The Effects Of Epidural Anesthesia On Type Of Delivery

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Abstract: A retrospective cohort study of 626 low-risk patients admitted for labor and delivery under the care of a family physician was designed to test the hypothesis that epidural anesthesia increases the frequency of instrumental and operative deliveries. The crude odds ratio of instrumental or operative delivery in women electing to have epidural anesthesia was 9.56 (95 percent confidence interval, 5.57 to 16.40; $P < 0.001$). Controlling for bias by multivariate analysis did not change the conclusion indicated by the crude odds ratio—use of elective epidural anesthesia results in markedly increased odds of instrumental or operative delivery. (J Am Bd Fam Pract 1988; 1: 238-44.)

The principal aim of this study was to test the hypothesis that epidural anesthesia increases the frequency of instrumental and operative delivery for low-risk obstetrical patients under the professional care of board-certified family physicians.

During the past 10 years, the rate of Cesarean section in the U.S. has almost tripled.[1] Surprisingly, middle- to upper-class women, who typically have low-risk pregnancies, are more likely to undergo Cesarean section than women of lower social class.[1] In low-risk, middle- to upper-class women, we found that the frequency of abnormal outcomes of pregnancy was higher when delivery occurred in a high technology urban hospital than when delivery was in a lower technology rural hospital.[2] One important question is whether current use of intrapartum high technology could account for these differences.

Epidural anesthesia is one application of intrapartum technology that has been questioned.[3,4] Some clinicians have reported that it increased the rate of instrumental deliveries,[5-8] but others have considered it to be safe and effective.[6,9] This study assesses the impact of use of epidural anesthesia on the type of delivery in low-risk patients of board-certified family physicians.

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Methods and Study Design

Records

A cohort of 626 low-risk patients admitted to the hospital for labor and delivery under the care of a family physician was studied retrospectively. The records of these patients were reviewed through delivery, regardless of whether the actual delivery was performed by the family physician or an obstetrical specialist.

The medical records, which were chosen from 863 patients of family physicians, were from a previously compiled computerized data base.[2] We included only singleton pregnancies that qualified as low-risk immediately prepartum according to criteria of Morrison and Olsen[10] and in which the fetus was vertex in presentation, had attained a gestation of 37 weeks or more, and weighed more than 2,500 g. We excluded elective or repeat Cesarean sections.

When elected, lumbar epidural anesthetic was administered by the anesthesiology staff using one or more of the following agents: chloroprocaine, bupivacaine, or lidocaine. Epidural anesthesia was considered elective if either the anesthesiology staff or the family physician recorded that the patient requested it and no medical indication for it was noted in the chart. Two patients were eliminated from the study because epidural anesthesia was thought to be medically indicated.

Overall, data were available from more than 97 percent of the cases, and for each variable studied, at least 82 percent of the cases had data available.

Analysis

The principal independent variable was elective use of epidural anesthesia. The principal depend-

Table 1. *Type of Delivery in 624 Women.**

Type	Epidural Anesthetic (n = 110) Number	Epidural Anesthetic (n = 110) Percent	No Epidural Anesthetic (n = 514) Number	No Epidural Anesthetic (n = 514) Percent	*P* value†	cOR‡	*P* value§
Instrumental or operative	40	36.4	29	5.6	<0.001	9.56	<0.001
Low-forceps	17	15.5	13	2.5	<0.001	10.01	<0.001
Mid-forceps	9	8.2	5	1.0	<0.001		
Emergency Cesarean section	14	12.7	11	2.1	<0.001	8.82	<0.001

*Two patients were excluded from the study because epidural anesthesia was medically indicated.
†Derived from Mann-Whitney *U* test.
‡Crude odds ratio for type of delivery in women electing to have epidural anesthesia.
§Derived from Mantel-Haenszel χ^2 test.

ent variable was the type of delivery, which was dichotomized into normal spontaneous vaginal delivery and all others, including low- or mid-forceps delivery and emergency Cesarean section. In this report, the second group is referred to as instrumental or operative delivery.

Other factors that were analyzed included demographic, maternal, fetal, labor, and obstetric care characteristics. *Demographic* variables included maternal age, marital status, and social status as measured by the Hollingshead-Redlich scale. *Maternal* factors included gravidity, parity, and the physician's estimation of pelvic adequacy. *Fetal* factors included gestational age and birth weight. *Labor* variables included the duration of stage 2 labor, intrapartum risk as measured by Morrison, et al.[11] and Akhtar and Sehgal,[12] and station and presentation at the start of the second stage or at the last-recorded examination before stage 2. The Akhtar risk scale includes abnormal tracings of

Table 2. *Demographic, Maternal, and Fetal Characteristics in 624 Women.**

Characteristic	Epidural Anesthetic (n = 110) Number or Mean	Epidural Anesthetic (n = 110) Percent	No Epidural Anesthetic (n = 514) Number or Mean	No Epidural Anesthetic (n = 514) Percent	*P* value†
Demographic					
Age, years	24.2		25.2		<0.001
Single	14	12.7	46	8.9	<0.001
Middle-to upper-social status	78	70.9	342	66.5	<0.001
Maternal					
Primigravida	64	58.2	117	22.8	<0.001
Nulliparous	77	70.0	131	25.5	<0.001
Contracted pelvis‡	15	13.6	4	0.7	<0.001
Fetal					
Birth weight, grams	3,600		3,570		<0.001
Gestational age >42 weeks	13	11.8	36	7.0	<0.001

*Two patients were excluded from the study because epidural anesthesia was medically indicated.
†Derived from Mann-Whitney *U* test.
‡As estimated from physician's examination.

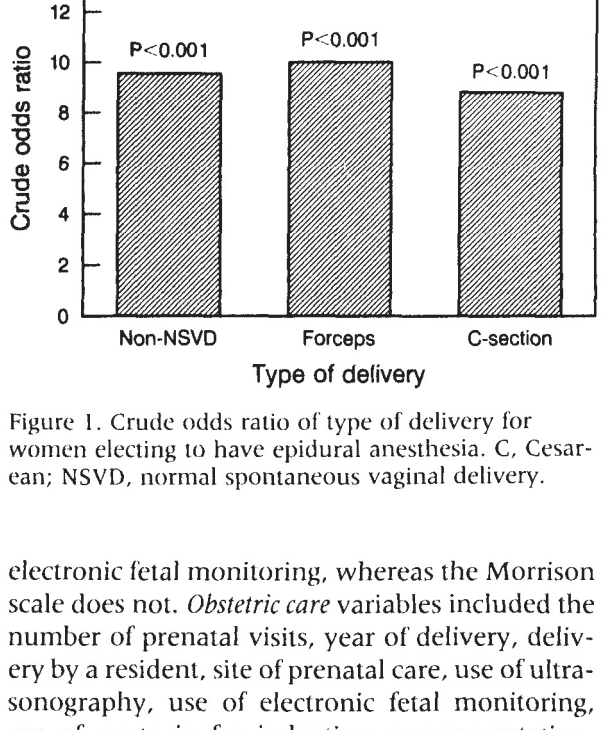

Figure 1. Crude odds ratio of type of delivery for women electing to have epidural anesthesia. C, Cesarean; NSVD, normal spontaneous vaginal delivery.

electronic fetal monitoring, whereas the Morrison scale does not. *Obstetric care* variables included the number of prenatal visits, year of delivery, delivery by a resident, site of prenatal care, use of ultrasonography, use of electronic fetal monitoring, use of oxytocin for induction or augmentation, and transfer to and consultation with the department of obstetrics. Seven of these factors could also be considered outcomes: transfer, consultation, the two intrapartum risk scores, duration of the second stage of labor, station, and presentation.

Statistical Analysis

The Mann-Whitney *U* test was used to compare demographic, maternal, fetal, labor, and obstetric care characteristics of patients who received an epidural anesthetic with the characteristics of patients who did not. Potential confounders were initially tested for significance by the Mantel-Haenszel χ^2 test and then tested for confounding or interaction by stratified analysis and adjusted odds ratios.[13,14]

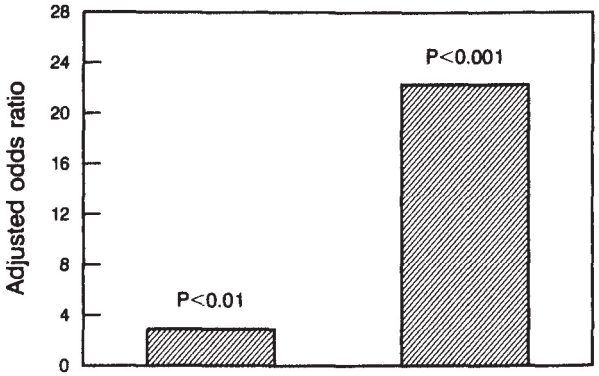

Figure 2. Adjusted odds ratio of instrumental or operative delivery for women electing to have epidural anesthesia, by stage at administration.

Power of the Study

This study had a 95 percent chance of detecting a change from 5.6 percent to 18.6 percent, at the two-sided 0.05 level, in instrumental or operative delivery between women electing or not electing to have epidural anesthesia. The odds ratio was approximately 3.3 at this power. All subgroup analyses had less power than this.

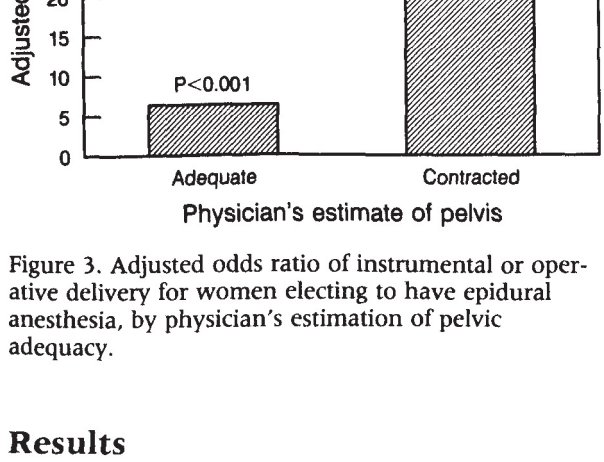

Figure 3. Adjusted odds ratio of instrumental or operative delivery for women electing to have epidural anesthesia, by physician's estimation of pelvic adequacy.

Results

Type of Delivery

Women electing to have epidural anesthesia had a higher percentage of instrumental or operative delivery than those who did not ($P < 0.001$, Table 1). The crude odds ratio in this group was 9.56 (95 percent confidence interval, 5.57 to 16.40; $P < 0.001$, Figure 1).

The higher percentage of instrumental or operative delivery for women electing epidural anesthesia was also noted when the subgroups of low- or mid-forceps and Cesarean section were analyzed separately (Figure 1). In women electing epidural anesthesia, the crude odds ratio of a forceps delivery was 10.01 (95 percent confidence interval,

Table 3. *Labor Characteristics in 624 Women.**

Characteristic	Epidural Anesthetic (n = 110)		No Epidural Anesthetic (n = 514)		
	Number or Mean	Percent	Number or Mean	Percent	*P* value†
High Morrison risk‡	38	34.5	48	9.3	<0.001
High Akhtar risk‡	44	40.0	36	9.7	<0.001
Station§					
Negative	6	5.7	93	22.9	
Zero	31	29.2	134	32.9	
Positive	69	65.1	180	44.2	<0.001
Presentation§					
Anterior	32	59.3	82	70.1	
Transverse	12	22.2	19	16.2	
Posterior	10	18.5	16	13.7	=0.257
Duration of stage 2, minutes	91		39		<0.001

*Two patients were excluded from the study because epidural anesthesia was medically indicated.
†Derived from Mann-Whitney *U* test.
‡Intrapartum score.
§At start of second stage or at last-recorded examination before second stage.

5.22 to 19.20; $P < 0.001$), and for a Cesarean section, it was 8.82 (95 percent confidence interval, 3.85 to 20.20; $P < 0.001$). Because these estimates of the crude odds ratio were similar, we combined forceps and Cesarean section delivery under the heading of instrumental or operative delivery.

Identification of Bias and Effect Modifiers

Significant differences in demographic, maternal, fetal, labor, and obstetric care characteristics were found between women electing to have epidural anesthesia and those who did not (Tables 2–4). Controlling for this bias reduced but did not eliminate the increased odds of instrumental or operative delivery.

Stratified analysis showed effect modifications for six variables:

- Stage of labor when the epidural anesthetic was given (Figure 2)
- Physician's estimate of pelvic adequacy (Figure 3)
- Station of the presenting part at the beginning of stage 2 or at the last-recorded examination before stage 2 (Figure 4)
- Marital status (Figure 5)
- Social status (Figure 6)
- Gestational age (Figure 7)

Parity combined with the stage at which the epidural anesthetic was given also produced effect modification (Figure 8), but regression analysis for all these factors failed to eliminate the increased odds ratios for patients who received epidural anesthesia.

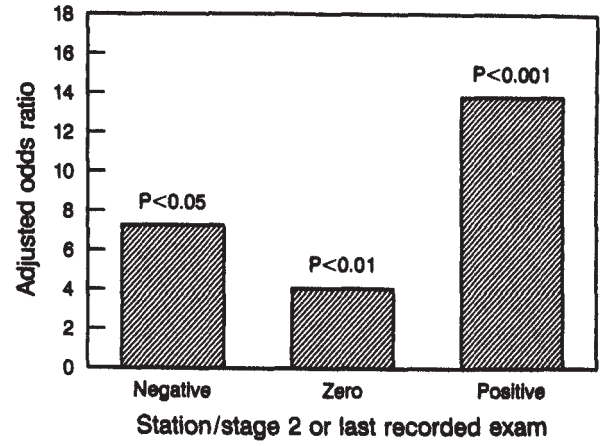

Figure 4. Adjusted odds ratio of instrumental or operative delivery for women electing to have epidural anesthesia, by station at start of stage 2 or at last-recorded examination before stage 2.

Table 4. *Obstetric Care Characteristics in 624 Women.**

Characteristic	Epidural Anesthetic (n = 110) Number or Mean	Epidural Anesthetic (n = 110) Percent	No Epidural Anesthetic (n = 514) Number or Mean	No Epidural Anesthetic (n = 514) Percent	*P* value†
<5 Prenatal visits	0		8	1.6	<0.001
Ultrasonography used	108	98.2	481	93.6	<0.001
EFM‡ used	109	99.1	371	72.2	<0.001
Oxytocin used	56	51.4	94	18.3	<0.001
Transfer§					
Stage 1 of labor	10	9.1	15	2.9	
Stage 2 of labor	23	20.9	9	1.8	<0.001
Consultation					
Stage 1	11	10.0	20	3.9	<0.001
Stage 2	22	20.0	13	2.5	<0.001
Year of delivery					
1980	0		1	0.2	
1981	2	1.8	36	7.0	
1982	8	7.3	102	19.8	
1983	26	23.6	143	27.8	
1984	73	66.4	221	43.0	
1985	1	0.9	11	2.1	<0.001
Site of prenatal care					
Rochester	62	56.4	145	28.2	
Kasson	44	40.0	166	32.3	
Zumbrota	4	3.6	203	39.5	<0.001
Delivery by resident	27	24.5	68	13.2	<0.001

*Two patients were excluded from the study because epidural anesthesia was medically indicated.
†Derived from Mann-Whitney *U* test.
‡EFM, electronic fetal monitoring.
§To obstetrics department.

The following characteristics were associated with the greatest differences:

- Epidural anesthetic given during stages 1 and 2
- Single
- Middle to high social status
- Positive station at the beginning of stage 2 or at the last recorded examination before stage 2
- Contracted pelvis

Lesser differences were found in these circumstances:

- Epidural anesthetic administered only during stage 1
- Married
- Low social status
- Gestational age more than 42 weeks
- Zero or negative station

Nulliparous women electing to have epidural anesthesia during only the first stage of labor were not at increased risk for instrumental or operative delivery; however, the small number of patients within this group precluded firm conclusions.

Discussion

Our finding that epidural anesthesia during labor is associated with increased instrumental and operative deliveries agrees with studies from Great Britain and South Africa.[5-8] This finding is independent of all other variables, and we have shown that there is minimal confounding from demographic, maternal, fetal, labor, and obstetric care characteristics, even though intrapartum Akhtar risk, duration of the second stage of labor, and the estimate of pelvic adequacy are also known to affect the type of delivery.

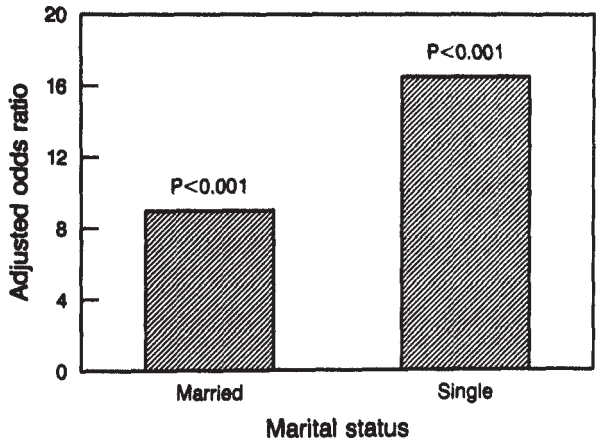

Figure 5. Adjusted odds ratio of instrumental or operative delivery for women electing to have epidural anesthesia, by marital status.

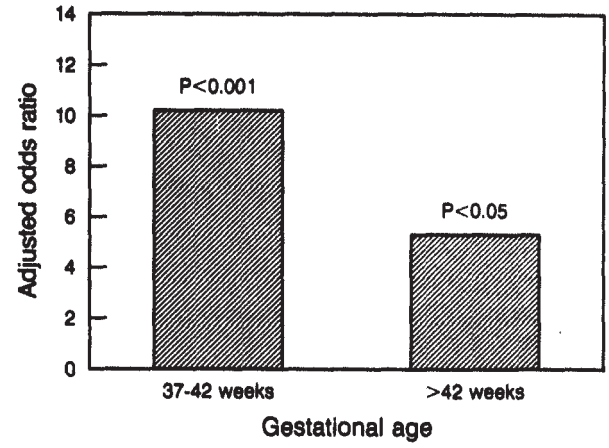

Figure 7. Adjusted odds ratio of instrumental or operative delivery for women electing to have epidural anesthesia, by gestational age.

We have no reason to believe that our experience is unique because other aspects of our obstetrical practice are comparable with state and national rates for neonatal mortality, Cesarean section (9.6 percent), and forceps delivery (7.2 percent).[2,15-17] We had no maternal deaths.

While we can account statistically for the relatively minor differences associated with the effect modifiers listed in the preceding section, we cannot say, from this study, whether patients could be better selected for elective epidural anesthesia than simply by patient or physician preference. A prospective study is needed to clarify these factors and other issues surrounding the optimal use of epidural agents. Until more and better information is available, we believe that the increased chance we have shown is reason enough for the physician to obtain informed consent for the procedure, especially when it is elective.

Conclusion

This study shows that low-risk women who elect to have epidural anesthesia have markedly increased odds of instrumental or operative delivery. Analysis of potential sources of bias, including effect modifiers, by using stratified analysis, probit regression, and analysis of partial correlations, modified the crude odds ratio but did not eliminate the independent association of epidural anesthesia with instrumental or operative delivery. The one-time cost of administration of epi-

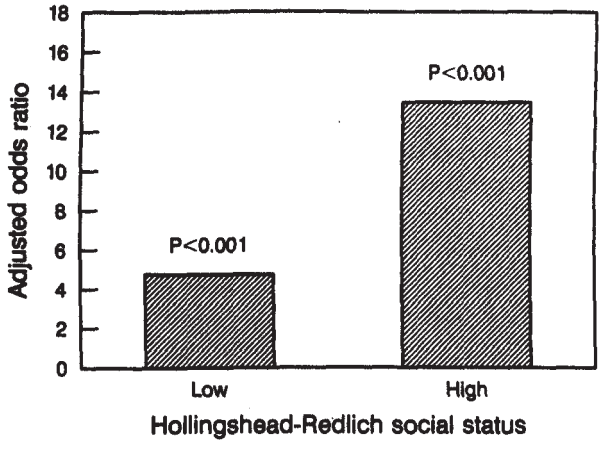

Figure 6. Adjusted odds ratio of instrumental or operative delivery for women electing to have epidural anesthesia, by social status (measured with Hollingshead-Redlich scale).

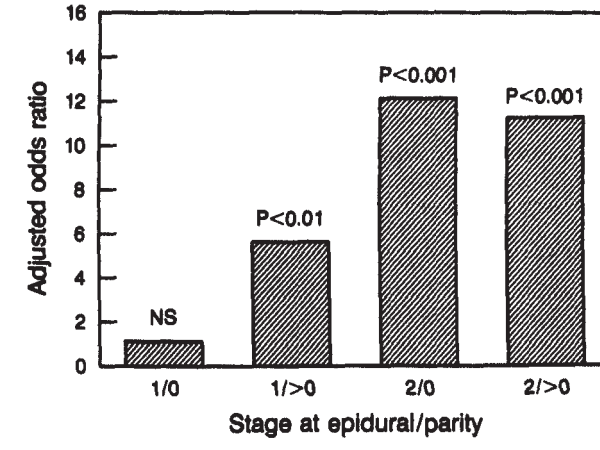

Figure 8. Adjusted odds ratio of instrumental or operative delivery for women electing to have epidural anesthesia, by stage at administration and parity. NS, not significant.

dural anesthetics at our institution is $200. Outcomes associated with epidural anesthesia during labor, such as Cesarean section, forceps delivery, consultation, and transfer of care, also add to the cost of obstetric care and are associated with increased maternal and neonatal morbidity.[18-20]

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Editorial Comment

This research project reports very precisely the outcome and effect of epidural anesthesia on women with a low-risk normal pregnancy. There is no question that the analgesia provided, epidural anesthesia, is profound and deeply embraced by gravid women. However, these authors point out very quickly that there is a greater incidence of operative deliveries, including Cesarean section and forceps. Also, the costs are not insignificant (consultation, transfer, cost of the epidural itself).

Women well trained in LeBoyer or Lamaze childbirth do not find the pain of labor overwhelming. Therefore, I believe readers should pause to appraise the elective use of epidural anesthesia when they consider the adverse outcome found in this study.

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