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ABSTRACT

Objective: Cervical injury is considered a risk factor for preterm birth. Prolonged or obstructed labor at term may increase the risk for damage to cervical and related tissues. This study was designed to evaluate whether an increased duration of the second stage of labor in a term primiparous delivery increases the risk of spontaneous preterm birth in the subsequent pregnancy.

Study Design: This was a cohort study of women having their first term and subsequent birth at the same institution using prospectively collected obstetric data from January 2005 to January 2015. The duration of the second stage of labor from the first term pregnancy (index case) was obtained from information recorded at delivery. Demographic and other clinical data were obtained. The risk for spontaneous preterm birth (sPTB) in the subsequent delivery was estimated based on the duration of the second stage regardless of mode of delivery in the first birth.

Results: 6,715 women were identified as eligible for analysis. In the index pregnancy, the rate of second stage cesarean was 6.2% (n=416) and the rate of operative vaginal delivery was 19.8% (n=1,264). Among the 6,342 women (94.4%) who delivered at term in the subsequent pregnancy, the median length of the second stage in the first delivery was 55 minutes (interquartile range 29-97). Among the 373 women (5.6%) who delivered preterm in the subsequent pregnancy, the median length of the second stage in the first term delivery was 42 minutes (interquartile range 24-93; p=0.0004). After adjustment for maternal age, obstetric service, race/ethnicity, smoking, and chronic hypertension, there was a 30% lower risk of sPTB in a subsequent delivery if the second stage of labor length was between 55-96 minutes in the first term delivery. There were no differences in sPTB when stratified by mode of delivery.

Conclusion: Second stage labor length in the index pregnancy was shorter for women who delivered preterm in a subsequent pregnancy. These data do not support the concept that cervical injury from a longer second labor stage is associated with preterm delivery after a prior term delivery.

Introduction

Preterm birth refers to a delivery that occurs before 37 weeks gestation, with 70 to 80 percent of preterm births occurring spontaneously. The overall preterm delivery rate in the United States is 12%. The greatest risk factor for preterm birth is a prior preterm birth (PTB) and a prior term birth seems to reduce the PTB risk to 5-8%. This observation suggests that women with spontaneous PTB (sPTB) after a prior term birth may have a different etiologic distribution than other women with PTB. Limited research has suggested an association of abnormal labors (such as a prolonged second stage of labor) with the development of cervical shortening, cervical insufficiency and/or preterm delivery due to spontaneous labor or PPROM (Naeye 1982). The etiology for cervical shortening/insufficiency and preterm delivery in women without otherwise obvious risk factors may be structural damage to the cervix during a previous term birth, due to a precipitous or prolonged second stage, cervical laceration, or an operative vaginal delivery. In one small prospective analysis, multiparous women experiencing cervical insufficiency after a term birth were more likely to have undergone a precipitous delivery, previous curettage, and prolonged second stage of labor (Vyas 2006). In a planned secondary analysis of a large retrospective cohort study of women with 2 consecutive deliveries, women with a full-term second-stage cesarean delivery had a significantly higher than expected rate of subsequent sPTB (13.5%) compared with both the overall national sPTB rate (7-8%) and to a first-stage cesarean delivery (2.3%) (Levine 2015).

Our study objective was thus to evaluate whether an increased duration of the second stage of labor in a primiparous delivery increases the risk of delivery prior to 37 weeks gestation in the subsequent pregnancy. We hypothesized that the length of the second stage of labor may lead to cervical trauma that in turn may increase the risk of prematurity and potentially cervical malfunction in a future pregnancy.

Methods

Cohort study of women having their first and second birth at the same institution using prospectively collected obstetric data from January 2005 to January 2015. The duration of the second stage of labor from the first term pregnancy (index case) was obtained from information recorded at delivery. Demographic and other clinical data were obtained. The risk for spontaneous preterm birth (sPTB) in the subsequent delivery was estimated based on the duration of the second stage in the first term birth regardless of mode of delivery.

Inclusion criteria:

All women with a pregnancy that delivered at term (≥37 weeks) who also had a second pregnancy delivering after 16 weeks gestation

- Both deliveries at the same institution
- Both singleton gestations
- Recorded length of labor stages

Exclusion criteria:

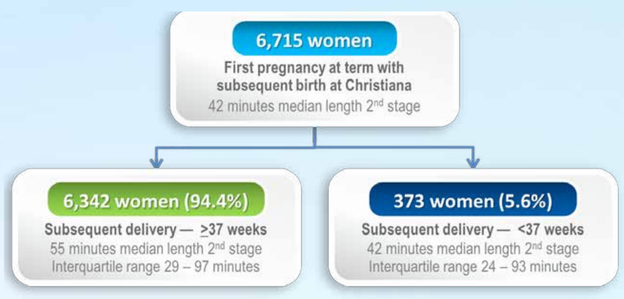
- Major fetal anomalies in either group
- Aneuploidy in either group

Statistical analyses included χ^2 test for categorical variables and Student's t-test for continuous variables. $p < 0.05$ was considered significant. Hazard ratios were generated to evaluate the risk of preterm birth by the duration of the second stage of labor. Multivariate log-binomial regression models were constructed to evaluate the adjusted risk ratio for preterm delivery by duration of the second stage of labor adjusted for potential confounders.

Results

6,715 women were identified as eligible for analysis (Table 1). The rate of second stage cesarean was 6.2% (n=416) and the rate of operative vaginal delivery was 19.8% (n=1,264). Among the 6,342 women (94.4%) who delivered at term in the second pregnancy, the median length of the second stage in the first delivery was 55 minutes (interquartile range 29-97). Among the 373 women (5.6%) who delivered preterm in the second pregnancy, the median length of the second stage in the first term delivery was 42 minutes (interquartile range 24-93; p=0.0004) (Flow diagram). Univariate and multivariate analyses were performed to evaluate the risk of preterm delivery in the subsequent pregnancy in relation to the duration of the second stage of labor in the first term pregnancy. In univariate analysis, sPTB was more common in women who delivered vaginally after a short second stage in the first pregnancy (p=0.01; Table 2). After adjustment for potential confounders including maternal age, obstetric service, race/ethnicity, smoking, and chronic hypertension, there was a 30% lower risk of sPTB in a subsequent delivery if the second stage of labor length was between 55-96 minutes in the first term delivery (Table 3). There were no differences in sPTB when stratified by mode of delivery.

Flow Diagram.
Patient Population Analyzed.



p = 0.0004

Table 1: Patient Characteristics

Maternal age	n (%)
< 19	1102 (16.4)
20-24	1625 (24.2)
25-29	1929 (28.7)
30-34	1632 (24.3)
35+	427 (6.4)
Race	**n (%)**
Caucasian	4718 (70.2)
African American	1154 (17.2)
Latina	239 (3.6)
Other	604 (9.0)
Obstetric service	**n (%)**
Private	5570 (83.0)
Resident service	1145 (17.0)
Medical issues	**n (%)**
Chronic hypertension	67 (1.0)
Preeeclampsia	495 (7.4)
Diabetes mellitus	23 (0.3)
Gestational diabetes	275 (4.1)
Labor characteristics	**n (%)**
Spontaneous vaginal delivery	5035 (75.0)
Vacuum assisted vaginal delivery	1164 (17.3)
Forceps assisted vaginal delivery	100 (1.5)
Cesarean delivery	416 (6.2)
Duration of the second stage of labor (minutes)	**n (%)**
<28	1606 (23.9)
28-54	1751 (26.1)
55-96	1656 (24.7)
97+	1702 (25.4)

Table 2: Unadjusted Analyses of Risk of sPTB in the Subsequent Pregnancy in Relation to the Duration of the Second Stage of Labor in the First Term Pregnancy by Mode of Delivery

Duration of Second Stage of Labor in First Term Delivery (minutes)	Term Birth Subsequent Delivery n (%)	sPTB Subsequent Delivery n (%)	P
Spontaneous vaginal delivery			
<28	1270 (26.3)	70 (34.5)	p = 0.01
28-54	1441 (29.8)	63 (31.0)	
55-96	1275 (26.4)	36 (17.7)	
≥97	846 (17.5)	34 (16.8)	
Vacuum assisted vaginal delivery			
<28	207 (18.6)	13 (26.0)	p = 0.42
28-54	202 (18.1)	11 (22.0)	
55-96	281 (25.2)	11 (22.0)	
≥97	424 (38.1)	15 (30.0)	
Forceps assisted vaginal delivery			
<28	21 (22.3)	1 (16.7)	p = 0.89
28-54	19 (20.2)	2 (33.3)	
55-96	20 (21.3)	1 (16.7)	
≥97	34 (36.2)	2 (33.3)	
Cesarean delivery			
<28	22 (5.6)	2 (10.0)	p = 0.68
28-54	13 (3.3)	0 (0)	
55-96	31 (7.8)	1 (5.0)	
≥97	330 (83.3)	17 (85.0)	

Table 3: Adjusted Analyses of Risk of Preterm Delivery in the Subsequent Pregnancy in Relation to the Duration of the Second Stage of Labor in the First Term Pregnancy

Duration of Second Stage of Labor (minutes)	Median (interquartile range)	Term Delivery n (%)	All Preterm Delivery		Spontaneous Preterm Delivery	
			n (%)	HR (95% CI)	n (%)	HR (95% CI)
<28	18 (12, 23)	1492 (23.5)	114 (30.6)	Reference	86 (30.8)	Reference
28-54	40 (33, 46)	1645 (25.9)	106 (28.4)	0.94 (0.72, 1.23)	76 (27.2)	0.92 (0.67, 1.25)
55-96	72 (68, 83)	1590 (25.1)	66 (17.7)	0.68 (0.50, 0.92)	49 (17.6)	0.70 (0.49, 1.00)
≥97	137 (113, 178)	1615 (25.5)	87 (23.3)	0.92 (0.69, 1.24)	68 (24.4)	1.02 (0.73, 1.42)
Total	-	6342 (100.0)	373 (100.0)	-	279 (100.0)	-

Hazard ratios were adjusted for maternal age, clinic or private patient, race/ethnicity, smoking, and chronic hypertension.

Conclusion

In our cohort, the length of the second stage of labor in the first term delivery was shorter for women who experienced PTB in a subsequent pregnancy. Our data do not support the concept that cervical injury from a prolonged second labor stage is a significant contributor to preterm birth risk after a prior term delivery. Strengths of our study include the use of large sample size from a single institution to evaluate a population where information is available for two subsequent deliveries. Limitations of our study include lack of detailed individual information regarding obstetric lacerations or cervical injury in women who experience a prolonged second stage or an operative vaginal delivery in their first term birth. Although no difference in the risk of sPTB was noted by the length of the second stage of labor in our study population, other aspects of the second stage such as lacerations or surgical trauma may indeed increase the risk of sPTB for some women at an individual level. Future prospective studies could aid in further clarifying this important clinical question.

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