ORIGINAL RESEARCH

Epidural Analgesia and Any Vaginal Laceration

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Background: **Studies have shown increased incidence of severe vaginal lacerations (third and fourth degree) in women under the influence of epidural analgesia. This increase has been attributed to the increased the use of operative vaginal delivery (OVD), with attendant increased risk of laceration. Although mild and moderate vaginal lacerations requiring suturing are clinically significant, their relationship to epidural analgesia has not been extensively studied.**

Objective: **The purpose of this study is to examine relationships between epidural analgesia in laboring women and vaginal lacerations at delivery. Our research addresses the question: "Is epidural analgesia in labor associated with reduced likelihood of vaginal laceration at delivery, compared with delivery without epidural analgesia? In addition, is there a difference in vaginal laceration rates between an urban hospital staffed by obstetricians and a suburban hospital staffed mainly by family physicians?"**

Study Design: **For the purposes of our study we included mild and severe perineal lacerations (first through fourth degree). We included all-term singleton vaginal deliveries at Truman Medical Centers Hospital Hill and Lakewood during 2013. We conducted a retrospective chart review that included 2131 women. We examined the relationship of OVD to epidural and to laceration. Since the 2 hospitals had different characteristics, we also examined the relationship of location of delivery to laceration. We controlled for maternal age, birth weight, location of delivery, OVD, parity, and race. We examined these factors using a logistic regression analysis.**

Results: **After controlling for all factors mentioned above, epidural was negatively associated with laceration (odd ratio [OR], 0.886; 95% CL, 0.665, 0.991). Other factors negatively associated with laceration included black race, parity, and delivery at Truman Medical Center Lakewood (TMCLW).**

Conclusions: **Patients who received epidural analgesia experienced fewer vaginal lacerations. There was no increase in OVD in patients who received epidural analgesia. Patients who delivered at a suburban hospital staffed by family medicine residents experienced fewer lacerations than those delivering at an urban hospital staffed by Obstetrics and Gynecology residents after controlling for race and other factors. (J Am Board Fam Med 2018;31:768–773.)**

Keywords: **Epidural Analgesia, Family Physicians, Gynecology, Lacerations, Logistic Regression, Obstetrics, Parity, Urban Hospitals**

Vaginal lacerations are a cause of pain, bleeding, and more serious complications such as fecal incontinence and sexual dysfunction.[1] The repair of vaginal lacerations prolongs the process of delivery, exposing the mother to risks such as infection, allergic reaction to local anesthetic, and immobility with attendant risks such as musculoskeletal pain and venous thrombosis.

Genital-tract trauma occurring during delivery has been variously referred to in the literature as vaginal laceration, vaginal tear, perineal laceration, perineal tear, etc. In this article we refer to this injury as a vaginal laceration.

Epidural analgesia is becoming more commonly available[2] and provides superior pain relief compared with noninvasive musculoskeletal techniques or intravenous analgesics.[3] It is associated with a longer second stage of labor,[4] increased use of oxytocin augmentation of labor, and increased inter-

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vention at the time of delivery including episiotomy[5] and operative vaginal delivery (OVD).[6]

Factors known to increase risk of vaginal laceration include primiparity,[7] operative vaginal delivery, prolonged second stage of labor, fetal size, fetal position,[8] and race, particularly Asian and white race.[9] The association between epidural analgesia and vaginal laceration has been extensively studied. Findings have included a positive association,[5] a negative association,[7] and no association after controlling for confounding variables.[11] Analysis of results have concluded that epidural analgesia increases the likelihood of severe vaginal laceration by increasing the likelihood of OVD,[8] or that it reduces the likelihood of vaginal laceration as reduced pain results in a more controlled delivery.[10]

Severe vaginal lacerations, defined as third- and fourth-degree lacerations, result in more pathology,[12] and are more studied than minor perineal lacerations, although minor lacerations and their repair carry similar risks.[13] All the studies that we found considered only severe vaginal lacerations.

The purpose of this study is to answer the following question: "Is epidural anesthesia associated with reduction in likelihood of vaginal laceration in our setting?" We reviewed 2131 vaginal deliveries from 2 safety net hospitals in Kansas City, MO occurring in 2013. We examined the relationship between epidural analgesia and any vaginal laceration using logistic regression analysis. We also compared laceration rates between the 2 institutions, 1 urban medical center and staffed exclusively by obstetrics and gynecology faculty and residents; and the other, a suburban hospital, staffed almost exclusively by family-medicine faculty and residents. Therefore, an additional research question arose: "Is vaginal laceration rate affected by hospital setting/discipline of the provider?"

Materials and Methods

Before this study approval was obtained from the institutional review board of the University of Missouri–Kansas City and the privacy board of Truman Medical Center Research.

Patient files were reviewed from all-term singleton vaginal deliveries occurring between January 1 and December 31, 2013 at Truman Medical Center Hospital Hill (TMCHH) and Truman Medical Center Lakewood (TMCLW), both in Kansas City, MO. We defined term gestation as 37 to 42 weeks by best dates. TMCHH is an urban safety net hospital where deliveries are staffed by obstetrics and gynecology faculty and residents. TMCLW is a suburban safety net hospital where deliveries are staffed by family medicine faculty and residents, 1 midwife, and occasionally by obstetricians. A total of 2131 patients were included in our study. Outcome was any vaginal laceration requiring repair including first-through-fourth-degree lacerations. Variables that were controlled for include parity, race, birth weight, maternal age, operative vaginal delivery, and location (TMCHH vs TMCLW). Results of our file review were tabulated in Excel, and logistic regression analysis conducted using SAS (SAS Institue Inc. Cary, NC), a statistical software package. This analysis produces an odds ratio with 95% confidence intervals and a P value. Results with $P < .05$ were reported as significant.

The evaluation of the degree of a vaginal laceration is subjective. We defined lacerations as wounds that required suturing for hemostasis or restoration of structural integrity. This is consistent with the practice of the Centers for Disease Control's [CDC's] National Hospital Discharge Survey, which tracks obstetric lacerations as the number of wounds sutured. Wounds of the vaginal mucosa or labia minora that did not surpass the vaginal fourchette posteriorly, and which required suturing were considered first-degree vaginal lacerations. Wounds extending beyond the fourchette to the cornified epithelium of the perineum were labeled second-degree vaginal lacerations. Wounds which involved perineal skin and any part of the anal sphincter were called third-degree vaginal lacerations. And wounds involving the above structures and extending to any part of the anal mucosa were termed fourth-degree vaginal lacerations. To classify the presence and type of vaginal laceration, each patient's delivery note was accessed via Cerner Powerchart. The note was read and the presence or type of laceration was determined based on the description by the delivering physician. "Hemostatic" lesions and "abrasions" were not included as lacerations. Often the note clearly labeled a laceration type. In other cases a judgment was made based on the description of the wound and its repair.

Results

Delivery Hospital

All deliveries at TMCHH were staffed by obstetricians. At TMCLW, 91.8% of deliveries were

staffed by family-medicine physicians, 6.3% by obstetric personnel, and 1.9% by a midwife.

Vaginal Lacerations

Our study revealed that 63.9% (n = 1362) of our patients had a laceration of any kind requiring closure. A small percentage (3.2%; n = 68) of our patients had a severe (third- or fourth-degree) laceration. A larger percentage (41.5%; n = 884) of our patients received epidural anesthesia. Finally, 64.4% (n = 803) who had no epidural had a laceration, and 63.2% (n = 559) of patients who did have epidural had a laceration. We consider second- through fourth-degree lacerations to be more clinically significant than lacerations involving only the vaginal mucosa, so we analyzed our results 2 ways; considering any laceration, and considering clinically significant (second- to fourth-degree) lacerations.

When considering all lacerations, factors that had a positive association with laceration included birth weight and operative vaginal delivery (OVD). Factors that had a negative association with laceration included black race, increasing parity, and delivery at TMCLW. Epidural anesthesia had a negative association with laceration (odd ratio [OR], 0.806; CI, 0.665 to 0.991) (Table 1).

When only second- to fourth-degree lacerations were considered, factors positively associated with laceration included increasing age, increasing birth weight, and OVD. Factors negatively associated with laceration included black race, delivery at TMCLW, and increasing parity. Epidural anesthesia was not associated positively or negatively with occurrence of these lacerations (Table 2).

Table 1. Odds Ratios in Patients with Any Vaginal Laceration

Variable	*P*	OR	95% CI
Birth weight (g)	.003	1	1 to 1
Epidural	.040	0.806	0.655 to 0.991
OVD	.003	1.996	1.256 to 3.170
Black race	.002	0.667	0.516 to 0.863
TMCLW location	<.001	0.615	0.487 to 0.776
Total parity	<.001	0.670	0.624 to 0.719

CI, confidential interval; OR, odd ratio; OVD, operative vaginal delivery; TMCLW, Truman Medical Center Lakewood.

Table 2. Odds Ratios in Patients with 2nd–4th Degree Lacerations

Variable	*P*	OR	95% CI
Birth weight	.017	1	1 to 1
OVD	<.001	3.484	2.346 to 5.174
Black race	<.001	0.614	0.470 to 0.801
TMCLW location	<.001	0.609	0.482 to 0.769
Total parity	<.001	0.639	0.584 to 0.700

CI, confidential interval; OR, odd ratio; OVD, operative vaginal delivery; TMCLW, Truman Medical Center Lakewood.

Race

Since black race emerged as a significant factor, the racial composition of the patient mix at our 2 hospitals was examined and found to be as follows: 44.6% of patients at TMCHH were identified as black race, 19.5% white, and 35.8% other. At TMCLW the mix was 19.2% black, 62.8% white, and 17.8% other. Race was determined by examining a spreadsheet containing information entered by labor and delivery nurses at the time of admission. The spreadsheet has columns for race titled, "Black," "White," and "Other." The term, "African American" is not used because patients listed as "Black race" were a mixture of African American, African, and other women either self-identified or identified by nurses as "black." The total number of patients included from the 2 institutions were similar, with 938 from TMCHH and 878 from TMCLW.

OVD

In previous studies,[14] increased use of OVD in patients with epidural analgesia has been implicated in causing increased rates of severe laceration among that subset of patients. That article cited a strong association between epidural and OVD (OR, 3.01, 95% CI, 2.225 to 4.075). By contrast, our patients with epidural analgesia underwent OVD only slightly more often. In patients without epidural analgesia, 7.4% had OVD, versus 9.5% of patients with epidural analgesia (Table 3). χ^2 testing did not reveal a significant association between epidural and OVD.

Comment

The results of our study indicate that the answer to our earlier question is: "Yes, epidural anesthesia is a

Table 3. Relationship between Epidural and Operative Vaginal Delivery

			Delivery Type		
			SVD	OVD	Total
Epidural	No	Count	501	40	541
		Percentage	92.6	7.4	100.0%
	Yes	Count	446	47	493
		Percentage	90.5	9.5	100.0%
Total		Count	947	87	1034
		Percentage	91.6%	8.4	100.0

OVD, operative vaginal delivery; SVD, Spontaneous Vaginal Delivery.

predictor of reduced likelihood of vaginal laceration."

The association between epidural anesthesia and vaginal laceration has been studied previously in various settings.[1,5,10] However, these studies have looked exclusively at severe perineal lacerations. We have chosen to examine the association of epidural analgesia with any vaginal laceration requiring sutures, and independently, lacerations that we consider clinically significant because of the increased pain and risk of infection associated with extension involving the cornified epithelium and muscles of the perineum. In both cases, lacerations were less common in the group with epidural analgesia. At our institution, the likelihood of a severe laceration (3.2%; n = 68) is less than in other studies,[14] and even lower at the suburban campus (2.2%).

Table 4. Comparison of Urban and Suburban Hospitals

	Truman Medical Center Hospital Hill	Truman Medical Center Lakewood
Provider, type, %		
Obstetrics	100	6.3
Certified nurse midwife		1.9
Family medicine		91.8
Patient race		
Black	44.6	19.2
White	19.5	62.8
Other	35.8	17.8
Any vaginal laceration requiring sutures rate		
n	679	628
%	61.7	60.9
Severe (third-and fourth-degree) laceration rate		
n	44	23
%	4.0	2.2
Vaginal laceration association with epidural		
P	Index for comparison	<.001
OR	0.615	
CI		0.487 to 0.776
OVD rate		
n	60	49
%	5.5	4.8
Epidural rate		
n	369	475
%	34.8	47.6

CI, confidential interval; OR, odd ratio; OVD, operative vaginal delivery.

Since we are a 2-hospital system, we took this opportunity to compare the outcomes of interest at our 2 safety-net hospitals, 1 urban with obstetric staff, and 1 suburban with family medicine staff. This comparison revealed a significant difference in vaginal lacerations between the 2 hospitals after controlling for age, birth weight, race, and OVD. Patients were significantly less likely to experience a vaginal laceration at the suburban campus (TMCLW: OR, 0.615; CL, 0.487, 0.776; $P < .005$). This reduced risk is especially striking considering black race proved to be a protective factor, and the urban campus (TMCHH) cared for a much larger proportion of black patients (44.6% vs 19.2%).

Our study further strengthens previous findings suggesting that vaginal lacerations are less common in patients with epidural anesthesia. As in other studies, black patients[15] and patients with increased parity[16] and lower birth weight[12,17] are less likely to sustain lacerations. It also raises a question. Why the significant difference in lacerations between the 2 hospitals? Patient populations are different with regard to racial makeup, yet interestingly this difference favors the hospital with the higher rate of laceration. In fact, delivery at the suburban hospital (TMCLW) carried a stronger negative association with vaginal laceration than did parity (Table 1). Rates of severe laceration were also lower at the suburban hospital. Differences between the 2 hospitals are summarized in Table 4. Physician staff at the hospitals differs, so differences in practice between family medicine and obstetric staff may play a part. Nursing staff may differ also, though no effort was made to characterize differences in nursing staff. However, it should be noted that the 2 hospitals share the same nursing administration and nursing protocols. There are likely differences in patient population that we were not able to quantify based on our chart review.

Limitations/Future Studies

Vaginal lacerations are important to patients, and prevention is obviously desirable. Therefore, it would be reasonable to study differences between the 2 hospitals that might contribute to the difference in a patient's likelihood of laceration. Our study, being retrospective, came with some obvious limitations, including differences in delivery documentation between the 2 hospitals and charts with incomplete data. The significant difference in vaginal laceration rates observed between the 2 hospitals staffed by different disciplines (obstetrics vs family medicine) raised more questions than it answered. If further studied, it could identify a practice measure that could help providers reduce the risk of a vaginal laceration. Variables of interest in addition to the make-up of physician staff include quality of prenatal care, duration of stage 2 labor, rate and timing of elective inductions, presence of nonreassuring fetal heart rates, and make-up of the nursing staff. It would also be desirable to quantify differences in practices such as "laboring down," "rest and descend," perineal massage, and treatment of the perineum with warm compresses or substances such as essences and oils.

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