

Assessment of obstetric history and cervical length as risk factors for preterm birth

Evaluación de la historia obstétrica y la longitud cervical como factores de riesgo para el parto prematuro

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Abstract

Introduction: Preterm birth, before 37 weeks of gestation, is the main determinant of neonatal morbidity and mortality and is associated with serious consequences, including compromised quality of life for the affected individual and physical, psychological, and economic costs. **Objective:** To evaluate the correlation of obstetric history, cervicovaginal infections, and cervical length with preterm birth. A prospective, blind cohort study evaluated 1,370 pregnant women from Ribeirão Preto between 20 and 25 weeks of gestation. **Materials and methods:** The correlation between obstetric history, cervical length, and gestational age at birth was obtained by calculating the relative risk of the different variables. **Results:** The distribution of pregnant women according to cervical length (CL) showed a predominance of women with a cervix longer than 2.5 cm ($n = 1,308$, 95.8%), followed by women with a cervix between 2 and 2.49 cm ($n = 42$, 3.1%) and < 2 cm ($n = 15$, 1.1%). Among the 1,370 pregnant women evaluated, 133 had spontaneous preterm birth (< 259 days); 14 (10.5%) preterm births occurred in women under 19 years of age, 105 (79%) in women between 19 and 35 years, and 14 (10.5%) in women older than 35 years. Microbiological analysis showed the growth of *Mycoplasma hominis*, *Ureaplasma urealyticum*, and other bacteria in 8, 17, and 16 women with preterm birth, respectively. Among the 133 women with spontaneous preterm birth, CL was < 2.5 cm in 15 women, < 2 cm in 3, < 1.5 cm in 3, and < 1 cm in 2. **Conclusion:** The identification of pregnant women at high risk for preterm delivery can reduce the incidence of preterm birth. Although no gold standard test exists for the prediction of preterm birth, this study confirms that the measurement of CL is a good individual predictor.

Keywords: Obstetric history, Cervicovaginal infections, Cervical length, Preterm birth risk factors.

Resumen

Introducción: El nacimiento pretérmino, antes de las 37 semanas de gestación, es el principal determinante de la morbi-mortalidad neonatal y se asocia a graves consecuencias, incluyendo el compromiso de la calidad de vida del individuo afectado y costes físicos, psicológicos y económicos. **Objetivo:** Evaluar la correlación de los antecedentes obstétricos, infecciones cervicovaginales y longitud cervical con el parto prematuro. Estudio de cohorte prospectivo, ciego, evaluando 1.370 gestantes de Ribeirão Preto entre 20 y 25 semanas de gestación. **Material y métodos:** La correlación entre los antecedentes obstétricos, la longitud cervical y la edad gestacional al nacer se obtuvo calculando el riesgo relativo de las diferentes variables. **Resultados:** La distribución de las gestantes según la longitud cervical (LC) mostró un predominio de mujeres

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con cuello uterino mayor de 2,5 cm ($n = 1,308$, 95.8%), seguidas de mujeres con cuello uterino entre 2 y 2,49 cm ($n = 42$, 3.1%) y menor de 2 cm ($n = 15$, 1.1%). De las 1,370 embarazadas evaluadas, 133 tuvieron un parto prematuro espontáneo (< 259 días); 14 (10.5%) partos prematuros se produjeron en mujeres menores de 19 años, 105 (79%) en mujeres de entre 19 y 35 años, y 14 (10.5%) en mujeres mayores de 35 años. Los análisis microbiológicos mostraron la proliferación de *Mycoplasma hominis*, *Ureaplasma urealyticum* y otras bacterias en 8, 17 y 16 mujeres con parto prematuro, respectivamente. Entre las 133 mujeres con parto prematuro espontáneo, la CL fue < 2.5 cm en 15 mujeres, < 2 cm en 3, < 1.5 cm en 3 y < 1 cm en 2. **Conclusión:** La identificación de las gestantes con alto riesgo de parto prematuro puede reducir la incidencia de parto prematuro. Aunque no existe una prueba de referencia para la predicción del parto prematuro, este estudio confirma que la medición de la longitud cervical es una buena predicción individual.

Palabras clave: Historia obstétrica. Infecciones cervicovaginales. Longitud cervical. Factores de riesgo de parto prematuro.

Introduction

Preterm birth, defined as birth occurring before 37 weeks or 259 days of gestation, is the main determinant of neonatal morbidity and mortality and is associated with serious short- and long-term consequences, including compromised quality of life for the affected individual and physical, psychological, and economic costs^{1,2}. Preterm births are classified as elective and spontaneous according to clinical presentation³. In the case of elective preterm births, which account for 25% of all premature births, the pregnancy is interrupted due to a maternal or fetal indication. On the other hand, spontaneous prematurity, which accounts for 50–75% of cases, is multifactorial and involves epidemiological, obstetric, and gynecological factors⁴.

The epidemiological risk factors for preterm birth include maternal age, low socioeconomic status, smoking (relative risk [RR] 1.2–1.6)⁵, stress, and a body mass index < 19, among others. Obstetric history, such as an interpregnancy interval of less than 6 months, is also an important factor (odds ratio 2.2; 95% CI 1.3–3.6)⁶. A history of preterm birth (RR 2.2; 95% CI 1.9–3.2)^{6,7} and infections such as bacterial vaginosis (RR 1.5–3), urinary tract infections with *Chlamydia* (RR 2.2; 95% CI 1.03–4.78)^{7,8}, and periodontal infections (RR 1.6; 95% CI 1.1–2.3)⁹ are associated with spontaneous preterm birth.

Two systematic reviews^{10,11} reported a relationship between a short uterine cervix on transvaginal ultrasound, and preterm delivery, both in asymptomatic women and in patients with risk factors for preterm birth. Thus, the present study aims to evaluate the correlation between cervical length (CL) and the risk of spontaneous preterm labor in asymptomatic patients from a Ribeirão Preto cohort to obtain a predictive measure that could be useful in the identification of asymptomatic pregnant women at risk of preterm birth as a strategy to prevent prematurity.

The objective of this study is to evaluate the correlation of obstetric history, CL measured by transvaginal ultrasound, and the presence of cervicovaginal infections with the occurrence of preterm birth.

Materials and methods

The present research was designed as a prospective, blind cohort study whose protocol followed the guidelines and standards for research involving humans of Resolution 196/96 of the National Health Council. The study was approved by the Ethics Committee of the University Hospital, Ribeirão Preto Medical School, University of São Paulo, under number 4116/2008, during its 276th meeting. The sample consisted of 1370 pregnant women in the second trimester of gestation residing in Ribeirão Preto. The criteria for inclusion in the study were signing the free informed consent form, being between 20 and 25 weeks of gestation, and undergoing obstetric ultrasound at < 20 weeks. The gestational age was obtained by adding the days from the 1st day of the last menstrual period to the day of inclusion in the study, divided by seven and expressed in weeks and complete days, and confirmed by obstetric ultrasound. Exclusion criteria were multiple pregnancies and fetuses with major congenital malformations or chromosomal syndromes diagnosed before 20 weeks.

Pregnant women eligible to enter the study were invited to the University Hospital for the interview and examinations, including obstetric ultrasound. The ultrasound examinations were performed by two observers trained and calibrated in the methods, always using the same equipment (HDI 11, HDI; Philips 730, GE), as follows: before the procedure, the pregnant women were instructed to empty their bladders completely. For transvaginal ultrasound, the pregnant women were placed in a gynecological position, dorsal decubitus, with their legs abducted. A 5–9 MHz transvaginal ultrasound transducer was used, which was completely covered

Table 1. Crude relative (RR) of preterm birth associated with maternal age, obstetric history, and history of preterm birth and RR

Risk factors	Crude RR	Adjusted RR			
		Cervical length < 2.5	Cervical length < 2	Cervical length < 1.5	Cervical length < 1
Maternal age					
19-35 years	0.96	0.86	0.88	0.88	0.88
> 35 years	1.32	0.94	0.96	0.94	0.94
Parity					
1 and 2 pregnancies	1.14	0.77	0.73	0.77	0.77
> 3 pregnancies	1.84	0.73	0.69	0.73	0.74
History of preterm birth					
Yes	13.24	3.72	4.36	3.60	3.59
RR adjusted for all risk factors studied					
Maternal age					
19-35 years	0.96	0.93	0.98	0.98	0.98
> 35 years	1.32	1.11	1.14	1.13	1.14
Parity					
1 and 2 pregnancies	1.14	0.56	0.55	0.55	0.55
> 3 pregnancies	1.84	0.50	0.49	0.49	0.49
History of preterm birth					
Yes	13.24	15.67	15.66	15.66	15.66

with a sterile, non-lubricated condom that contained a small amount of transmission gel in its reservoir. The best and shortest measurement of the uterine cervix was used^{12,13}.

The following data were collected at birth: hospital of birth, date of birth, gestational age at birth, birth weight, and time of amenorrhea.

Results

We evaluated 1370 pregnant women aged 12-45 years (mean 26.1 ± 6.1 years), residing in Ribeirão Preto. Of these, 143 were younger than 19 years, 1,119 were between 19 and 35 years old, and 108 were older than 35 years. Regarding obstetric history, 590 (43.1%) women were primigravida, and 190 (14.3%) had had at least one preterm birth.

Among the 1370 pregnant women evaluated, 133 had spontaneous preterm births (< 259 days), with 14 (10.5%) preterm births occurring in women under 19 years of age, 105 (79%) in women between 19 and 35 years, and 14 (10.5%) in women older than 35 years. Forty-nine (36.8%) of these preterm births occurred in primigravida women, 58 (43.6%) in women with a history of one or two previous pregnancies, and 26 (19.6%) in women with a history of three or more previous

pregnancies. Among the women with preterm births, 90 (68.2%) had a history of preterm birth.

The analysis of maternal age, obstetric history, and history of preterm delivery as risk factors for preterm birth are shown in [table 1](#), as well as the RR adjusted for CL, which allowed us to establish how much the length of the cervix alone contributed to preterm birth in women with the risk factors studied ([Table 1](#)).

Ultrasonographic evaluation of the uterine cervix showed that in the group of 133 women whose pregnancy ended in preterm birth, four had an open external cervical os, 9 women had an open internal cervical os, 14 had cervical funneling, two women had dynamic cervical changes, 30 women had no Ege, and 29 had sludge. The analysis of the ultrasound characteristics of the uterine cervix as risk factors for preterm birth is presented in [table 2](#).

Among the 133 women who had spontaneous preterm birth, CL was < 2.5 cm in 15 women, < 2 cm in 3, < 1.5 cm in 3, and < 1 cm in 2. The analysis of CL as a risk factor for preterm birth is presented in [table 3](#), as well as the RR adjusted for each group of the variables studied as risk factors, both independently and combined.

Discussion

In this study, CL was evaluated as a risk factor for preterm birth, adjusting the statistical analysis for other factors

Table 2. Crude relative risk of cervical ultrasound characteristics for preterm birth and RR adjusted for cervical length

Risk factors	Crude RR	Adjusted RR			
		Cervical lenght < 2.5	Cervical lenght < 2	Cervical lenght < 1.5	Cervical lenght < 1
OCE	3.02	2.35	2.24	1.90	1.39
OCI	2.57	2.31	2.49	1.96	2.61
Funneling	2.00	0.66	0.81	0.83	0.80
Dynamic changes	1.43	1.04	1.21	1.17	1.32
Ege	1.64	1.34	1.42	1.29	1.44
Sludge	1.46	1.21	1.22	1.16	1.16

Table 3. Crude relative risk of cervical ultrasound characteristics for preterm birth and RR adjusted for clinical characteristics, obstetric history, vaginal infections, ultrasound characteristics, and cervical length

Risk factors	Crude RR	RR adjusted for all risk factors studied			
		Cervical lenght < 2.5	Cervical lenght < 2	Cervical lenght < 1.5	Cervical lenght < 1
OCE	3.02	1.23	1.15	1.13	1.16
OCI	2.57	1.12	1.51	1.49	1.53
Funneling	2.00	0.85	0.94	0.95	0.95
Dynamic changes	1.43	1.11	1.19	1.17	1.21
Ege	1.64	1.02	1.09	1.08	1.09
Sludge	1.46	1.10	1.12	1.11	1.12

such as maternal age, obstetric history, history of preterm birth, ultrasound characteristics of the uterine cervix, and vaginal infection, to determine how much CL alone or in combination with other factors predicts preterm delivery.

In the present study, 133 (9.7%) of the 1370 patients evaluated had preterm birth, defined as birth before 37 weeks. This finding is in agreement with the international literature regarding the incidence rate of this obstetric complication^{4,8,10,11,14-20}. In the systematic review of Crane¹⁰, the CL cutoff was 25 mm to predict preterm birth before 35 weeks, as determined by ultrasound at 20 weeks of gestation.

There is an inverse relationship between CL and RR for preterm birth, a relationship that does not persist when the risk is adjusted for the other variables. The variable that showed the highest RR ratio when adjusted for CL was the presence of genitourinary infections, while the risk adjusted for clinical

characteristics and obstetric history remained stable^{21,22}. These findings indicate that, in the presence of genitourinary infection, the shorter the CL, the higher the risk of preterm birth. On the other hand, when adjusted for clinical characteristics, progressive shortening of the cervix does not modify the risk of preterm birth. This finding allows to establish clinical approaches to modifiable variables such as genitourinary infections, reducing the risk of preterm birth^{23,24}. These findings demonstrate that, in the presence of genitourinary infection, cervical shortening is associated with a higher risk of preterm birth than the infection itself.

Based on the results of this study, pregnant women with a cervix of 2.5 cm or shorter and with all other factors studied are at higher risk for preterm birth and should be considered candidates for the implementation of secondary prevention strategies. Since there is no standard

cutoff point below which the risk of preterm birth becomes significant, a strength of this study is the fact that four cut-off points were used for statistical analysis.

Conclusions

The identification of pregnant women who are at high risk of preterm birth, as well as modifiable risk factors, can reduce the incidence of preterm birth. Although no gold standard test exists for the prediction of preterm birth, this study confirms that the measurement of CL is a good individual predictor. Prediction is improved when CL is combined with other risk factors, such as cervicovaginal infections.

The assessment of CL to identify asymptomatic pregnant women at increased risk of developing spontaneous preterm labor is very useful in preventing prematurity and in reducing physical, psychological, and economic costs; however, there is currently no ideal test for predicting preterm birth. Preterm birth is a multifactorial process, and cervical dysfunction is partially responsible for this complication. Furthermore, the measurement of CL must be combined with other markers to improve the sensitivity and predictive value for the diagnosis of preterm birth. According to the literature, one option is biochemical markers such as metalloproteinases.

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Conflicts of interest

The authors declare they have no conflicts of interest.

Ethical aspects

The study was approved by the Ethics Committee of the University Hospital, Ribeirão Preto Medical School, University of São Paulo, under number 4116/2008, during its 276th meeting.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

Use of artificial intelligence for generating text. The authors declare that they have not used any type of generative artificial intelligence for the writing of this manuscript or for the creation of images, graphics, tables, or their corresponding captions.

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