5</sup> agreed with this conclusion in 1990, when their study found no effect of epidural analgesia on severe perineal laceration in a population of 2,832 women having operative deliveries.

Finally, the oldest study, by Bickers<sup>7</sup> in 1970, concluded that epidural analgesia was protective for perineal laceration. Because that study did not delineate between severe laceration (third and fourth degree) and less serious laceration (first and second degree), the lower laceration rate in the study can be possibly attributed to the lack of first- and second-degree lacerations in the epidural analgesia group. This group had increased rates of episiotomy. To our knowledge, these studies are the only ones to explore the association between epidural analgesia and severe perineal laceration.

Ours is the only reported study to use a community-based obstetric teaching practice to analyze the effect of epidural analgesia on incidence of severe laceration. In our study, women who gave birth vaginally at term with epidural analgesia had significantly higher incidences of severe laceration and instrument use. Epidural analgesia was found to be a strong predictor of instrument use (OR 3.01, 95% CI - 2.225–4.075). Operative vaginal delivery is well documented to be a significant cause of third- and fourth-degree laceration in both this study and many others<sup>12–16</sup> (OR 3.245, 95% CI 2.162–4.869). Given these facts, it is strongly sug-

**Table 5. Logistic Regression for Prediction of Need for Instrument Use.**

Variable	Odds Ratio	Confidence Interval (95%)
Epidural analgesia	3.01	2.225–4.075
Induced labor	1.703	1.25–2.32
Nulliparous	3.425	2.495–4.701
Birth weight >4 kg	1.779	1.095–2.89



gested that epidural analgesia can be linked to increased numbers of patients who have severe perineal trauma as a result of an increase in operative vaginal delivery.

It should be noted, however, that the patients who did not have instruments used during delivery had a 58% higher incidence of severe perineal laceration when epidural analgesia was used (Table 4). This finding suggests that epidural analgesia might be either an independent risk factor or linked to third- and fourth-degree perineal laceration by some other mechanisms. Despite the trend shown by the data in Table 4, epidural analgesia was not found to be a statistically significant independent risk factor when instrument use was included in the regression model.

### Limitations

This study was conducted at a single institution, and though it was a community hospital, it might not be typical of other community hospital providers or patients. St. Francis hospital is a teaching hospital and thus has a sizable number of patients who are delivered by family practice and obstetrics residents. In addition, indigent clinic patients, a population that is of relatively higher risk than maternity populations at many community hospitals, are delivered at St. Francis hospital. Nevertheless, when comparing the results of our study with those of Robinson et al<sup>4</sup> (even allowing for inclusion of only nulliparous women in this study), the dramatically lower use of epidural analgesia, episiotomy, and instrument delivery in our study suggests that our institution and patient population were more typical of a community maternity hospital.

This study assumed that delivering physicians and nurse-midwives had a uniform definition of third-degree tear. We assumed that any tear described as including "partial third degree" was a third-degree tear, and it was recorded in the log as such. Given that an experienced community physician was required to be present at all deliveries, the delivery log was likely to be consistent with the definition of third-degree laceration according to the American College of Obstetricians and Gynecologists.

Finally, it was impossible to determine accurately the effect of the relative skill of the provider in this analysis. Although there were no statistically significant differences among family physicians, obstetric specialists, obstetric residents, and nurse

midwives when analyzed as broad categories, this analysis did not take into account differences in technique and clinical decision making among individual providers. In addition, it is possible that some providers promote epidural analgesia for their patients more often than other providers, introducing a provider bias that cannot be controlled for in this study.

### Conclusion

Epidural analgesia has become an effective and popular method of pain control during vaginal delivery. Much attention is given to its safety and efficacy, but many patients and health care providers are unaware of its potential negative consequences. The effectiveness of epidural analgesia is not without the cost of an increased likelihood of instrument use during a delivery and the possibility of a severe laceration, such as a tear extending into the deep transverse perineal muscles and fibers of the anal sphincter (third degree) or rectal mucosa (fourth degree) (Tables 3 and 5). Patients and providers should be informed of the potential drawbacks of epidural analgesia, such as severe perineal laceration and its considerable long-term consequences, such as incontinence, dyspareunia, and rectovaginal fistula.

Epidural analgesia is associated with an increase in severe perineal trauma as a result of its tripling the risk of instrument use. Instrument use in vaginal delivery more than triples the risk of severe perineal laceration.

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### References

1. Poen AC, Felt-Bersma RJ, Dekker GA, Deville W, Cuesta MA, Meuwissen SG. Third degree obstetric perineal tears: risk factors and the preventive role of mediolateral episiotomy. *Br J Obstet Gynaecol* 1997; 104:563-6.
2. Martin S, Labrecque M, Marcoux S, Berube S, Pinault JJ. The association between perineal trauma and spontaneous perineal tears. *J Fam Pract* 2001; 50:333-7.
3. Al-Mufti R, McCarthy A, Fisk NM. Survey of obstetricians' personal preference and discretionary practice. *Eur J Obstet Gynecol Reprod Biol* 1997; 73:1-4.

4. Robinson JN, Norwitz ER, Cohen AP, McElrath TF, Lieberman ES. Epidural analgesia and third- or fourth-degree lacerations in nulliparas. *Obstet Gynecol* 1999;94:259–62.
5. Combs CA, Robertson PA, Laros RK Jr. Risk factors for third-degree and fourth-degree perineal lacerations in forceps and vacuum deliveries. *Am J Obstet Gynecol* 1990;163(1 Pt 1):100–4.
6. Walker MP, Farine D, Rolbin SH, Ritchie JW. Epidural analgesia, episiotomy, and obstetric laceration. *Obstet Gynecol* 1991;77:668–71.
7. Bickers WM. Epidural analgesia in obstetrics. *J Reprod Med* 1970;5:72–80.
8. Legino LJ, Woods MP, Rayburn WF, McGoogan LS. Third- and fourth-degree perineal tears. 50 year's experience at a university hospital. *J Reprod Med* 1988;33:423–6.
9. Nodine PM, Roberts J. Factors associated with perineal outcome during childbirth. *J Nurse Midwifery* 1987;32:123–30.
10. Janssen PA, Klein MC, Soolsma JH. Differences in institutional cesarean delivery rates—the role of pain management. *J Fam Pract* 2001;50:217–26.
11. Thorp JA, Breedlove G. Epidural analgesia in labor: an evaluation of risks and benefits. *Birth* 1996;23:63–83.
12. Studd JW, Crawford JS, Duignan NM, Rowbotham CJ, Hughes AO. The effect of lumbar epidural analgesia on the rate of cervical dilatation and the outcome of labour of spontaneous onset. *Br J Obstet Gynaecol* 1980;87:1015–21.
13. Hoult IJ, MacLennan AH, Carrie LE. Lumbar epidural analgesia in labour: relation to fetal malposition and instrumental delivery. *Br Med J* 1977;1: 14–6.
14. Walton P, Reynolds F. Epidural analgesia and instrumental delivery. *Anaesthesia* 1984;39:218–23.
15. Kaminski HM, Staffl A, Aiman J. The effect of epidural analgesia on the frequency of instrumental obstetric delivery. *Obstet Gynecol* 1987;69:770–3.
16. Beynon CL. Midline episiotomy as a routine procedure. *J Obstet Gynaecol Br Commonw* 1974;81: 126–30.