

Transvaginal sonographic assessment of the cervix and preterm labor

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Summary

Objective: The purpose of the study was to assess the accuracy of cervical measurements by transvaginal ultrasonography during the 1st and 2nd trimester in the prediction of preterm labor. **Study Design:** Five hundred high-risk pregnant women in preterm labor were studied retrospectively. **Results:** A significantly higher percentage rate of preterm delivery was found in women with abnormal cervical length compared to those with normal cervical length (54.6% [118 of 216 women] vs 16.5% [47 of 284 women], $p < 0.001$). Also in women with abnormal dilatation of the internal cervical os the percentage was significantly higher compared to those with normal findings (78.7% [133 of 216 women] vs 9.7% [32 of 284 women], $p < 0.001$). For women with cervical funneling the incidence of preterm delivery was significantly higher compared to the rest of the women (94.3% [33 of 35] vs 28.4% [132 of 465], $p = 0.015$). **Conclusion:** Our data confirm that sonographic assessment between the 9th and 12th week is the best cut-off period for predicting preterm labor.

Key words: Pregnancy; Cervix; Ultrasonography; Preterm labor; Cervical length; Cervical funneling.

Introduction

Preterm delivery is one of the most frequent complications during pregnancy. Preterm birth is the cause of perinatal mortality and morbidity. Indeed, 75% of perinatal mortality and morbidity are due to preterm delivery [1, 2]. Despite increasing knowledge of preterm labor risk factors and the preventive measures taken in pregnancy follow-up programmes, this pathology remains a public health priority in developed countries. In the management of preterm labor, it is important to assess the condition of the uterine cervix since cervical ripening is an integral part of the process of preterm labor. The diagnosis of preterm labor is often subjective, traditionally relying on digital examination of the cervix. Unfortunately, digital assessment of cervical effacement and dilatation may be variable. Transvaginal cervical evaluation is more accurate than digital examination of the cervix in the assessment of the risk for preterm delivery. Clinical studies have shown that transvaginal sonographic examination can provide reliable and objective diagnostic markers for preterm labor and therapeutic cervical cerclage [3]. The use of transvaginal cervical assessment during the 1st and the 2nd trimester of pregnancy resulted in early diagnosis of cervical changes (shortening of cervical length or presence of cervical funneling) in asymptomatic patients [4]. The purpose of this paper was to assess the prognostic value of transvaginal ultrasonographic measurements and wedging of the cervical internal os and to establish the relationship of cervical findings to the risk of spontaneous preterm delivery.

Materials and Methods

In a retrospective study between 1995 and 2005, 500 high-risk women with singleton pregnancies underwent transvaginal sonographic examination to assess the cervical length and presence of cervical funneling as a screening test for spontaneous preterm delivery. High-risk factors include infections, intercurrent maternal illness, surgery, recurrent vaginal bleeding, socioeconomic deprivation, previous preterm birth, cervical weakness, uterine overdistension (multiple pregnancies, or pregnancies known to be at risk of polyhydramnios), and uterine abnormalities. In our study, women attending for full hospital antenatal care were offered a transvaginal ultrasound scan in the 1st trimester (9-12 weeks of gestation) and a second one in the 2nd trimester (18-20 weeks of gestation). Our study involved 320 nulliparous women, 140 multiparous and 40 pregnant women with a history of recurrent miscarriages. All pregnant women were between 16-44 years old. In our study we included only singleton pregnancies in which monitoring of pregnancy as well as delivery occurred in our clinic. We excluded patients in advanced labor in whom the diagnosis of preterm labor was not in question. Other exclusion criteria included missed miscarriages, known stillbirths, preeclamptic women and pregnancies with known fetal congenital abnormalities. Transvaginal sonography was carried out by one of the investigators using a 5-MHz transducer (GE-LOGICTM 400). With the maternal bladder empty, the cervical lengths as well as the presence of cervical funneling were measured in the sagittal plane after visualizing simultaneously the internal and external cervical os. Cervical length less than 3 cm and dilatation of the internal os more than 10 cm were criteria for the pathological appearance of the cervix. A "V" or "U"-shaped indentation of the internal os by the amniotic membranes was determined to be a very important sign for cervical incompetence. According to the above criteria women were entered into four categories: 1st group with normal cervical length and dilatation of the internal os (reference category), 2nd group with abnormal cervical length and normal dilatation of the internal cervical os, 3rd group with normal cervical length and abnormal dilatation of the internal cervical os, and 4th group with abnormal cervical

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length and abnormal dilatation of the internal os. In our study 50 women had had therapeutic cervical cerclage (16th-18th week of gestation).

We also studied the correlation between abnormal findings of the above parameters and spontaneous preterm labor. Preterm labor was defined as delivery before the 37th week of gestational age. For statistical analysis, categoric variables were compared with the chi-square test. Furthermore, multiple logistic regression was used to determine the possible significance of funneling, independent of cervical length, in the prediction of spontaneous delivery (odds ratio, OR). A p value < 0.05 was regarded as significant.

Results

Of 500 women with transvaginal sonographic cervical assessment, 216 (43.2%) had abnormal cervical length during the 1st and 2nd trimester. Abnormal dilatation of the internal cervical os was observed in 169 (33.8%) women during the 1st trimester and 170 (34.0%) women during the 2nd trimester. One hundred and ten (22%) women had abnormal cervical length and abnormal dilatation of the internal cervical os at the same time. Of 500 women with transvaginal sonographic cervical assessment who met the entry criteria for the study, 165 (33.0%) had preterm delivery (median 35 weeks). Dilatation of the internal cervical os for the above group of women was between 28-37 mm. Funneling of the cervical canal at the level of the internal os was present in 35 (7.0%) cases; in addition, 42 (8.4%) women had elective placement of a cervical suture. In terms of mode of delivery, 283 (56.6%) women had had a normal vaginal delivery, 171 (34.2%) women had had a lower segment cesarean section and 46 (9.2%) had had assisted vaginal delivery (Table 1). Table 2 shows selected demographic and clinical characteristics of the study population and the correlations with preterm delivery. Logistic regression analysis was performed to examine the relationship between preterm labor and transvaginal sonographic variables in the 1st and the 2nd trimesters of pregnancy. A significant higher percentage rate of preterm delivery was found for the women with abnormal cervical length compared to those with normal cervical length (54.6% [118

Table 2. — Preterm labor and clinical characteristics.

	No. of women	%	p value
Cervical length (1st trimester)			
≥ 3 cm	47	16.5	< 0.001
< 3 cm	118	54.6	
Cervical length (2nd trimester)			
≥ 3 cm	47	16.5	< 0.001
< 3 cm	118	54.6	
Dilatation of internal cervical os (1st trimester)			
≤ 10 mm	32	9.7	78.7
> 10 mm	133	78.7	
Dilatation of internal cervical os (2nd trimester)			
≤ 10 mm	32	9.7	78.2
> 10 mm	133	78.2	
Cervical funneling			
No	132	28.4	< 0.001
Yes	33	94.3	
Cervical cerclage			
No	133	29.1	< 0.001
Yes	32	76.2	

of 216 women] vs 16.5% [47 of 284 women], $p < 0.001$), as well as women with abnormal dilatation of the internal cervical os compared to those with normal findings (78.7% [133 of 216 women] vs 9.7% [32 of 284 women], $p < 0.001$). In fact, logistic regression analysis showed that risk of spontaneous preterm delivery was six times higher in women with abnormal cervical length compared to those with cervical length within normal limits (crude, cOR = 6.1, 95% CI = 4.0-9.2 for both trimesters) and more than 30 times higher in women with abnormal dilatation of the internal cervical os compared to women with normal findings (1st trimester: cOR = 34.5, 95% CI = 20.6-58.0; 2nd trimester: cOR = 33.5, 95% CI = 20.0-56.1). A significant increased risk of spontaneous preterm delivery was observed in women with cervical funneling (cOR = 41.6, 95% CI = 9.8-175.9). In this study group the incidence of preterm delivery was significantly higher compared to the rest of the women (94.3% [33 of 35] vs 28.4% [132 of 465], $p = 0.015$). A significant relation was found between cervical cerclage and recurrence of preterm labor. The incidence of preterm labor was significantly higher in women with cervical cerclage compared to women with no medical intervention (76.2% versus 29.0%, $p < 0.001$). Multiple unconditional logistic regressions were performed for all subjects to determine which variables were independent predictors of spontaneous preterm labor. Among the entire group, abnormal dilatation of the internal cervical os was found to be the most important independent predictor of preterm delivery, during the 1st trimester of pregnancy (adjusted, aOR = 24.4, 95% CI = 13.9-42.9). At the same time, abnormal cervical length during the 1st trimester (adjusted, aOR = 4.7, 95% CI = 2.7-8.2) as well as cervical funneling (aOR = 5.2, 95% CI = 1.1-23.3) were found to be associated with increased incidence of preterm delivery (Table 3). Table 4 shows the relationship between recurrence of preterm labor and transvaginal sonographic variables. A significant relation was found between the endocervical canal length and funnel length. The presence of abnormal

Table 1. — Clinical characteristics of patients.

Clinical characteristics	No. of women	%
Cervical length (1st trimester) < 3 cm	216	43.2
Cervical length (2nd trimester) < 3 cm	216	43.2
Dilatation of internal cervical os (1st trimester) > 10 mm	169	33.8
Dilatation of internal cervical os (2nd trimester) > 10 mm	170	34.0
Cervical funneling	35	7.0
Cervical cerclage	42	8.4
Preterm labor	165	33.0
<i>Mode of delivery</i>		
Normal vaginal delivery	283	56.5
Low segment cesarean section	171	34.2
Assisted vaginal delivery	46	9.2

Table 3. — Correlation between preterm labor and clinical characteristics expressed as odds ratios (OR) with 95% confidence intervals (CI).

	cOR (95% CI)	p	aOR (95% CI)	p
Cervical length (1st trimester) < 3 cm	6.1 (4.0-9.2)	< 0.001	4.7 (2.7-8.2)	< 0.001
Cervical length (2nd trimester) < 3 cm	6.1 (4.0-9.2)	< 0.001	n.s.	
Internal diameter cervical os (1st trimester) > 10 mm	34.5 (20.6-58.0)	< 0.001	24.4 (13.9-42.9)	< 0.001
Internal diameter cervical os (2nd trimester) > 10 mm	33.5 (20.0-56.1)	< 0.001	n.s.	
Cervical funneling	41.6 (9.8-175.9)	< 0.001	5.2 (1.1-23.3)	0.033
Cervical cerclage	7.8 (3.7-16.4)	< 0.001		n.s.

All variables that showed a significant effect on the presence of preterm labor in univariate analysis were entered into the multivariate logistic regression model; variables are binary (0 = No, 1 = Yes); cOR: crude odds ratio; aOR: adjusted odds ratio; n.s., not significant.

Table 4. — Preterm labor outcome.

Cervical length < 3 cm	Dilatation of internal cervical os > 10 mm	n	Cumulative incidence	cOR	aOR*	95% CI	p value#
No	No	225	4.4	ref	ref		
Yes	No	106	20.8	5.6	5.6	2.6-12.4	< 0.001
No	Yes	59	62.7	36.2	29.9	12.9-69.4	< 0.001
Yes	Yes	110	87.3	147.4	116.4	49.3-274.4	< 0.001

* Logistic regression analysis adjusting for presence of funneling and cervical cerclage. cOR: crude odds ratio; aOR: adjusted odds ratio; #: significance for adjusted odds ratios; ref: reference category.

cervical length only was associated with a significantly increased likelihood of preterm labor compared to the reference group (women with cervical length and dilatation of the internal cervical os within normal limits (aOR = 5.6, 95% CI = 2.6-12.4). However, the presence of abnormal dilatation of the internal cervical os was found to be associated with a greater risk of preterm delivery compared to the reference group (aOR = 29.9, 95% CI = 12.9-69.4). It should be noted that only the presence of abnormal dilatation of the internal os is associated with a higher risk of preterm delivery compared to the risk of preterm delivery due to abnormal cervical length only (aOR = 6.4, 95% CI = 3.2-13.0). The observed number of preterm deliveries in women with abnormal cervical length and abnormal dilatation of the internal cervical os was 116 times higher (aOR = 116.4, 95% CI = 49.3-274.4) compared to the reference group. The predictive value of therapeutic cervical cerclage in the above group was studied as well. We found that women with only one abnormal cervical variable (cervical length, dilatation of the internal cervical os) and cervical cerclage had ten times increased likelihood of preterm delivery (cOR = 10.7, 95% CI = 2.9-39.0 p < 0.001). However, in women with both abnormal cervical variables, we found that therapeutic cervical cerclage reduced the risk of preterm delivery by about 80%. In this study group the percentage rate of preterm delivery was significantly lower in women with therapeutic cervical cerclage (72.0% vs 91.8%). Finally the incident rate of cesarean section was significantly greater in women with preterm delivery (61.2% vs 20.9%, p < 0.001).

Discussion

Preterm labor, its recurrence and preterm delivery are probably the greatest problem in modern perinatology. The past 20 years have seen many advances in perinatal medicine but, unfortunately, 11-12% of the total pregnancies are complicated by preterm delivery. Furthermore, there has been an increased incidence of preterm delivery over the last few years (more than 7% since 1990) [5, 6]. This data is very important due to the high incidence of neonatal morbidity (70%) and likelihood of neurological complications (50%) [7, 8]. The above facts make the accurate diagnosis of preterm labor with a reduction in the high-false positive rate an important goal [9-12]. Our study, which included a significant number of women at high-risk of preterm delivery, confirmed a significant relationship between transvaginal sonographic cervical length less than 3 cm and increased incidence of preterm delivery. The sensitivity of transvaginal sonographic cervical length was higher in the 1st trimester of pregnancy. A greater relationship was found between dilatation of the internal cervical os more than 3 mm and preterm delivery. Especially during the 1st trimester funneling provided a significant additional contributing factor in the prediction of spontaneous preterm delivery. Consequently, in women with funneling the risk of preterm delivery was considerably higher than in women without funneling. Our findings confirm those of earlier studies [13-16], suggesting that transvaginal ultrasound cervical assessment is substantially better than digital examination in the prediction of spontaneous preterm delivery. Several authors have suggested that the first sonographic cervical assessment should be done between the 15th and 24th week of gestation. The results of our study suggest that sonographic assessment between the 9th and 12th week is the best cut-off period to maximize sensitivity and specificity for predicting preterm labor. In terms of the effectiveness of therapeutic cervical cerclage, we found a significantly reduced incidence of preterm delivery, only in women with abnormal cervical length and abnormal dilatation of the internal cervical os. However, from our findings therapeutic cervical cerclage in women with only one abnormal cervical variable increased the incidence of spontaneous preterm delivery. Our findings confirm several other studies which suggested the low prevention value of therapeutic cervical cerclage and the greater risk of preterm delivery, usually due to chorioamnionitis [17-19]. Alternatively Althuisius *et al.*, reported that therapeutic cervical cerclage reduces the incidence of spontaneous preterm delivery in women with cervical length less than 2.5 cm diagnosed before the 27th week of gestation [20]. In conclusion, transvaginal sonographic examination of the uterine cervix provides objective information about the risk of preterm labor and its consequences, especially during the 1st trimester of pregnancy. In terms of the prevention value of therapeutic cervical cerclage, we suggest that it be performed only in cases of cervical incompetence diagnosed by obstetric history and transvaginal sonographic assessment.

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