The Association Between Preterm Birth and Prior Term Delivery Complications

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Research Article

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Abstract

Purpose: Our aim was to explore potential risk factors for Preterm birth (PTB) that had been associated with the patient's obstetric history and which had not been previously examined in depth.

Methods: Retrospective analysis of all women who had their first, term, singleton delivery and their second delivery, between 2013 and 2020. Obstetrical and neonatal outcomes, including the rate of preterm birth in the following delivery, were compared among three different groups, based on complications occurring the first pregnancy: emergency end second stage cesarean, large for gestational age neonate and delivery which required a uterine and/or cervical revision.

Results: There were 233 women of whom 77 underwent emergency end second stage cesarean delivery and 156 who underwent elective CD in their first delivery at term, with no difference in the rate of PTB between the two groups in the subsequent delivery (3.9% vs. 3.21%, $p<0.72$). There were 396 women with infants weighing more than 3.8kg and 5,136 women with infants weighing less than 3.8kg, in their first term delivery. These two groups did not differ in the rate of PTB in their subsequent delivery (1.52% vs. 2.94%, $p<0.1$). Finally, there were 298 women who underwent uterine and/or cervical revision who were compared to 5,234 women without these procedures, in their first term delivery. Again, there was no difference between these groups in the rate of PTB in the subsequent delivery (2.35% vs. 2.87%, $p<0.72$).

Conclusion: Risk factors examined in our analysis did not emerge as risk factors for PTB.

Introduction

Preterm birth (PTB) is a delivery that occurs prior to 37 weeks gestation[1]. In the United States, PTB occurs in one out of every ten births[2]. It is the leading cause of neonatal morbidity and mortality worldwide[3] with 965,000 neonatal deaths every year, and an additional 125,000 deaths in children aged one to five years[4]. Preterm babies who survive are far more likely to suffer from short- and long-term sequelae such as neurodevelopmental impairment, education, behavior, psycho-social matters, growth, and health related issues[5].

Risk factors for PTB can be divided into (1) maternal demographics, such as black race; (2) obstetric history, such as a history of PTB or short inter-pregnancy interval; (3) maternal medical disorders that can lead to indicated iatrogenic PTB, such as hypertensive disorders in pregnancy; (4) maternal medical disorders that can lead to spontaneous PTB, such as uterine anomalies or a history of cervical trauma; (5) current pregnancy characteristics such as multiple gestation, substance use or intrauterine infection. [6]

Despite various established risk factors, not all cases of PTB have identifiable preceding warning signs. Further research and a better understanding of risk factors is crucial for improving our ability to prevent and treat PTB.

In this study, we attempted to identify risk factors for PTB that are associated with an adverse event that occurred at a prior term delivery. We evaluated the risk of PTB among three populations of women, all of whom had a singleton pregnancy that ended in a term birth, with one of the following complications: (1) end second stage cesarean delivery, (2) delivery of a Large for gestational age infant; or (3) uterine or cervical manual revision.

It has been shown before that that having one prior term delivery reduces the risk of preterm birth[7], meaning that all the women in our cohort are considered low risk for PTB due to their obstetric history. We then evaluated the subsequent singleton birth and tried to ascertain if despite their low risk, these women were at a higher risk for PTB due to past pregnancy complications. Our hypothesis was that these adverse outcomes can be associated with an increased risk of PTB in the subsequent pregnancy.

Methods

A single center retrospective cohort study, of all women who delivered at our tertiary, university affiliated, medical center.

Data collection: Data were retrieved from our department's comprehensive computerized perinatal and delivery database and linked with data from the neonatal unit by means of a unique admission number assigned to each parturient and her offspring. The documented data included demographics (age), obstetrical history (gravidity, parity, previous cesarean deliveries and any prior labor and delivery complications related to the study), current pregnancy complications, labor, and childbirth outcomes (mode of delivery, indication for cesarean or instrumental delivery if performed, labor induction) and perinatal-neonatal outcome (gestational age at birth, gender, birthweight, Apgar score, neonatal intensive care unit [NICU] hospitalization).

Study population: The cohort included all women who delivered their first and second births between 2013–2020, at the Rabin Medical Center, Israel. Only women delivering a live infant were included. In order to exclude preterm birth as a confounder, the sample was further restricted to first birth at term defined as 37 + 0/7 through 42 + 0/7 weeks of gestation. Second birth occurring between 22 + 0/7 through 42 + 0/7 weeks of gestation.

The cohort was divided into 3 sub-groups. The first subgroup consisted of women who had their first birth via cesarean delivery (CD) - we compared emergency end second-stage CD to elective or semi-elective, i.e. not intra-partum, CD in this group. Emergency end second stage CD was defined as one performed at ≥ 9cm cervical dilatation.

The second subgroup consisted of women who had their first birth via vaginal delivery with a singleton Large for gestational age (LGA) neonate, defined by a birth weight of 3.8kg or higher, and compared them to women who delivered singleton neonate weighing under 3.8kg.

The third subgroup consisted of women who had their first birth via vaginal delivery and required a uterine and/or cervical revision and compared them to women who did not require any revision.

Outcome measures: The primary outcome was preterm labor in the subsequent delivery.

Statistical analysis: Data analysis was performed with the SAS software (SAS Cooperation, Version 34.0, North Carolina, United States). For all variables, categorical data were presented as count (percentage) and continuous variables were presented as mean ± standard deviation. Continuous variables were compared using T test. Chi-square and Fisher's exact tests were used for categorical variables, as appropriate. Differences were considered significant when *p* value was less than 0.05.

Results

During the study period, in our cesarean delivery subgroup 233 women underwent CD in their first birth, of whom 77 women (33%) had urgent end second stage CD and 156 women (67%) had elective or semi-elective CD.

Baseline characteristics of the women in the cesarean delivery subpopulation during subsequent pregnancy are summarized in Table 1.1.1. Maternal age, gravidity, parity, and chronic diseases did not differ between these groups. Also, mode of delivery, birth weight and neonatal outcomes were similar between the two groups (Table 1.1.2).

Preterm birth rates were similar between these two groups (3.9% vs. 3.21%, $p < 0.72$) (Table 2).

In our LGA sub population, 396 (7.0%) women had neonatal birthweight larger than 3.800kg and 5136 (93%) women had neonates weighing less than 3.800kg.

Baseline characteristics of the women in the LGA subgroup are summarized in Table 1.2.1. Maternal age, gravidity, parity and chronic diseases did not differ between these groups. Also, mode of delivery, birth weight and neonatal outcomes were similar between the two groups (Table 1.2.2).

Preterm birth rates were similar between these two groups (1.52% vs. 2.94%, $p < 0.1$) (Table 2).

In our uterine and/or cervical revision subgroup, 298 (5%) women underwent revision and 5234 (95%) did not have revision.

Baseline characteristics of the women with and without revision are summarized in Table 1.3.1. Maternal age, gravidity, parity and chronic diseases did not differ between these groups. Also, mode of delivery, birth weight and neonatal outcomes were similar between the two groups (Table 1.3.2).

Preterm birth rates were similar between these two groups (2.35% vs. 2.87%, $p < 0.72$) (Table 2).

Discussion

Preterm birth is a multifaceted public health concern. Identification of risk factors before pregnancy is an essential component of clinical obstetric care since early interventions may reduce the risk of preterm birth.

While obstetric history was documented to lead to spontaneous PTB, there are different unexamined or not sufficiently examined potential risks that may influence the timing of labor. These include urgent end second stage CD, vaginal delivery of a large for gestational age infant at term and manual lysis of the cervix and uterus.

Spontaneous preterm birth is a result of multiple etiologies that can occur alone or in combination[8]. It is conceived that the integrity of the cervix is one of the important factors influencing the chances for PTB. Cervical trauma caused by injury to the cervix during a cesarean delivery in advanced delivery stage, may alter cervical integrity and increase the risk for PTB in a subsequent pregnancy. While there are conflicting results with respect to the contributing effect of end second stage CD[9, 10], there are no reports regarding vaginal delivery of a large for gestational age infant and manual lysis of the cervix and uterus.

We have investigated three potential risk factors but could not demonstrate higher risk for PTB by any of the three previous birth events evaluated. End second stage CD, LGA and cervix or/and uterus revision in previous delivery were not associated with increased PTB risk. However, despite the large numbers of total deliveries, the number of women with perceived risk factors during previous deliveries may have been too small. Moreover, potential bias in the selection of our cohort is the fact that they all had a term delivery in their first pregnancy. There is a correlation between term deliveries in the first delivery and the subsequent delivery[7].

Conclusions

In summary, based on the results of this study, end second stage cesarean delivery, infant larger than 3800kg and uterine or cervical revision during previous delivery, did not increase risk for PTB in subsequent pregnancy. Further research, based on larger cohort, is necessary to investigate potential risk factors for PTB that are yet to be associated.

Declarations

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Competing Interests:

The authors have no relevant financial or non-financial interests to disclose.

Ethics approval:

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Rabin Medical Center Institutional Review Board (February 13, 2020 Approval number 0164-20-RMC).

Consent to participate:

Informed consent was waived due to the retrospective design of the study.

Author Contribution:

S Barbash-Hazan: Conceptualization, Data curation, Formal analysis, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing.

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M Eisner: Investigation, Project administration, Resources, Supervision.

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Conflict of Interests:

None declared

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Tables

Table 1- Baseline characteristics of study populations

1.1 First population- Women who underwent an end second stage CD in their first birth compared to women who underwent elective or semi-elective CD.

Table 1.1.1
Characteristics of the subsequent singleton pregnancy following a cesarean delivery at end second stage compared to elective or semi-elective cesarean delivery

Maternal demographics at second delivery	**history of an elective or semi-elective cesarean delivery** **(n = 156)**	**history of a cesarean delivery at end second stage of delivery** **(n = 77)**	**P value**
Maternal age, years	31.2 ± 4.7	31 ± 4	0.664
Gravidity	2	2	-
Parity	1	1	-
Gestational Diabetes	17 (10.9%)	10 (13%)	0.666
Type 1 or 2 diabetes	5 (3.2%)	1 (1.3%)	0.666
Chronic Hypertension	7 (4.5%)	5 (6.5%)	0.538
Data presented as Mean ± Standard Deviation or n (%)			

Table 1.1.2
Outcomes of neonates of the subsequent singleton pregnancy following a cesarean delivery at end second stage compared to elective or semi-elective cesarean delivery

Obstetric demographics at second delivery	**history of an elective or semi-elective cesarean delivery (n = 156)**	**history of a cesarean delivery at end second stage of delivery (n = 77)**	**P value**
Pregnancy weeks	38.5 ± 1.4	38.2 ± 1.8	0.377
Gestational age at delivery, weeks ± days			
Mode of delivery:			
Vaginal	29 (18.6%)	7 (9.1%)	0.082
Assisted	14 (9%)	9 (11.7%)	0.495
Cesarean	113 (72.4%)	61 (79.2%)	0.337
Birth weight, grams	3309.5 ± 429.1	3253 ± 549.1	0.431
Neonatal gender, Male	77 (49.4%)	44 (57.1%)	0.269
5-minute Apgar score < 7	0 (0%)	1 (1.3%)	0.330
Umbilical Cord pH	7.3 ± 0.1	7.3 ± 0.1	0.041
NICU hospitalization	3 (1.9%)	4 (5.2%)	P0.221
Data presented as Mean ± Standard Deviation or n (%)			
NICU - Neonatal Intensive Care Unit			

1.2 Second population- women who gave birth a LGA neonate (>3.800kg) in their first birth compared to women who gave birth to an AGA or SGA infant in their first birth.

Table 1.2.1
Characteristics of the subsequent singleton pregnancy following a birth of a LGA neonate compared to a birth of a non-LGA infant

Maternal demographics at second delivery	**History of a birth of a non-LGA neonate** **(n = 5136)**	**History of a birth of a LGA neonate** **(n = 396)**	**P value**
Maternal age, years	29.8 ± 5	29.1 ± 4.3	0.005
Gravidity	2	2	-
Parity	1	1	-
Gestational Diabetes	361 (7%)	42 (10.6%)	0.012
Type 1 or 2 diabetes	53 (1%)	2 (0.5%)	0.433
Chronic Hypertension	125 (2.4%)	5 (1.3%)	0.167
Data presented as Mean ± Standard Deviation or n (%)			

Table 1.2.2
Outcomes of neonates of the subsequent singleton pregnancy following a birth of a LGA neonate compared to a birth of a non-LGA neonate

Obstetric demographics at second delivery	**History of a birth of a non-LGA neonate (n = 5136)**	**History of a birth of a non-LGA neonate (n = 396)**	**P value**
Pregnancy weeks	39 ± 1.3	39.3 ± 1.2	0.001
Gestational age at delivery, weeks ± days			
Mode of delivery:			
Vaginal	4716 (91.9%)	355 (89.6%)	0.13
Assisted	154 (3%)	4 (1%)	0.018
Cesarean	264 (5.1%)	37 (9.3%)	0.001
Birth weight, grams	3265.6 ± 417.6	3650.9 ± 412.8	< 0.001
Neonatal gender, Male	2670 (52%)	185 (46.7%)	0.047
5-minute Apgar score < 7	1 (0.2%)	0 (0%)	1
Umbilical Cord pH	7.3 ± 0.1	7.35 ± 0.1	0.005
NICU hospitalization	54 (1.1)%	0 (0%)	0.031
Data presented as Mean ± Standard Deviation or n (%)			
NICU - Neonatal Intensive Care Unit			

1.3 Third population- Women who underwent manual revision of uterine and/or cervical cavity after their first birth compered to women without revision.

Table 1.3.1
Characteristics of the subsequent singleton pregnancy following a delivery complicated by manual revision

Maternal demographics at second delivery	**No history of a manual revision** **(n = 5234)**	**History of a manual revision** **(n = 298)**	**P value**
Maternal age, years	29.7 ± 4.9	30.5 ± 4.6	P = 0.002
Gravidity	2	2	-
Parity	1	1	-
Gestational Diabetes	380 (7.3%)	23 (7.7%)	P = 0.731
Type 1 or 2 diabetes	53 (1%)	2 (0.7%)	P = 0.768
Chronic Hypertension	123 (2.3%)	7 (2.3%)	P = 1
Data presented as Mean ± Standard Deviation or n (%)			

Table 1.3.2
Outcomes of neonates of the subsequent singleton pregnancy following a delivery complicated by manual revision

Obstetric demographics at second delivery	**No history of a manual revision** **(n = 5234)**	**History of a manual revision** **(n = 298)**	**P value**
Pregnancy weeks Gestational age at delivery, weeks ± days	39 ± 1.3	39 ± 1.5	P = 0.73
Mode of delivery:			
Vaginal	4808 (91.9%)	263 (88.3%)	P = 0.040
Assisted	147 (2.8%)	11 (3.7%)	P = 0.369
Cesarean	277 (5.3%)	24 (8.1%)	P = 0.048
Birth weight, grams	3253 ± 549.1	3343.7 ± 476	P = 0.060
Neonatal gender, Male	2717 (51.9%)	138 (46.3%)	P = 0.065
5-minute Apgar score < 7	1 (0.2%)	0 (0%)	P = 1
Umbilical Cord pH	7.3 ± 0.1	7.3 ± 0.1	P = 0.674
NICU hospitalization	48 (0.9%)	6 (2%)	P = 0.070
Data presented as Mean ± Standard Deviation or n (%) NICU - Neonatal Intensive Care Unit			

Table 2

Associations between possible risk factors in the first pregnancy and preterm birth in the subsequent pregnancy

Cesarean delivery	End second stage CD	Elective & semi Elect. CD	P value
	77	156	
% Preterm birth	3 (3.9%)	5 (3.2%)	0.721
Birthweight	Birthweight >3.8kg	Birthweight <3.8kg	
	396	5136	
% Preterm birth	6 (1.5%)	151 (2.9%)	0.115
Revision of uterus/cervix	Revision	No Revision	
	298	5234	
% Preterm birth	7 (2.4%)	150 (2.9%)	0.721
Data presented as Mean ± Standard Deviation or n (%)			