Variations in Cesarean Delivery for Fetal Distress

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BACKGROUND. Increases in cesarean section frequency may be dependent on institutional or individual practitioner characteristics. The purpose of this study was to examine whether the diagnosis of fetal distress was influenced by time of day or institutional factors.

METHODS. Chart review was performed on a random sample of women stratified by month of delivery at each institution (N=8647). All women who gave birth by elective cesarean section or whose labor was induced were excluded from analysis (n=2207), leaving a total population of 6440 for study. Women were stratified based on risk status, and comparisons were made between the time of delivery, maternal socioeconomic factors, and obstetric variables for those who had a cesarean section for fetal distress compared with women who gave birth vaginally.

RESULTS. Large variations in rates of cesarean delivery for fetal distress were observed among the participating institutions (range 0.9% to 3.0% of all deliveries). Increased rates of cesarean delivery for fetal distress were observed in nonwhite women and those who had had a previous cesarean delivery. Also, a significant increase in rates of cesarean section for fetal distress was noted between the hours of 9:00 PM and 3:00 AM. When adjusted for risk status, previous cesarean delivery, race, use of pitocin augmentation, length of labor, and site, time of day was still a significant predictor (adjusted odds ratio=1.56, 95% confidence interval 1.06 to 2.29) for cesarean delivery for fetal distress.

CONCLUSIONS. Cesarean delivery for the diagnosis of fetal distress appears to vary depending on institutional and other nonclinical factors. The observation that cesarean deliveries for fetal distress peak during nighttime hours raises the possibility that the interpretation of fetal monitor tracing is influenced by physician and patient fatigue or other clinical factors.

KEY WORDS. Cesarean section; dystocia; fetal monitoring; fetal distress; pregnancy, high risk; labor stage, first. *(J Fam Pract 1996; 43:461-467)*

After rising markedly in recent decades, cesarean section rates in the United States appear to have reached a plateau.[1-3] Concerns about the increasing frequency of cesarean delivery have prompted several examinations of the diagnoses given as reasons for this procedure.[4] While cesarean delivery for fetal dystocia is responsible for the some of the increase in cesarean section rates,[4,5] distress has also increased substantially in recent years.[6]

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Estimates for the frequency of performing cesarean sections for fetal distress range from 2% to 7%[4,6,7] of all deliveries. Fetal distress, like dystocia, has remained a poorly defined term. Much reliance has been placed on the interpretation of fetal monitor tracings, which has been shown to have great interrater variability.[8] Clear guidelines indicating when operative interventions are appropriate for "nonreassuring" tracings do not exist, leaving the provider with great latitude to determine both what constitutes fetal distress and when distress is serious enough to indicate a cesarean delivery. This lack of objectivity may result in the same variations in practice patterns seen for dystocia, where provider, payer, and institutional biases have been implicated in causing variations in cesarean delivery rates.[9-13]

This study was undertaken to determine to what

degree cesarean section for fetal distress varies among institutions and providers, and whether patient and obstetric variables influence the diagnosis of fetal distress and operative delivery. In addition, we sought to determine whether cesarean delivery for fetal distress follows temporal patterns previously reported for dystocia,[14] which suggested that the interpretation of fetal heart rate tracings and decisions based on those interpretations differ depending on the time of day. This could indicate that the diagnosis of fetal distress may be influenced by nonclinical factors such as physician or patient fatigue or the environment in which the physician practices.

METHODS

Data were derived from a retrospective study of deliveries occurring at five institutions in the calendar years 1991 and 1992. The participating institutions ranged in size from 110 to 560 beds and were located in five noncontiguous states. The institutions did not share medical staffs. Four of these institutions were community hospitals, and one facility was the primary affiliate of a state-supported medical school. Resident trainees in obstetrics and gynecology and family practice, or both, were present in all five facilities. Immediate access to anesthesia and pediatric resuscitation was available at two of the five facilities.

To generate the sample population, a clustered random sample of patients who gave birth during the 2 years under consideration was generated as follows. All deliveries occurring each month during these 2 years were considered for analysis. When an institution reported more than 80 deliveries per month, a random sample of 80 patients was selected for analysis based on a random number sequence that included as possibilities the total number of patients who gave birth during that month. Using this technique, a total of 8647 patients were identified and their hospital charts were reviewed.

TABLE 1

Factors Classifying Patient as High-Risk

- Hypertension or preeclampsia
- Preexisting or gestational diabetes
- Chronic cardiac or renal disease
- Current drug or alcohol abuse
- Thrombophlebitis during pregnancy
- Intrauterine fetal growth retardation
- Placental abruption or previa
- Premature labor or rupture of membranes
- Multiple gestation
- Active herpes at time of delivery
- Oligo- or polyhydramnios
- Abnormal presentation

Because induction of labor generally may be associated with higher cesarean section rates in certain groups of patients[15] and usually follows a temporal pattern of its own, all patients whose labors were induced were excluded from analysis (n=1515). In addition, all women who were admitted for planned cesarean delivery were excluded (n=692). This produced a total sample of 6440 women available for analysis. Because of the theoretical possibility that physicians' knowledge of preexisting maternal or fetal risk factors would alter the interpretation of fetal heart rate patterns and bias toward intervention, women were stratified into low- (n=5621) and high-risk (n=819) categories based on the presence or absence of specific risk factors (Table 1). These risk factors constitute the factors that would identify a woman as high-risk according to the Hollister Risk Form (Hollister, Inc, Libertyville, Ill), which was used by many of the physicians in the study.

The diagnosis of cesarean section for fetal distress was obtained from discharge summaries or operative records and included all patients who received a cesarean for fetal distress, nonreassuring heart rate patterns, or decelerations of any type. Fetal monitor strips were not available to validate these findings. To investigate temporal patterns of delivery, deliveries were grouped into 3-hour time periods starting with midnight.

Data were analyzed using Epi Info, Version 5.0.[16] Noncontinuous variables were compared using chi-square, while continuous variables were analyzed using Student's *t* test or the Kruskal-Wallis H test for variables with differing variances. Logistic regression analyses were performed using cesarean delivery for fetal distress as the independent variable and including race (white vs all others), risk status, use of pitocin augmentation, and previous cesarean delivery as dependent variables. To adjust for length of labor, the first stage of labor was categorized as short (6.5 hours or less), moderately long (over 6.5 hours but less than 13 hours), and long (over 13 hours). Also included as dependent variables were adjustments for the site of delivery and a dicoto-

TABLE 2

Cesarean Section Rates for Fetal Distress at Each Participating Institution

Institution	High-Risk Population %	Rates for Fetal Distress: Low-Risk Women no. (%)	Rates for Fetal Distress: High-Risk Women no. (%)	Rates for Fetal Distress: Total no. (%)
A	7.5	7/ 724 (1.0)	0/ 58 (0)	7/ 782 (0.9)
B	10.1	9/1027 (0.9)	1/112 (0.9)	10/1139 (0.9)
C	11.2	24/1494 (1.6)	4/188 (2.1)	28/1682 (1.6)
D	12.1	25/1185 (2.1)	6/158 (3.8)	31/1343 (2.3)
E	19.7	31/1201 (2.6)	15/293 (5.1)	46/1494 (3.0)
All sites	12.7	96/5631 (1.7)	26/809 (3.2)	122/6440 (1.9)

mous variable indicating delivery between 9:00 PM and 2:59 AM vs all other times. Statistical significance was defined as $P<.05$.

RESULTS

Overall, the cesarean delivery rate due to fetal distress was 1.9%. This included a rate of 1.7% in the low-risk women (ranging by institution from 0.9% to 2.6%, $P=.007$) and 3.2% in high-risk women (range 0% to 5.1%, $P=.35$) (Table 2). When we examined the contribution of fetal distress to the total cesarean section rate, we found that the diagnosis of fetal distress was responsible for 15.6% (range 6.8% to 18.9%) of all cesarean sections performed at the participating hospitals.

For the five institutions under consideration, both the overall cesarean delivery rate and rate for fetal distress were related to the percentage of women categorized as high-risk cared for in that institution. As the percentage of high-risk women increased, the cesarean section rate for fetal distress also increased in almost a linear fashion (Figure 1). This finding was not limited to high-risk women, however. Even in low-risk women, cesarean delivery for fetal distress occurred more often when the institution cared for a higher percentage of high-risk women (Figure 1).

Comparisons of demographic and obstetric variables between patients who gave birth by cesarean section for fetal distress and those who had a vaginal delivery are shown in Table 3. Patients in whom fetal distress was diagnosed were similar in age to similar those who had a vaginal delivery, but were more likely to be African-American (21% vs 12%, $P=.02$). No relationship was found between cesarean delivery for fetal distress and insurance status or marital status. Patients who received a cesarean section for fetal distress were more likely to be employed outside the home, however, than those who had a vaginal delivery (61% vs 46%, $P=.003$).

For low-risk patients, analysis of obstetric variables showed that patients who had a cesarean section for fetal distress were of lower parity (0.80 vs 1.08, $P=.01$) and more likely to be primiparous (59% vs 41%, $P=.001$). Compared with women who gave

FIGURE 1

Cesarean section rates for fetal distress in high-risk women (x) and low-risk women (*open box*) based on the percentage of patients at high risk served by the institution.

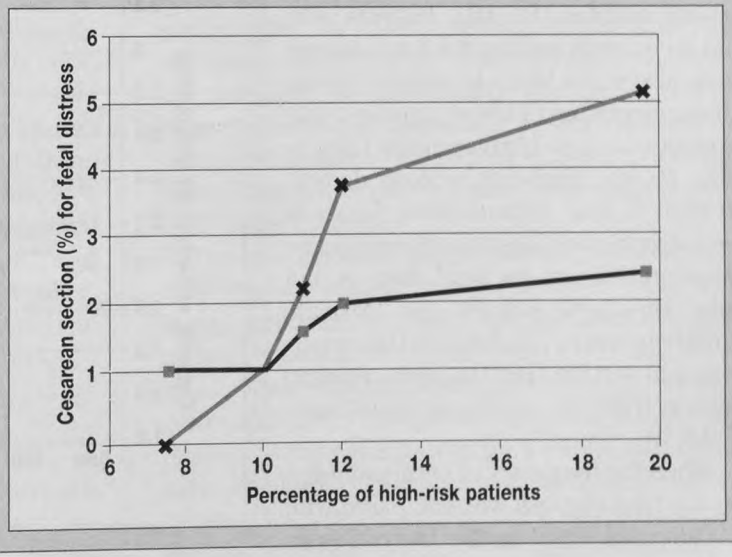


TABLE 3

Demographic and Obstetric Characteristics of Low-Risk Women Who Had Cesarean Sections for Fetal Distress

Characteristic	Vaginal Delivery (n=4990)	Cesarean for Fetal Distress (n=96)	*P* Value
Mean age, y (SD)	26.2 (5.7)	26.9 (5.9)	.11
Race, no. (%)			.02
White	4244 (86)	75 (75)	
African-American	601 (12)	20 (21)	
All others	145 (3)	4 (4)	
Insurance type, no. (%)			.24
Medicaid/none	2144 (43)	33 (34)	
Private indemnity	2330 (47)	53 (55)	
HMO/PPO	516 (10)	10 (10)	
Married, no. (%)	3604 (72)	70(73)	.89
Employed, no. (%)	2305 (46)	59 (61)	.003
Mean parity (SD)	1.08 (1.22)	0.80 (1.36)	.01
Pitocin augmentation, no. (%)	875 (18)	25 (26)	.03
Previous cesarean,* no. (%)	299 (6)	18 (19)	<.001
Length of first stage, min (SD)	546 (385)	662 (519)	.004

*Rate for multiparous patients 10% vs 44%, *P*=.003
HMO/PPO denotes health maintenance or preferred provider organization.

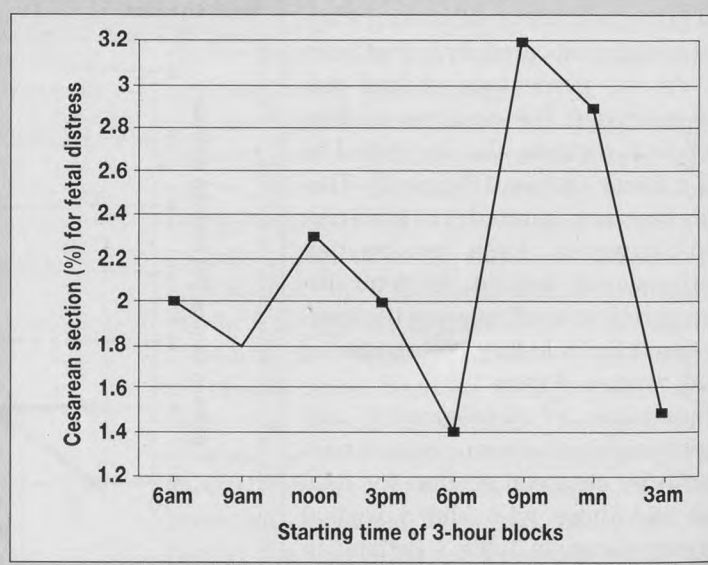
birth vaginally, those who had a cesarean section for distress were also more likely to have had a previous cesarean delivery (19% vs 6%, *P* <.001 for all patients; 43% vs 10%, *P*=.003, when limited to multiparas). Interestingly, even though the first stage of labor was curtailed by surgical intervention, patients who received a cesarean section for fetal distress were noted to have longer first stages of labor than those who gave birth vaginally (662 vs 546 minutes, *P*=.004). Patients who had a cesarean section for fetal distress were also more likely to receive pitocin for augmentation of labor compared with women who gave birth vaginally (26% vs 18%, *P*=.03). High-risk women demonstrated similar relationships between demographic and obstetric variables and cesarean delivery for fetal distress, but only the associations for African-American race (*P*=.04) and previous cesarean section (*P*=.001) with cesarean delivery reached statistical significance (Table 4).

When the frequency of cesarean delivery for fetal distress was compared with all deliveries based on the time of day, an interesting pattern was found (Figure 2). Cesarean section for fetal distress was relatively constant between 3:00 AM and 8:59 PM, but then showed an increase between the hours of 9:00 PM and 2:59 AM (*P*=.008 for this period compared with the rest of the day). When analyzed separately for obstetricians who performed their own cesarean deliveries and other providers (family physicians and nurse midwives) who did not perform cesarean sections and needed consultations for this procedure, similar increases in rates of cesarean section were found between 9:00 PM and 2:59 AM for women managed by obstetricians and nonobstetricians.

When all cesarean deliveries for fetal distress occurring between 9:00 PM and 2:59 AM were combined into one group and compared with other times, we found that the average length of the first stage of labor was almost 30 minutes shorter for deliveries between

FIGURE 2

Comparison of cesarean section rates for fetal distress and time of day, defined as 3-hour block beginning with the time indicated.



9:00 PM and 2:59 AM (644±639 minutes vs 671±456), although with the small number of patients in each sample, this did not reach statistical significance (P=.16). We also examined the mean measure of cervical dilatation recorded before the cesarean section and found no difference based on whether the patient gave birth between 9:00 PM and 2:59 AM compared with all other times (4.8 ± 2.7 cm vs 5.0 ± 2.6, P=.76).

TABLE 4

Demographic and Obstetric Characteristics of High-Risk Women Who Had a Cesarean Section for Fetal Distress

Characteristic	Vaginal Delivery (n=656)	Cesarean for Fetal Distress (n=26)	*P* Value
Mean age, y (SD)	26.2 (5.9)	27.7 (6.9)	.10
Race, no. (%)			.04
White	491 (75)	15 (58)	
African-American	144 (22)	11 (42)	
All others	20 (3)	0 (0)	
Insurance type, no. (%)			.48
Medicaid/none	307 (47)	15 (58)	
Private indemnity	295 (45)	10 (39)	
HMO/PPO	54 (8)	1 (4)	
Married, no. (%)	465 (71)	14 (54)	.06
Employed, no. (%)	305 (47)	8 (31)	.17
Mean parity (SD)	1.08 (1.22)	0.80 (1.36)	.01
Pitocin augmentation , no.(%)	189 (29)	10 (39)	.29
Previous cesarean,* no.(%)	19 (3)	11 (42)	<.001
Length of first stage of labor, min (SD)	586 (428)	621 (451)	.36

*5% vs 100% for multiparous women, P<.001
HMO/PPO denotes health maintenance or preferred provider organization.

To determine whether the site of delivery and time of delivery were related to cesarean section for fetal distress independent of other factors, a logistic regression model was tested that included these variables along with high-risk status, race, use of pitocin, length of the first stage of labor, and previous cesarean delivery. Regression analysis showed that even after adjusting for other variables, delivery time between 9:00 PM and 2:59 AM remained associated with cesarean delivery for fetal distress (adjusted odds ratio=1.56, 95% confidence interval, 1.06 to 2.29, P=.02). Using the site with the largest proportion of high-risk patients as the reference, even after adjusting for high-risk status, the two sites with the lowest proportion of high-risk patients had significantly lower rates of cesarean delivery for fetal distress (adjusted OR=0.38, 95% CI, 0.19 to 0.76, P=.006 for site B, and adjusted OR=0.36, 95% CI, 0.16 to 0.79 for site A). Also of note is that cesarean delivery for fetal distress is not significantly affected by race or use of pitocin when adjusted for site and other risk factors.

DISCUSSION

Our data suggest that intervention for fetal distress is not a random process. Assuming fetal distress is a random event, a temporal pattern for the diagnosis of this problem suggests that physicians interpret and act on changes in fetal monitor tracings or use fetal monitoring differently during late night hours. Fetal heart rate patterns that might be tolerable during the day when services are more readily available result in earlier intervention when physicians or patients are fatigued or when support staff may be less available. The same variations were noted in hospitals with access to 24-hour-per-day anesthesia and pediatric backup, however, as in hospitals without such a support staff. Alternatively, a change in the threshold of abnormality tolerated before a cesarean section is deemed necessary could reflect decreased patience on the part of the provider at a time of day when patients and physicians are most likely to be fatigued.

Previous evidence suggested that physicians performed cesarean deliveries for dystocia more commonly during daytime hours and that a lull in cesarean section activity occurred during the night.[14] While others have substantiated a relationship between cesarean delivery for dystocia and time of day, some of these studies are flawed by a failure to exclude induced labors.[9,10] Our data suggest that a temporal pattern exists in the performance of cesarean section for fetal distress; however, this relationship is

weaker than other factors that were associated with cesarean delivery for fetal distress. Interestingly, the relationship between time of day and cesarean delivery for distress was not consistent with the pattern described for dystocia. Instead of cesarean sections being performed during daylight hours as was observed for dystocia, our data suggest that the diagnosis of fetal distress leads to a disproportionate number of deliveries late at night or in the very early morning.

These data suggest that decisions regarding the care of low-risk patient are influenced by the care of high-risk women. The diagnosis of fetal distress and intervention in low-risk women were related to the number of high-risk women cared for in that institution. The observation that decision-making regarding an individual patient is influenced by a physician's prior experience is not new. Cesarean delivery is not a benign event, however, and high cesarean section rates have focused closer scrutiny on the performance of this procedure. [1-6] Other reports of provider variation in the performance of cesarean sections[10-12] suggest that further examination of factors that influence obstetric decision-making would be useful.

We also found that longer labors and a prior cesarean delivery were associated with an increased risk for cesarean delivery. The association of longer first stage of labor and fetal distress remained even after adjustment for other factors, such as site, risk status, and previous cesarean delivery (adjusted OR 1.34, 95% CI, 1.06 to 1.69), and could reflect a heightened sense of anxiety on the part of the provider caring for the patient with a long labor. This anxiety might prompt interventions based on criteria that otherwise would not spur surgical delivery. Alternatively, the longer first stage of labor could reflect an increased risk to the fetus from prolonged labor. In the case of a prior cesarean delivery, fetal distress is associated with uterine scar dehiscence.[16] Provider awareness of the potentially disastrous consequences of a delay in action in this circumstance might prompt providers to perform a cesarean section for indications of a nonreassuring fetal heart rate pattern, whereas in other cases observation of the patient would be considered adequate. The increased risk of cesarean delivery for fetal distress in women attempting vaginal births after having had a cesarean section may partially explain the elevated cesarean delivery rates observed in early studies of women undergoing a trial of labor.[17,18]

The findings of this study should be interpreted in light of several limitations. First, the diagnosis of fetal distress could not be independently validated and was based on the primary reason given in the medical record by the attending physician at the time of the cesarean procedure. As noted earlier, however, there is no clear consensus on the fetal heart rate criteria that define fetal distress or necessitate intervention. Since this study was prompted by a concern about interventions based on the physician's interpretation of the fetal heart rate pattern, we believe that the physician's diagnosis of fetal distress is a better indicator of what the physician believed was actually happening than fetal monitor tracings. This belief reflects the opinion that medical decision-making regarding intervention for fetal distress is a complex process involving the patient's progress in labor and the underlying risk for poor outcome as well as fetal monitor data.

Second, the possible effect of differential use of fetal monitoring was not investigated as a possible contributing factor in the increased diagnosis of fetal distress at late hours. Others have reported that the use of electronic fetal monitoring is associated with increased risk for cesarean delivery for fetal distress.[19] It is possible that during these hours continuous electronic fetal monitoring of patients was more likely to be in use, which could result in an increase in the detection of abnormal fetal heart rate tracings during the night. The effects of fetal monitoring on cesarean section for fetal distress are considered to be small, however; previous studies estimate that the total difference in overall rates of cesarean delivery for fetal distress is only 0.5% for patients continuously monitored as compared with a population in which no monitoring was performed.[19] Since continuous electronic fetal monitoring was in use during the non-peak hours for cesarean section in this study, the overall effect of monitoring should be even less than 0.5%.

Medical decision-making is a complex task that is influenced by the clinical condition of the patient, the physician's medical training and emotional state, the desires of the patient and family, and the availability of immediate assistance in the event of a depressed infant. Under circumstances where less than optimal outcomes can result in the threat of a malpractice action, the inexact equation that determines what decision is made can be influenced by

variables such as the desires of tired family members or by physician fatigue. This study suggests that the decision to perform a cesarean section for fetal distress is subject to a great deal of variability, and that some of this variability is associated with the time of day and the environment in which the physician practices. Greater attention to the conditions that influence these decisions would be useful to determine how the diagnosis of fetal distress and decisions to intervene with a cesarean section can be optimized to ensure the best and most cost-effective care of the patient.

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