

Transvaginal Cervical Length and Amniotic Fluid Index: Can it Predict Delivery Latency Following Preterm Premature Rupture of Membrane?

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Abstract

Background: This study was performed to determine whether transvaginal cervical length (TVCL), amniotic fluid index (AFI), or a combination of both can predict delivery latency within 7 days in women presenting with preterm premature rupture of membranes (PPROMs). **Materials and Methods:** This was a prospective observational study of TVCL measurements in eighty singleton pregnancies with PPRM between 24–34 weeks. Transvaginal ultrasonography was performed to measure the CL and AFI. Delivery latency was defined as the period from the initial TVCL after PPRM to delivery of the baby, with our primary outcome being delivery within 7 days of TVCL. Sensitivity, specificity, and predictive values were used to test whether the presence of a short TVCL, AFI, or a combination of both affected the risk of delivery within 7 days. **Results:** The study showed that the validity of CL alone in predicting labor when the cutoff value = 2 cm, the sensitivity = 52.6%, specificity = 69%, positive predictive value (PPV) = 60.6%, negative predictive value (NPV) = 61.7%, and accuracy = 61.25%. The validity of AFI alone when the cutoff value = 5 cm, the sensitivity = 71.1%, specificity = 50%, PPV = 56.3%, NPV = 65.6%, and accuracy = 60%. With a combination of CL and AFI in predicting time of labor after PPRM, the following results were found: sensitivity = 50%, specificity = 92.8%, PPV = 86.4%, NPV = 67.2%, and accuracy = 72.5%. In women with PPRM, we found the ratio of gestational age (GA) ≤ 30 weeks who labored within 7 days as 44.7% and those labored more than 7 days as 55.3%. **Conclusion:** Our study showed that there was an increase in PPV when combining AFI and CL in the prediction of time of labor, so women with AFI ≤ 5 and CL ≤ 2 had 86.4% risk of delivery within 7 days after PROM. Furthermore, we found that there was no significant association between GA and parity with the prediction time of labor.

Keywords: Expectant management, latency, perinatal outcome, prematurity, preterm premature rupture of membranes

INTRODUCTION

Preterm premature rupture of membranes (PPROMs) complicate only 2% of pregnancies but are associated with 40% of preterm deliveries and can result in significant neonatal morbidity and mortality.^[1]

Complications of PPRM include preterm delivery, chorioamnionitis (13%–60%), placental abruption (4%–12%), endometritis (2%–13%), and cord compression. Another important complication commonly seen with PPRM is fetal malpresentation at delivery.^[2] It is often assumed that gestational age (GA) of delivery is the most important factor in the determination of perinatal outcome after PPRM. In the absence of further complications, labor is often induced at 32–34 weeks of gestation.^[3,4] Antibiotics for PPRM could prevent 4% of neonatal deaths due to complications of

prematurity and 8% of those due to infection.^[5] Erythromycin for women with PPRM is associated with a range of health benefits for the neonate, thus a probable reduction in childhood disability, while co-amoxiclav cannot be routinely recommended for PPRM because of its association with neonatal necrotizing enterocolitis.^[6] The volume of amniotic fluid remaining after rupture appears to have prognostic importance in pregnancies before 26 weeks.^[7] The prediction of delivery latency could help direct the need for specific interventions such as hospitalization, intensive

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Access this article online

Quick Response Code:



Website:
www.medjbabylon.org

DOI:
10.4103/MJBL.MJBL_20_18

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How to cite this article: Mubarak AM. Transvaginal cervical length and amniotic fluid index: Can it predict delivery latency following preterm premature rupture of membrane?. *Med J Babylon* 2018;15:78-82.

monitoring, timing of antenatal steroids, and magnesium for neuroprotection.^[8]

The aim of this study was to determine whether transvaginal cervical length (TVCL), amniotic fluid index (AFI), or a combination of both can predict delivery latency within 7 days in women presenting with PPROMs.

MATERIALS AND METHODS

This cross-sectional observational study was conducted from January 2017 to October 2017 at AL-ZAHRA teaching hospital. This study was approved by scientific and ethical committees at Kufa medical college.

The study includes eighty singleton women with PPROM between 24 and 34 weeks of GA. PPROM was diagnosed by history and physical examination. Nitrazine test was performed by placement of a nitrazine paper in the vaginal fluid collected from the posterior vaginal pool; the nitrazine paper will turn deep blue quickly if the vaginal fluid has an alkaline pH and the membrane is probably intact if the color of the paper remains yellow (pH 5.0–5.5).

Fern-positive test was done by placing sample of the vaginal fluid on a glass slide and allowed to dry under the microscope, looking for a crystallization pattern that would resemble a fern plant. Pooled vaginal fluid was obtained by sterile speculum examination. GA was calculated from the 1st day of the last normal menstrual period and an ultrasound would be performed in early pregnancy when available.

Exclusion criteria included women in labor (defined as painful uterine contractions and cervical dilation of >3 cm confirmed by digital examination), twin pregnancy, fetal heart rate abnormalities, vaginal bleeding or cervical cerclage and sign of chorioamnionitis, and also women with a previous history of preterm labor and with a history of diabetic mellitus or hypertension.

All women were hospitalized and TVCL was performed within 72 h of admission. Measurements of the TVCL were done with an empty maternal bladder. Calipers were placed where the anterior and posterior walls of the cervix were sonographically opposed and the shortest technically best measurements were used. The presence of funneling was noted. AFI was recorded at the time of the TVCL measurement.

Prophylactic antibiotics used included amoxicillin 500 mg intravenously every 8 h for 2 days, followed by oral amoxicillin 500 mg every 8 h or erythromycin succinate 500 mg every 6 h for 5 days. Two doses of 12 mg betamethasone were given intramuscularly, 24 h apart.

Patients were monitored by cardiotocography and vital signs four times a day in order to detect fetal distress or imminence of labor. Digital examination was avoided until the onset of labor. Full blood cell count and C-reactive protein titration were performed upon admission, on the 48th h following rupture of membranes, and then once a week.

Our primary end point was prediction of delivery latency period within 7 days from performance of the TVCL at admission. To provide a more meaningful risk assessment for clinical purposes, TVCL and AFI were analyzed as dichotomous variables as <2.0 and >2.0 cm for TVCL and <5 and >5 cm for AFI, respectively. Sensitivity, specificity, and predictive values were used to examine whether the presence of TVCL, AFI, or a combination of both characteristics affected the risk of delivery within 7 days.

Statistical analysis

All the statistical analysis was done using the SPSS program (version-20) statistic software package (IBM Corp, 2011). We used Chi-square test for categorical data and independent sample *t*-test for numerical data. For detection of cutoff value and to find sensitivity and specificity of test, we used receiver operator characteristic curve. $P \leq 0.05$ was regarded statistically significant.

RESULTS

This study was conducted on eighty women with PROM. The mean age of women was 24.6 ± 5.9 years (range, 16–40 years). The parity ranged between 0 and 5. There were 38 women delivered within 7 days of PPROM and 42 women delivered after 7 days of PPROM.

As shown in Table 1, there was no significant difference in age, parity, and GA, while there was a significant difference in AFI which is lower in those women delivered within 7 days. Furthermore, there was highly significant difference in CL which is less in women delivered within 7 days.

The area under the curve for AFI was 0.629 [Figure 1]. The validity of AFI in predicting time of labor in women with PPROM when the cutoff value was 5 is shown in Table 2.

The area under the curve for CL was 0.711 [Figure 2]. The validity of CL in predicting the time of labor in women with PPROM when the cutoff value was 2 is shown in Table 3.

Table 4 shows that there was an increase in positive predictive value (PPV) when we combine AFI and CL in

Table 1: Comparison between those delivered within and after 7 days of preterm premature rupture of membrane

	Labor	Mean $\pm$ SD	P
Age/years (16-40)	Within 7 days	24.6216 $\pm$ 6.16600	0.921
	>7 days	24.7561 $\pm$ 5.76099	
Parity (0-5)	Within 7 days	1.2432 $\pm$ 1.44155	0.896
	>7 days	1.2857 $\pm$ 1.41913	
GA/weeks (24-34)	Within 7 days	30.5294 $\pm$ 3.02750	0.876
	>7 days	30.4250 $\pm$ 2.69746	
AFI/cm	Within 7 days	4.6081 $\pm$ 1.45838	0.023
	>7 days	5.6429 $\pm$ 2.33553	
CL/cm	Within 7 days	1.9459 $\pm$ 0.66357	0.001
	>7 days	2.4381 $\pm$ 0.64542	

AFI: Amniotic fluid index, CL: Cervical length, SD: Standard deviation, GA: Gestational age

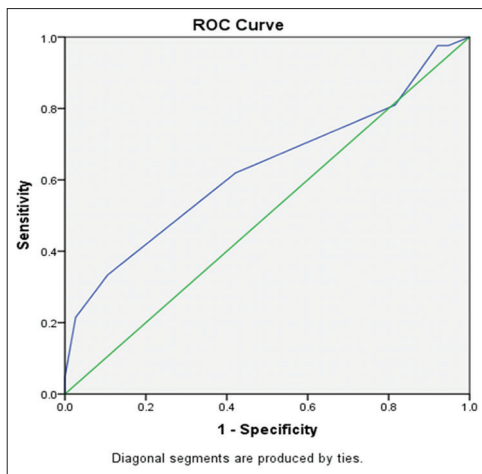


Figure 1: Receiver operating characteristic curve for amniotic fluid index

Table 2: Validity of amniotic fluid index in predicting time of labor after preterm premature rupture of membrane

AFI	Labor		Total
	Within 7 days	>7 days	
≤5	27	21	48
>5	11	21	32
Total	38	42	80

Sensitivity=71.1%, specificity=50%, PPV=56.3%, NPV=65.6%, accuracy=60%. PPV: Positive predictive value, NPV: Negative predictive value, AFI: Amniotic fluid index

Table 3: Validity of cervical length in predicting time of labor among women with preterm premature rupture of membrane

CL2	Labor		Total
	Within 7 days	>7 days	
≤2	20	13	33
>2	18	29	47
Total	38	42	80

Sensitivity=52.6%, specificity=69%, PPV=60.6%, NPV=61.7%, accuracy=61.25. PPV: Positive predictive value, NPV: Negative predictive value, CL: Cervical length

Table 4: Validity of cervical length and amniotic fluid index in predicting time of labor after preterm premature rupture of membrane

Combination	Labor		Total
	Within 7 days	>7 days	
Positive	19	3	22
Negative	19	39	58
Total	38	42	80

Sensitivity=50%, specificity=92.8%, PPV=86.4%, NPV=67.2%, accuracy=72.5%. PPV: Positive predictive value, NPV: Negative predictive value

prediction of time of labor, so women with AFI ≤ 5 and CL ≤ 2 had 86.4% risk of delivery within 7 days after PPROM.

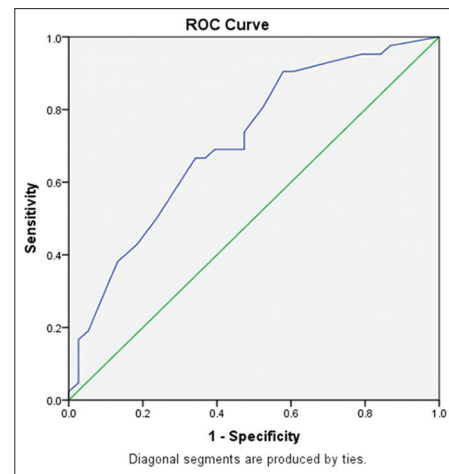


Figure 2: Receiver operating characteristic curve for cervical length

Table 5 shows that there was no significant association between GA and time of delivery.

DISCUSSION

Prediction of the latency period can be important, particularly when delivery in a hospital with tertiary level facilities is planned.^[9]

Many reports had tested the usefulness of performing a cervical scan in the prediction of preterm labor in PPROM with conflicting results.

Many studies show that short CL was significantly associated with premature delivery after PPROM,^[10-13] these findings were supported by a recent study done by Kathir *et al.* which shows that posterior cervical angle assessment using transvaginal sonography is an useful tool in assessing the latency interval in women with PPROM. This could help in counseling and planning timely referral to centers with neonatal facilities^[14] and this finding supports our study.

Carlan *et al.*^[15] and Fischer and Austin^[16] found no relationship between CL and latency period. This may be attributed to the cutoff CL used in their studies. Our study shows the validity of CL in predicting labor in women with PPROM when cutoff = 2 cm [Table 3], with a sensitivity = 52.6%, specificity = 69%, PPV = 60.6%, negative predictive value (NPV) = 61.7%, and accuracy = 61.25%. Other studies assess the use of AFI in predicting latency period in PPROM.

Vermillion *et al.*^[17] showed that an AFI < 5 cm after PPROM between 24 and 32 weeks' gestation is associated with shorter latency preceding delivery; this finding has been supported by several authors^[18-21], which indicates that the presence of oligohydramnios in PPROM is related to a shorter latency (interval between rupture of membranes and delivery) compared to PPROM without oligohydramnios, while Borna *et al.*^[22] showed that AFI < 5 cm did not have a shorter latency until delivery.

Our study shows the validity of AFI in predicting time of labor in women with PPROM when cutoff = 5 [Table 2],

Table 5: Association between gestational age and time of delivery

Labor	GA/weeks		P
	≤30 (%)	>30 (%)	
Within 7 days	17 (44.7)	21 (50.0)	0.638
>7 days	21 (55.3)	21 (50.0)	
Total	38 (100.0)	42 (100.0)	

GA: Gestational age

sensitivity = 71.1%, specificity = 50%, PPV = 56.3%, NPV = 65.6%, and accuracy = 60%.

The relation between GA and latency period had also been studied. Jeon *et al.*^[21] reported that earlier GA at PPROM is significantly associated with longer latency duration. Melamed *et al.*^[23] reported that the duration of the latency period was inversely related to GA at admission. Other authors^[24-26] found that an inverse relationship between GA at the time of presentation and latency period was established. Hsieh *et al.*^[27] showed that latency in PPROM at <3 cm was longer in PPROM at ≥30 weeks' gestation in both singleton and twin pregnancies.

This study sought to determine whether CL and AFI would independently predict latency in a period of more than 7 days and whether there is an increase in PPV if used in combination.

Our study showed that there was an increase in PPV when we combine AFI and CL in prediction time of labor, so women with AFI ≤5 cm and CL ≤2 cm had 86.4% risk of delivery within 7 days after PPROM. This result was in agreement with the result of several authors.^[28-30] Studies demonstrate shorter latency period with TVCL ≤2 cm and AFI ≤5 cm in pregnant women who presented with PPROM.

CONCLUSION

Our study shows that there was an increase in PPV when we combine AFI and CL in prediction of time of labor, so women with AFI ≤5 and CL ≤2 had 86.4% risk of delivery within 7 days after PPROM. Furthermore, we found that there was no significant association between GA and parity with the prediction time of labor.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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