Prediction of latency period in patients with PPROM by cervical measurements using Transvaginal Ultrasound; A Prospective cohort study

Mohamed I Taema1, Khalid Akkour 2, Shahida Khaliq 2, Amr Sobhy1
1-Department of obstetrics and gynecology, Ain shams university. Cairo Egypt
2- Department OB/GYN, Faculty of medicine, King Saud University, Riyadh, KSA

Abstract

Background: Preterm premature rupture of membranes (PPROM) is a main cause of Preterm Labor (PTL) which is the most major cause of perinatal morbidity and mortality. Measurements of angle between cervix and uterus may play a role in prediction of PTL.

Aim of the Work: To assess the accuracy of cervical length, posterior and anterior cervical angles to predict the latency in PPROM.

Design: A cohort Prospective study on 150 patients with PPROM was done in 2 private hospitals in KSA.

Methods : patients with PPROM had underwent a transvaginal ultrasound examination to measure cervical length (CxL), posterior and anterior uterocervical angle.

Results: The latency period was within 2 days in 42 patients (28%) while was after 2 days in 108 patients (72%) of cases. The cervical length (CxL) cut-off value was 26.0 mm, while the sensitivity and specificity were (79.7% and 67.4% respectively), The Cut off value of posterior uterocervical angle (PCA) was 109.0° while the sensitivity and specificity were (94.0% and 62.3% respectively), The Cut off value of anterior uterocervical angle (ACA) was 107.0° while the sensitivity and specificity were (94.0% and 73.4% respectively).

Conclusion: The combination of the length of Cervix (CxL), PCA and ACA values can predict the latency period in patients with PPROM

key words: latency period, PPROM, length of the cervix, ACA, PCA

Corresponding author:
Amr Sobhy Sweed
Lecturer of OB/GYN Faculty of medicine, Ain Shams University, Cairo-Egypt
Consultant obstetrics and gynecology, Madinah National hospital , Madinah al Munawara - Saudia Arabia
e-mail: sobhyamr@yahoo.com
phone: +966548051466

Introduction

PPROM is defined as fetal membranes rupture before 37 weeks of pregnancy [1], It may reach 3% of all pregnancies and accounts for about 30% of preterm deliveries. Prematurity Can lead to respiratory distress syndrome, cerebral palsy after intraventricular hemorrhage, necrotizing enterocolitis and perinatal death [2].

Latency period in PPROM is defined as the interval between PROM and birth [3]. The measurement of Cervical length by transvaginal ultrasound (TVS) is used to assess the risk of preterm birth. At second trimester, the short cervix less than 26 mm is significantly correlated with preterm labor, it has a high negative predictive value. But its predictive accuracy as a single measure is limited [3].

Secondly, the posterior uterocervical angle (PCA), is defined as the angle between the cervical canal and the posterior uterine wall [4]. Furthermore, PCA was shown to be associated with an interval of specificity of 67.4% for the labor within 48 hours of PPROM. [5] The Anterior uterocervical angle (ACA) is defined as the angle between the cervical canal and the anterior uterine wall [6].

Aim of the Work

To assess the accuracy of cervical length (CxL), ACA and PCA in prediction of latency period in patients with PPROM.

Materials and Methods

A Cohort Prospective study was conducted at 2 private hospitals in Saudia Arabia during the period from January 2022 till August 2022. The ethical committee of both hospitals approved the study

Primary outcomes: ACA, PCA and latency period

Secondary Outcomes Cervical Length (CxL) and relevant obstetric outcomes

SAMPLE SIZE JUSTIFICATION

Sample size was calculated using software of SPSS® version 11, adjusting the type-1 error (α) at 0.05 and power of 80%. Results from Kathir et al., 2017 were taken as reference, they reported that PCA 113.0° achieved a sensitivity of 80.4% and a specificity of about 65.5% for the labor within 48 hours of ROM, with the assumption of labor within 48 hours among 63.8% of cases, assuming same findings for ACA, this study included 150 cases.

Eligibility Criteria

Patients with PPROM were included if they experienced rupture of membranes between 28 − 34 weeks diagnosed by eye visualization of amniotic fluid through the external cervical opening by speculum examination. The Exclusion criteria included fetal heart rate abnormalities, Antepartum hemorrhage, chorioamnionitis, history of cervical cerculage in this pregnancy and women who were in active labor at admission.

Clinical Protocol

All patients with PPROM were admitted, diagnosed Clinically and managed expectantly in the absence of criteria of chorioamnionitis. All Patients have received corticosteroids in the form of Dexamethasone 6 mg IM/12 hrs for 48 hrs (total 24 mg) and received antibiotics in the form of 1 gm oral Azithromycin as recommended by ACOG [7].

Obstetric Ultrasound was performed by senior sonographer to assess Fetal age, presentation, Biophysical profile, amniotic fluid volume and placenta location. Transvaginal ultrasound was performed after the patient has the sensation of full bladder, the probe was placed in the anterior fornix, decreasing the pressure on the cervix [8], In order to measure PCA and ACA, a line was drawn between the external and internal cervical os another was drawn parallel to the inner side of the posterior wall of the uterus (PCA) and anterior wall of the uterus (ACA), Cervical length is the measurement between the internal and the external cervical os. Termination of pregnancy was indicated in cases of chorioamnionitis, patient entered in labor of fetal distress determined by CTG, or reaching 34 weeks.

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 23.0 (SPSS Inc., Chicago, Illinois, USA). The quantitative data were presented as mean± standard deviation and ranges. Also, qualitative variables were presented as number and percentages. ***The following tests were done:*** Independent-samples t-test of significance was used when comparing between two means & Chi-square (x2) test of significance was used in order to compare proportions between qualitative parameters. Receiver operating characteristic (ROC curve) analysis was used to find out the overall predictivity of parameter in and to find out the best cut-off value with detection of accuracy was represented using the terms sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy, the likelihood ratio of a positive test and the likelihood ratio of a negative test.

Results

Table 1 shows the demographic data of 150 patients including age, body mass index, parity, total leucocyte count, amniotic fluid index, the length of Cervix (CxL), (PCA) and (ACA)

Table 2 shows a high statistically significant difference between 2 groups as regard the length of Cervix (CxL), (PCA) and (ACA). No statistically significant difference between 2 groups as regarding age, body mass index, parity, total leucocyte count, amniotic fluid index.

Table 3 shows the diagnostic accuracy of data measured in prediction of latency period within the two days .Table 4 shows the diagnostic characteristics of measured item as cutoff points in the prediction of latency period within the 2 days.

Discussion

Interpretation of our results and their comparison to other studies

Our study has measured the cervical length, posterior uterocervical angle and anterior uterocervical angle by transvaginal ultrasound in order to predict the latency period in patients with PPROM. We found that ACA and PCA were significantly higher among patients that had labor within 2 days, while CXL was significantly lower among the same cases.

In our study, CXL had a cutoff value 26 mm, its sensitivity was 79.7% while its specificity was 67.4% in the prediction of latency period within 2 days.

Rizzo et al., who reviewed 92 patients with PPROM found that a CXL< 20 mm was associated with shorter latency. In Contrast, Carlan et al; Fischer and Austin found no statistically significant relationship between CXL and latency period with a 3 cm cutoff to characterize short CXL [9,10,11].

Our study proved that PCA and ACA parameters are highly statistically significant in prediction of latency period within 2 days in PPROM. In the study by Kathir et al., PCA was shown to be associated with latency period (p value = 0.003). PCA of 113.0° with a sensitivity 80.4% and specificity 65.5% for the labor within 2 days of PROM. [12]

Perez et al. in their study, ACA > 105° predicted the latency period ≤ 7 days with a sensitivity 78% and latency period ≤ 2 days with a sensitivity 90%. These results might be affected by low number of cases that included in Perez' study (98 women).

Mean AFI in patients with the latency period within two days was 4.31±1.09 cm while in patients with latency period after the two days was 4.92±1.38 cm (p value=0.011).

Mehra et al. found a positive correlation between short CXL and high labor rates within seven days (when cutoff value is < 20 mm and a sensitivity 44% with specificity 74%), [13]

In the study by Ayad et al; the mean TLC in cases with latency period < two days, the latency period between 2 - 7 days and the latency period > 7 days group, were 13.449 ± 2.959, 10.845 ± 2.432 and 9.389 ± 2.656, ($10^3/\mu L$) respectively. The ANOVA test showed a statistically significant difference in the mean of TLC among different PPROM groups with F = 16.755, p value < 0.001.

Clinical implication of our study

For clinical practice, the use of transvaginal Ultrasound in this study in patients with PPROM may assist in the decision of the transfer of pregnant women to other highly qualified hospitals with better neonatal facilities and for administration of corticosteroids for the enhancement of fetal lung maturation.

Limitations and strength of our study

The small sample size is the main limitation of this study and the lack of randomization of study while the advantage of study, it was carried in 2 hospitals which decrease the publication bias.

Recommendation for further studies

Further studies are needed to be multicentral and include large no of participants to study the effect of cervical angles in prediction of latency period in PPROM.

Conclusion

The combination of the length of Cervix (CxL), posterior uterocervical angle (PCA) and anterior uterocervical angle (ACA) measurements can predict the latency period in women with PPROM

Ethics approval

Study was approved by Ethical Committee of 2 private hospitals

Consent for publication

Non applicable

Availability and data material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors report there are no competing interests to declare

Funding

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Table 1. The Demographic and the Basal characteristics.

Demographic data	Mean±SD	Range
Age (years)	27.34±5.81	18-42
BMI (kg/m²)	21.83±3.37	18-31
Parity	**No.**	**%**
Primi	56	37.3%
Multi	94	62.7%
Basal		
TLC (×10³/mL)	8.77±2.75	4-18
AFI (cm)	4.69±1.43	2-8
Cervical length (mm)	25.91±2.96	15-32
Posterior uterocervical angle (°)	110.26±5.20	93.6-121.4
Anterior uterocervical angle (°)	108.63±5.41	96.2-124.4

Table 2. Comparison according to latency period (two days) regarding demographic and basal characteristics.

	Within (n=42)	After (n=108)	p-value
Demographic data			
Age (years)	27.13±4.59	27.44±6.22	0.770
BMI (kg/m²)	23.87±3.77	21.01±2.75	0.08
Parity			
Primipara	12 (28.6%)	44 (40.7%)	0.232#
Multipara	30 (71.4%)	64 (59.3%)	
Basal			
Enrollment GA (week)	33.66±1.53	33.46±1.94	0.550
TLC (×10³/mL)	9.38±2.08	8.57±2.14	0.038*
AFI (cm)	4.31±1.09	4.92±1.38	0.061
Cervical length (mm)	24.07±3.57	26.52±2.45	<0.001**
Posterior uterocervical angle (°)	113.73±3.98	108.94±5.00	<0.001**
Anterior uterocervical angle (°)	113.53±4.49	106.69±4.49	<0.001**

Using: Independent Sample t-test; #Chi-square test

*p-value >0.05 is insignificant; *p-value <0.05 is significant; **p-value <0.001 is highly significant*

Table 3. Diagnostic performance of basal measurements in prediction of latency period within two days.

Factor	AUC	SE	P	95% CI	Cut off
TLC	0.530	0.050	0.632	0.433-0.628	-
AFI	0.620	0.043	0.020*	0.536-0.706	-
Cervical length	0.762	0.041	<0.001**	0.681-0.845	≤26 mm
Posterior uterocervical angle	0.812	0.034	<0.001**	0.745-0.879	≥109.0°
Anterior uterocervical angle	0.897	0.025	<0.001**	0.849-0.946	≥107.0°

*AUC: Area under curve, SE: Standard error, CI: Confidence interval, *significant.*

Table 4. Diagnostic characteristics of basal measures cutoff points in predicting latency period within two days.

Characters	Cervical length ≤ 26.0 mm		Posterior uterocervical angle ≥ 109.0°		Anterior uterocervical angle ≥107.0°	
	Value	95% CI	Value	95% CI	Value	95% CI
Sensitivity	79.7%	67.42%-90.37%	94.0%	84.66%-100.06%	94.0%	84.66%-100.06%
Specificity	67.4%	58.45%-74.66%	62.3%	52.84%-69.46%	73.4%	64.87%-80.27%
DA	70.69%	63.75%-77.01%	70.69%	63.75%-77.01%	79.15%	72.62%-84.76%
YI	45.39%	32.03%-58.75%	54.16%	43.66%-64.67%	65.89%	55.90%-75.89%
PPV	47.84%	37.33%-58.45%	48.25%	38.56%-58.14%	56.92%	46.10%-67.32%
NPV	90.78%	83.23%-96.08%	97.61%	91.19%-100.78%	98.33%	92.82%-100.98%
LR+	2.34	1.81-3.03	2.38	1.93-2.94	3.35	2.56-4.36
LR−	0.33	0.19-0.55	0.12	0.04-0.31	0.10	0.04-0.26
LR	7.27	3.54-14.96	20.39	7.01-59.33	34.11	11.62-100.16
Kappa	0.38	0.25-0.50	0.42	0.31-0.52	0.55	0.44-0.66

CI: Confidence interval, YI: Youden's index. DA: Diagnostic accuracy, PPV: Positive Predictive value, NPV: Negative Predictive value, LR+: Positive likelihood ratio, LR−: Negative likelihood ratio, LR: Diagnostic odd ratio.