Intrapartum Intervention And Delivery Outcome In Low-Risk Pregnancy

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***Abstract*: A retrospective cohort study of 1597 low-risk pregnancies assessed the effects of obstetrical intervention using logistic regression. Both maternal and neonatal morbidity were low (15.2 percent and 3.8 percent, respectively). Epidural analgesia, oxytocin, or both, were associated with worse maternal outcome, and neonatal outcome was worse when oxytocin was used. However, epidural analgesia seemed to provide a protective neonatal effect when oxytocin was used during labor. Both elective and medically necessary use of these interventions were associated with increased morbidity. If obstetrical interventions, particularly oxytocin and epidural analgesia, are applied in low-risk pregnancies, labors must be monitored carefully and the risk-benefit ratios judged advantageous. (J Am Board Fam Pract 1991; 4:83-8.)**

During the last 15 years, there has been debate about how technology should be applied in the intrapartum care of obstetric patients. Much of the technology in use today was introduced for management of high-risk pregnancies. It has been shown clearly that high-risk pregnancies have better outcomes when managed intensively in major referral centers,[1] and intrapartum transfer of high-risk patients to obstetric centers is safe and cost-effective.[1-4] In fact, many interventions have proved so efficacious in high-risk pregnancies that they have been considered useful for any labor, high or low risk.[5-7]

Despite extensive use of technology, optimal interventions for low-risk pregnancies have not been defined, even though multiple studies have tried to determine them. These studies have shown increasing use of technology[1,5-7] and increased cost[2] but little benefit.[8-12] Some studies suggest that interventions even increase maternal and neonatal morbidity.[8-11,13-17]

Our study assessed the risks and benefits of current intrapartum obstetric technology when used for low-risk pregnancies. Our purpose was to assist the physician who practices obstetrics in evaluating the risks and benefits of current technologic interventions that are commonly applied electively.

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Methods

The study population consisted of all women with low-risk pregnancies admitted to a family medicine service for prenatal and intrapartum care from January 1, 1981, to June 25, 1987. Obstetrical consultation was obtained when necessary. All pregnant patients initially seen by a family physician were included in the study, regardless of whether the eventual delivery was by the family physician or the obstetrical staff.

This was a retrospective cohort study. Of 2803 pregnancies, 1597 met the study criteria for low risk. Data were abstracted from maternal prenatal and hospital records and from neonatal hospital and clinical records for the neonates' first 28 days of life. Frequent chart auditing and abstractor review kept abstracting errors to a minimum.

Definition of Low-Risk Pregnancy

Low-risk pregnancies were defined to include only singleton pregnancies with a gestational age of at least 37 weeks but less than 42 weeks at time of delivery and babies weighing more than 2500 grams.

Patients were excluded when considered at high-risk immediately prepartum. Criteria for exclusion included:

- Previous or elective Cesarean section
- Chronic renal disease or other chronic debilitating disease
- Current essential hypertension
- Premature rupture of membranes prior to 37 weeks' gestation

- Polyhydramnios or intrauterine growth retardation confirmed by ultrasonography
- Current preeclampsia or eclampsia
- Diabetes mellitus including gestational diabetes mellitus
- Heart disease (New York Heart Association class II or more)
- Previous or antepartum stillbirths or neonatal death
- Vaginal bleeding after 20 weeks' gestation
- Multiple gestation
- Nonvertex presentation
- Rh-isoimmunization
- Infant deaths caused by congenital anomalies

Definitions of Morbidity

To evaluate the impact of obstetrical interventions, maternal and neonatal outcomes were studied separately. Because we anticipated low mortality rates, morbidity was our focus. Maternal morbidity was defined as:

- Midforceps or Cesarean section delivery
- Maternal postpartum infection
- Uterine atony or postpartum hemorrhage
- Fourth-degree episiotomy or tear

We defined neonatal morbidity as:

- 5-minute APGAR score < 7
- Intermediate high-intensity or intensive nursery care
- Presence of a birth injury
- Resuscitation at birth requiring intubation

Intermediate high-intensity nursery care included intravenous lines, oxygen by hood, antibiotics, and orogastric feeding tubes (level II care). Intensive nursery care entailed the addition of mechanical ventilation to level II care. Intubation done simply to check for the presence of meconium-stained amniotic fluid below the vocal cords of the neonate was not counted as a poor outcome.

Definitions of Interventions

We assessed the effects of three interventions on maternal outcome: use of oxytocin, monitoring, and pain relief. Because use of oxytocin required electronic monitoring of mother and fetus, they had to be treated as one category, with four levels, for purposes of analysis: (1) no oxytocin with intermittent auscultation, (2) no oxytocin with electronic monitoring, (3) oxytocin induction with electronic monitoring, and (4) oxytocin augmentation with electronic monitoring.

Pain relief also was grouped into four levels: (1) local or pudendal anesthesia, (2) sedative or analgesic drug, (3) paracervical block, and (4) epidural block.

Each delivery was coded at the highest level of intervention used for each category. However, if an epidural block was administered as preparation for a Cesarean section, that delivery was not coded for epidural block. Instead, it was coded at the highest level of pain relief used during management of labor. This modification avoided any artifacts in determining the relation between the level of pain relief and Cesarean section as an item of maternal morbidity outcome.

Three intervention categories were considered for their effects on neonatal outcome: *oxytocin* with two levels (use or nonuse); *pain relief* with two levels (local, pudendal, analgesic, sedation, or paracervical block as level 1 and epidural block or general anesthesia as level 2); and *delivery facilitation* with three levels (spontaneous vaginal delivery, low forceps or vacuum extraction, and midforceps or Cesarean section). Each delivery was coded at the highest level of intervention used.

Data Analysis

Data were analyzed with logistic regression by means of the GLIM system.[18] The dependent variable was the log odds of a morbid outcome. The predictors were the interventions, and dummy indicators were used for the levels within intervention categories. All possible hierarchical models were fit to the maternal and neonatal outcome data sets separately. The simplest model was chosen. This model fit the data in that the log likelihood ratio statistic was not significantly different from the saturated model's likelihood statistic, and any further simplification by dropping terms would decrease significantly the goodness-of-fit. Adjacent levels within intervention categories were combined when they did not differ significantly. The final model retained only statistically significant terms. All statistical tests were two-sided and an f level of 0.05 was used for significance. The final model was summarized for presentation with the model estimated probabilities for morbid outcome and associated 95 percent confidence intervals.

The interventions found to be significant in the final model were examined more closely to compare the rate of morbid outcome in medically indicated versus elective uses of those interventions. When documented information was not present, the intervention was classified as elective.

Elective indications for oxytocin use were "postdate pregnancy" at less than 42 weeks' gestation, fetal macrosomia, maternal obesity, and a prolonged latent phase of labor. Oxytocin use was considered medically necessary for prolonged deceleration phase, arrest disorder without cephalopelvic disproportion, prolonged active phase, positive contraction stress test, maternal disease, and ruptured membranes without labor.

Elective indications for epidural analgesia were maternal distress and incoordinate uterine contractions. Medical indications for epidural analgesia were limited to maternal medical conditions and persistent occiput posterior. The only elective instrumental delivery facilitation indication was a prolonged second stage (greater than 2 hours). All other delivery facilitation indications were medically necessary.

Statistical Power

Initial sample size calculations indicated a need for 1438 low-risk pregnancies to guarantee at least 95 percent power to detect doubling or halving in the proportion of pregnancies experiencing a morbid outcome. This guarantee would hold when comparing pregnancies receiving any individual technologic intervention with pregnancies not receiving that intervention for interventions affecting at least 10 percent of the pregnancies and for baseline rates of morbid outcome of at least 2.5 percent.

Results

Demographics

The two clinics of the family medicine service[8] are located in a predominantly white, middle-class area, and the demographics of our low-risk study population reflect these facts. White patients accounted for 1525 (95.5 percent) of the 1597 women with low-risk pregnancies, and Southeast Asians accounted for 47 (2.9 percent). The mean age was 26 years (range 14–44 years), and 1490 (93.3 percent) were married. The majority were Class II or III (middle class)[19] by the Hollingshead-Redlich 2-factor scale of socioeconomic status. Parity was represented by primigravid women (519, 32.5 percent), mothers with one previous pregnancy (633, 39.6 percent), and mothers with two previous pregnancies (305, 19.1 percent). The parity of the remaining 140 women (8.8 percent) ranged from 3 to 12. The number of prenatal visits ranged from 1 to 25; the mean was 12 ± 2.66.

Table 1. Maternal Morbidity (n = 1597).

Morbidity Categories	Number of Individual Outcomes (Percent)
Type of delivery	
Midforceps	35 (2.2)
Cesarean section	32 (2.0)
Infection	
Cervicitis	2 (0.1)
Endometritis	26 (1.6)
Cystitis	11 (0.7)
Pyelonephritis	2 (0.1)
Wound	15 (0.9)
Fever	13 (0.8)
Episiotomy	
Fourth degree (including tear)	47 (2.9)
Peroneal tear: fistula	1 (0.1)
Hematoma	13 (0.8)
Bleeding	
Uterine atony	60 (3.8)
Hemoglobin < 90 g/L	50 (3.1)
Hemorrhage or retained placenta	14 (0.9)

Maternal Outcome

There were no maternal deaths. Overall maternal morbidity, as defined above, occurred in 243 of 1597 pregnancies (15.2 percent). Individual outcomes were distributed throughout the morbidity categories (Table 1). With increasing intervention, the percentage of pregnancies having a morbid outcome increased.

Table 2. Best-Fitting Logistic Regression Model for Maternal Morbidity: Model Probabilities, 95 Percent Confidence Intervals, and Observed Probabilities.*

	Oxytocin	
Block Pain Relief	No	Yes
No	11.2% [10.9%]	21.2%[22.8%]
	(9.4%, 13.3%)	(16.8%, 26.3%)
Yes	17.0% [18.2%]	30.4% [28.1%]
	(13.7%, 21.1%)	(26.8%, 34.3%)

*[ ] = observed probability; ( ) = 95% confidence interval of fitted probabilities.

Table 3. Maternal Morbidity by Indications for Intervention.

	Oxytocin					
	None		Elective		Medically Indicated	
	Number of Pregnancies	Percent Morbidity	Number of Pregnancies	Percent Morbidity	Number of Pregnancies	Percent Morbidity
Block pain relief						
None	964	10.9	95	21.1	102	24.5
Elective	288	17.5	57	29.8	76	25.0
Medically indicated	9	33.3	1	0	5	60.0

Logistic regression analysis disclosed two significant main effects: use of oxytocin for either augmentation or induction versus no oxytocin ($P < 0.001$) and use of block pain relief techniques versus other pain relief ($P = 0.001$). Table 2 summarizes the probabilities of maternal morbid outcome. It also includes estimates from the final logistic regression model and 95 percent confidence intervals. The proportion of morbid outcomes was nearly doubled in deliveries in which oxytocin was used compared with those without oxytocin. Morbidity increased by roughly 50 percent in deliveries involving epidural or paracervical blocks compared with those using other pain relief methods.

Table 3 shows maternal morbidity in relation to elective versus medically necessary indications for the use of these interventions. Oxytocin and block technology for pain relief were each associated with an increase in maternal morbidity regardless of the reasons for use.

Neonatal Outcome

There were no neonatal deaths. There were two infants with lethal congenital anomalies who were excluded from our study. Also excluded were intrauterine fetal deaths prior to labor and delivery. Overall neonatal morbidity, as defined above, was 61 of 1597 deliveries (3.8 percent). Individual outcomes were distributed throughout the morbidity categories (Table 4). As with the maternal data, an increase in interventions was associated with an increase in morbid events.

Table 4. Neonatal Morbidity (n = 1597).

Morbidity Categories	Number of Infants	Percent
Nursing care		
Intermediate high intensity	9	0.6
Intensive	12	0.8
Type resuscitation		
Intubation > 3	20	1.3
Full code at birth	2	0.1
Injury		
Laceration	6	0.4
Fracture	9	0.6
Paralysis	1	0.1
APGAR		
5 min < 7	11	0.7

Logistic regression analysis was applied to the neonatal morbidity data. There was a significant main effect ($P < 0.001$) for type of delivery, primarily associated with lower morbidity in infants born by spontaneous vaginal delivery compared with any delivery facilitation. Infants delivered by Cesarean section or midforceps had a greater proportion of morbid outcomes than those delivered by low-forceps or vacuum extraction, but the difference was not significant. There was a significant interaction ($P = 0.031$) between oxytocin use and pain relief. Infants born to mothers who received oxytocin and local pain relief had worse outcomes than infants born in any of the remaining three categories of oxytocin use and pain relief.

The final logistic regression model for these data involved two binary factors: a factor for delivery type and a factor for the combined categories of pain relief and oxytocin use. The model is summarized in Table 5. Any delivery facilitation was associated with a more than 5-fold increase in the proportion of morbid outcomes compared with spontaneous vaginal delivery. The use of oxytocin and local pain relief was associated with a doubling of the proportion of morbid outcomes compared with any other oxytocin and pain relief combination. Note that in deliveries in which oxytocin was used, epidural block or general anesthesia was associated with decreased morbidity compared with local pain relief, irrespective of delivery type.

Table 5. Best-Fitting Logistic Regression Model for Neonatal Morbidity: Model Probabilities, 95 Percent Confidence Intervals, and Observed Probabilities.*

Delivery Type	Oxytocin-Pain Relief		
	No Oxytocin-Any Pain Relief	Oxytocin-Local Pain Relief	Oxytocin-Epidural-General Anesthesia
Normal spontaneous vaginal	2.3% [2.3%] (1.6%, 3.2%)	5.6% [5.5%] (3.2%, 9.6%)	2.3% [2.1%] (1.6%, 3.2%)
Forceps, vacuum, or Cesarean section	13.4% [11.7%] (8.9%, 19.7%)	28.2% [30%] (21.8%, 35.6%)	13.4% [16.3%] (8.9%, 19.7%)

*[ ] = observed probability; ( ) = 95% confidence interval of fitted probabilities.

Table 6 shows neonatal morbidity in relation to the elective or medically indicated use of oxytocin. Medically indicated oxytocin was associated with a higher proportion of morbid outcomes. However, even elective use of oxytocin was associated with increased morbidity.

In addition, the relation of neonatal morbidity to elective or medically indicated use of instrumentally facilitated delivery was examined. Of the 153 facilitated deliveries, 21 were elective and had no morbidity, and 132 were indicated and had 16.7 percent morbidity.

Discussion

Our study shows that intrapartum obstetrical interventions, particularly use of oxytocin and epidural block, were associated with an increased maternal and fetal morbidity in low-risk pregnancies.

We reviewed a large number of pregnancies and found overall maternal morbidity to be 15.2 percent (243/1597). Almost 85 percent of women whose pregnancies were considered low risk were delivered of their infants by their family physician without any complications. Similarly, more than 96 percent (1536/1597) of the neonates of this group were delivered without complications. These figures compare favorably with figures from other studies of low-risk pregnancies.[8,10-12] We included undesirable outcomes as well as true obstetrical morbidity in developing our morbidity index. Thus, although events were clearly undesirable, and therefore classified as morbid outcomes, they rarely had any long-term effect.

The overall Cesarean section rate in our group of low-risk patients was only 2 percent. Even with the addition of the midforceps rate to the Cesarean section rate, the overall combined rate of 4.2 percent was much lower than the current local and national averages for Cesarean sections. In our institution, the Cesarean section rate for 1988 was 19.6 percent (Heise RH, oral communication, June 1989). Nationally, the rate is approximately 24 percent.[20] It appears that the rate of Cesarean section is quite low in clearly defined low-risk pregnancies.

Both the use of epidural analgesia and the use of oxytocin predicted an increased maternal morbidity. Obviously, some labors that appear normal and low risk immediately prepartum can require more intensive management because of changing intrapartum factors. Interventions in these labors are likely medically indicated by the circumstances of the labor. Although medically indicated

Table 6. Neonatal Morbidity Related to Indications for Oxytocin Use.

Delivery Type	No Oxytocin-Any Pain Relief		Oxytocin-Local Pain Relief				Oxytocin-Epidural-General Anesthesia			
			Oxytocin Elective		Oxytocin Medically Indicated		Oxytocin Elective		Oxytocin Medically Indicated	
	Number of Pregnancies	Percent Morbidity	Number of Pregnancies	Percent Morbidity	Number of Pregnancies	Percent Morbidity	Number of Pregnancies	Percent Morbidity	Number of Pregnancies	Percent Morbidity
Normal spontaneous vaginal	1167	2.3	85	4.6	97	6.2	43	0	52	3.8
Forceps, vacuum, or Cesarean section	94	11.7	4	25.0	6	33.3	21	23.0	28	10.7

use of the interventions is typically associated with worse outcomes than is elective use, the differences are small and not significant. Both elective use and medically necessary use of oxytocin and epidural analgesia were associated with increased maternal morbidity.

Overall neonatal morbidity was low. Morbidity increased with use of oxytocin and with any delivery other than spontaneous vaginal delivery. If delivery by instrumentation was elective, however, there was no increased neonatal morbidity. Elective or indicated oxytocin use was associated with increased neonatal morbidity. For all delivery types, when oxytocin was used, neonatal morbidity was less if the mothers had an epidural block. This is due possibly to adverse fetal effects from intravenous or intramuscular narcotics. Alternatively, epidural analgesia could allow more "fine tuning" of the oxytocin infusion, thus preventing hyperstimulation or longer, more stressful labors. Further investigation of this effect is needed.

Conclusion

A retrospective study cannot establish cause and effect. However, we found that low-risk pregnancies in which oxytocin was used or epidural analgesia provided pain relief were associated with increased maternal and neonatal morbidity. This was true regardless of the reasons the interventions were used. If the labor course requires application of increased technology, the physician needs to monitor the laboring woman more closely. When use of these interventions is elective, the physician must carefully consider the risk-benefit ratio.

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