Print ISSN 1110-208X

Online ISSN 2357-0016

Original article

Correlation between Amniotic Fluid Index, Uterocervical Angle and Umbilical Artery Doppler with Latency Period in Preterm Premature Rupture of Membranes

Omar K. Naser, Amina E. Elfakharany, Wagdy M. Amer, and Diaa M. El-Mowafi

Department of Obstetrics and Gynecology, Faculty of Medicine Benha University, Egypt.

Corresponding to: Amina E. Elfakharany, Department of Obstetrics and Gynecology, Faculty of Medicine, Benha University, Egypt.

Email:

dr.aminaelfakharany@gmail.com

Received:

Accepted:

Abstract

Background: Preterm premature rupture of membranes (PPROM) between 24 and 34 weeks of gestation is a significant contributor to preterm birth, leading to various neonatal complications. Accurate prediction of the latency period—the time from membrane rupture to delivery—can enhance clinical management by guiding interventions that improve outcomes for both mother and neonate. This study aimed to assess the correlation between Amniotic Fluid Index (AFI), Uterocervical Angle (UCA), and Umbilical Artery (UA) Doppler with the latency period in PPROM. **Methods:** In this prospective cohort study, 100 pregnant women with PPROM between 24 and 34 weeks of gestation were included. The cohort was divided into two groups based on the latency period: Group I (n=58) delivered within 7 days post-PPROM, and Group II (n=42) delivered after 7 days. **Results:** AFI at PROM was significantly lower in Group I (4 cm) compared to Group II (7.4 cm, $P < 0.001$). The mean UCA was larger in Group I (124.38 ± 19.37°) than in Group II (104.92 ± 26.51°, $P < 0.001$). Higher pulsatility index (PI) (0.98 ± 0.16 vs. 0.92 ± 0.11, $P = 0.019$) and S/D ratio (2.89 ± 0.68 vs. 2.66 ± 0.45, $P = 0.043$) were observed in Group I. Logistic regression identified AFI and UCA as significant predictors of prolonged latency. **Conclusion:** Lower AFI, larger UCA, and higher UA Doppler PI and S/D ratios are significantly linked with a shorter latency period in PPROM cases.

Keywords: PPROM; Amniotic Fluid Index; Uterocervical Angle; Umbilical Artery Doppler; Latency Period.

Introduction

Premature rupture of membranes (PROM) refers to the breaking of the amniotic sac prior to the onset of labor and before reaching 37 weeks of gestation (1). A notable complication of PPROM is early delivery, with the latency period—the time from membrane rupture to delivery—typically being shorter at earlier gestational ages (2).

Understanding the latency period is crucial for clinical management decisions. Accurate prediction of this period enables the timely administration of interventions such as corticosteroids for fetal lung development and antibiotics for infection prevention, ultimately enhancing outcomes for both mother and neonate (3).

The Amniotic Fluid Index (AFI), which quantifies amniotic fluid volume by measuring the deepest pockets in four uterine quadrants, is a critical parameter in managing PPROM. Lower AFI levels are linked to shorter latency periods and increased risks of infection and adverse neonatal outcomes (4).

The uterocervical angle (UCA), an angle formed between the lower uterine segment and the cervical canal, serves as a straightforward and non-invasive indicator of preterm birth risk. Its assessment can aid in the management of PPROM by providing valuable predictive information (5).

Umbilical artery (UA) Doppler assessment evaluates fetal blood flow and placental resistance through indices like the pulsatility index (PI) and systolic/diastolic (S/D) ratio. Abnormal readings indicate higher risks of perinatal complications, guiding necessary interventions (6).

Therefore, we conducted this study to assess the correlation between AFI, uterocervical angle and umbilical artery Doppler and to predict latency period in PPROM 24 to 34 weeks in pregnancy.

article in press

Patients and Method

Study design and population

This prospective cohort study was conducted with 100 pregnant women experiencing PPROM between 24 and 34 weeks of gestation, at the Obstetrics & Gynaecology Department, Faculty of Medicine, Benha University. The study received approval from the Institutional Review Board (IRB), Faculty of Medicine, Benha University **(MS 20-4-2023)**. All participants provided informed consent. The study was done over a period of one year from July 2023 to July 2024.

Inclusion criteria encompassed pregnant women with PPROM between 24 and 34 weeks of gestation and singleton pregnancies. Exclusion criteria included infants with intrauterine growth restriction (IUGR), clinical signs of chorioamnionitis at the time of PPROM diagnosis, onset of labor within the first 48 hours of hospital admission, and cases with previous history of preterm labor or cervical insufficiency.

Indications for pregnancy termination included occurrence of fetal distress and clinical evidence of chorioamnionitis (7).

Participants were categorized into two groups based on the latency period: Group I included those who delivered within 7 days of PPROM (n=58), and Group II included those who delivered after 7 days (n=42).

All patients were subjected to

Complete history and physical examination: Obstetric ultrasound to confirm gestational age and evaluate fetal weight and amniotic fluid.

Radiological investigations:

Doppler Ultrasound (Device: Voulson P8, GE Healthcare, USA) was used to Ensure viability and fetal measurements including:

The AFI technique involves dividing the uterus into four quadrants and measuring the deepest vertical pocket of fluid in each quadrant, then summing these measurements. AFI and maximal vertical pocket (MVP) measurements were taken from fluid pockets that were at least 1 cm wide and free of umbilical cord and fetal parts (8, 9).

The uterocervical angle (UCA) is a transvaginal sonography (TVS) marker that measures the angle between the lower uterine segment and the cervical canal (10). To determine the UCA, a line is drawn from the internal os to the external os, with calipers placed where the cervical walls touch the os. A second line is then traced along the lower uterine segment, ideally extending 3 cm up the anterior uterine segment. The angle formed between these two lines is the UCA measurement. **Figure 1** (10)

Umbilical artery Doppler indices, including the PI and systolic/diastolic (S/D) ratio, were measured from a free-floating loop of the umbilical cord near its abdominal insertion. The waveform was obtained away from the placenta to ensure it was free from the influence of fetal breathing. The umbilical artery was identified on colour Doppler by the number of vessels, flow pattern, and direction. The Doppler gate was accurately placed on the artery to ensure precise sampling (11).

Statistical analysis

Data analysis was performed using SPSS version 28 (IBM, Armonk, New York, United States). Quantitative data were tested for normality using the Shapiro-Wilk test and summarized as means, medians, or percentages. Comparisons were made using t-tests, Mann-Whitney U tests, Chi-square tests, or Fisher's exact tests as appropriate. ROC analysis was employed to assess predictive values, while correlations were evaluated using Spearman's rank correlation. Kaplan-Meier and log-rank tests were used to estimate delivery times, and logistic regression analysis was conducted to identify predictors of prolonged latency. A significance level of $P < 0.05$ was set for all tests.

Results

Age, BMI, parity, gravidity, and mode of previous delivery did not differ significantly between the groups. **Table 1**

The mean gestational age at diagnosis of premature rupture of membranes (PROM) was 211 ± 23 days, and the mean gestational age at delivery was 221 ± 25 days. The median time from PROM to delivery was 4 days, ranging from 0 to 42 days. In terms of the interval between PROM and delivery (latency period), 57 participants (57%) delivered within 7 days, while 43 participants (43%) delivered 7 or more days after PROM. **Table 2 and Figure 2**

In those who underwent CS, females with time from PROM to delivery < 7 days demonstrated significantly higher urgent CS (59.6%) compared to those with time ≥ 7 days (18.6%) (P < 0.001). In those who underwent spontaneous delivery, females with time from PROM to delivery < 7 days demonstrated significantly higher spontaneous delivery (31.6%) compared to those with time ≥ 7 days (9.3%) (P < 0.001). **Table 3**

The median AFI at PROM was significantly lower in group I (4 cm) compared to group II (7.4 cm) (P < 0.001). The mean uterocervical angle was significantly larger in group I (124.38 ± 19.37 degrees) than group II (104.92 ± 26.51 degrees) (P < 0.001). Doppler measurements showed significant differences, with higher PI (0.98 ± 0.16 vs. 0.92 ± 0.11, P = 0.019) and S/D (2.89 ± 0.68 vs. 2.66 ± 0.45, P = 0.043) in group I. Fetal weight (P = 0.171) and Doppler resistance index (RI) (P = 0.772) were not significantly different between the groups. **Table 4**

ROC analysis for predicting a latency period of >7 days showed significant AUC values for several parameters. AFI had an AUC of 0.769 (P < 0.001), with a 95% confidence interval of 0.666 – 0.872, and the best cutoff point was >5, yielding sensitivity, specificity, PPV, and NPV of 80%, 100%, 100%, and 83.3%, respectively. The uterocervical angle had an AUC of 0.790 (P < 0.001), with a 95% confidence interval of 0.684 – 0.896, and the same cutoff point and predictive values as AFI. PI showed an AUC of 0.667 (P = 0.004), with a 95% confidence interval of 0.559 – 0.774, and S/D had an AUC of 0.669 (P = 0.004), with a 95% confidence interval of 0.560 – 0.777, both with the same cutoff point and predictive values. **Figure 3**

The latency period, defined as the time from PROM to delivery, showed significant correlations with several variables. There was a positive correlation with the amniotic fluid index (AFI) at PROM (r = .0.368, P < 0.001). Conversely, the uterocervical angle (r = -.394, P < 0.001), Doppler pulsatility index (PI) (r = -.199, P = 0.048), and Doppler systolic/diastolic (S/D) ratio (r = -.227, P = 0.023) were negatively correlated with the latency period. The Doppler resistance index (RI) was not significantly correlated with the latency period (P = 0.668). **Figure 4**

Univariate and multivariate logistic regression analyses identified significant predictors for a latency period of >7 days after PROM. Univariate analysis showed that AFI, uterocervical angle, and Doppler PI were significant predictors. In the multivariate analysis, controlling for age, BMI, parity, gravidity, and gestational age at PROM, a one-unit increase in AFI was associated with 50% increased odds of a latency period ≥7 days (OR = 1.503, 95% CI = 1.237 – 1.827, P < 0.001). Conversely, a one-unit increase in the uterocervical angle was associated with 3.6% reduced odds of a latency period ≥7 days (OR = 0.964, 95% CI = 0.943 – 0.986, P = 0.001). **Table 5**

article in press

Table 1: General and clinical characteristics of the studied cases according to latency period length.

		Time from PROM to delivery		Total	
		<7 days	≥7 days		P-value
Age (years)	Mean ±SD	28 ±6	28 ±4	28 ±5	0.842
BMI (kg/m^2)	Mean ±SD	27.73 ±2.28	28.25 ±2.26	27.95 ±2.28	0.258
Parity	Median (range)	1 (0 - 5)	1 (0 - 4)	1 (0 - 5)	0.757
Gravidity	Median (range)	2 (1 - 6)	3 (1 - 5)	2 (0 - 6)	0.509
Mode of previous delivery					
CS	n (%)	25 (65.8)	14 (48.3)		0.150
VD	n (%)	13 (34.2)	15 (51.7)		

*Significant P-value; SD: Standard deviation; APH: Antepartum hemorrhage; CS: Cesarean section; VD: Vaginal delivery.

Table 2: Gestational age at PROM diagnosis and delivery and latency period length.

Parameter		
Gestational age at diagnosis of PROM (days)	Mean ±SD	211 ±23
Gestational age delivery (days)	Mean ±SD	221 ±25
Time from PROM to delivery (days)	Median (range)	4 (0 - 42)
Latency period		
<7 days	n (%)	57 (57)
≥7 days	n (%)	43 (43)

SD: Standard deviation; PROM: Premature rupture of membranes.

Table 3: method of pregnancy termination according to time from PROM to delivery.

Method of termination of pregnancy		**Time from PROM to delivery**		
		<7 days	**≥7 days**	**P-value**
CS				
Elective CS	n (%)	4 (5.3)	20 (46.5)	**<0.001***
Urgent CS	n (%)	34 (59.6)	8 (18.6)	
VD				
Spontaneous	n (%)	18 (31.6)	4 (9.3)	**<0.001***
Induction	n (%)	2 (3.5)	11 (25.6)	

CS: Caesarean Section, VD: Vaginal Delivery, *: Statistically Significant Value.

Table 4: US and Doppler findings according to latency period length.

		Time from PROM to delivery		Total	
		<7 days	≥7 days		P-value
AFI at PROM (cm)	Median (range)	4 (1 - 9)	7.4 (0 - 11.5)	5 (0 - 11.5)	**<0.001***
Uterocervical angle	Mean ±SD	124.38 ±19.37	104.92 ±26.51	116.01 ±24.58	**<0.001***
Doppler PI	Mean ±SD	0.98 ±0.16	0.92 ±0.11	0.96 ±0.14	**0.019***
Doppler RI	Mean ±SD	0.61 ±0.12	0.6 ±0.12	0.6 ±0.12	0.772
Doppler S/D	Mean ±SD	2.89 ±0.68	2.66 ±0.45		**0.043***

*Significant P-value; SD: Standard deviation; PI: Pulsatility index; AFI: Amniotic fluid index; RI: Resistance index; S/D: Systolic/diastolic ratio.

Table 5: Univariate and multivariate logistic regression analysis to predict latency period > 7 days.

	Univariate		Multivariate	
	OR (95% CI)	**P-value**	**OR (95% CI)**	**P-value**
AFI at PROM (cm)	1.45 (1.216 - 1.73)	**<0.001***	1.503 (1.237 - 1.827)	**<0.001***
Uterocervical angle	0.962 (0.943 - 0.982)	**<0.001***	0.964 (0.943 - 0.986)	**0.001***
Doppler PI	0.032 (0.001 - 0.724)	**0.031***	0.088 (0.003 - 2.754)	0.166
Doppler RI	0.602 (0.02 - 17.832)	0.769	2.594 (0.049 - 136.734)	0.638
Doppler S/D	0.508 (0.252 - 1.025)	0.059	0.664 (0.297 - 1.482)	0.317

*Significant P-value; AFI: Amniotic fluid index; PI: Pulsatility index; OR: Odds ratio; RI: Resistance index; S/D: Systolic/diastolic ratio; CI: Confidence interval.

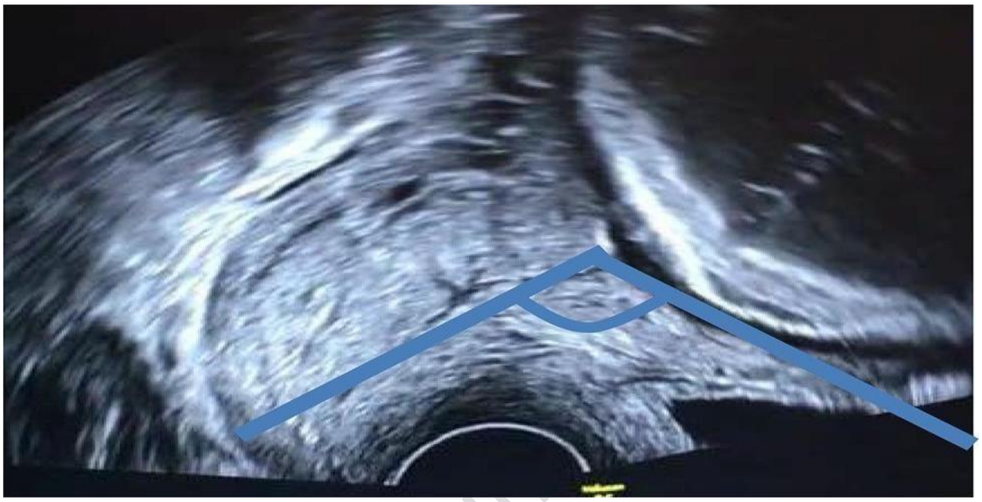

Figure 1: Uterocervical angle.

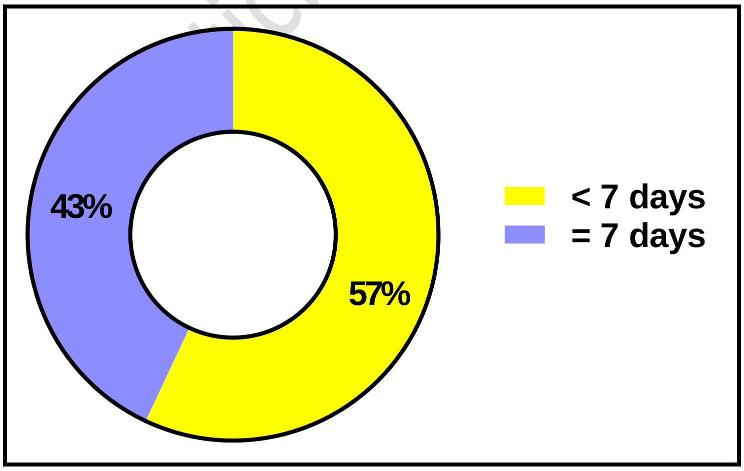

Figure 2: Latency period in the studied females.

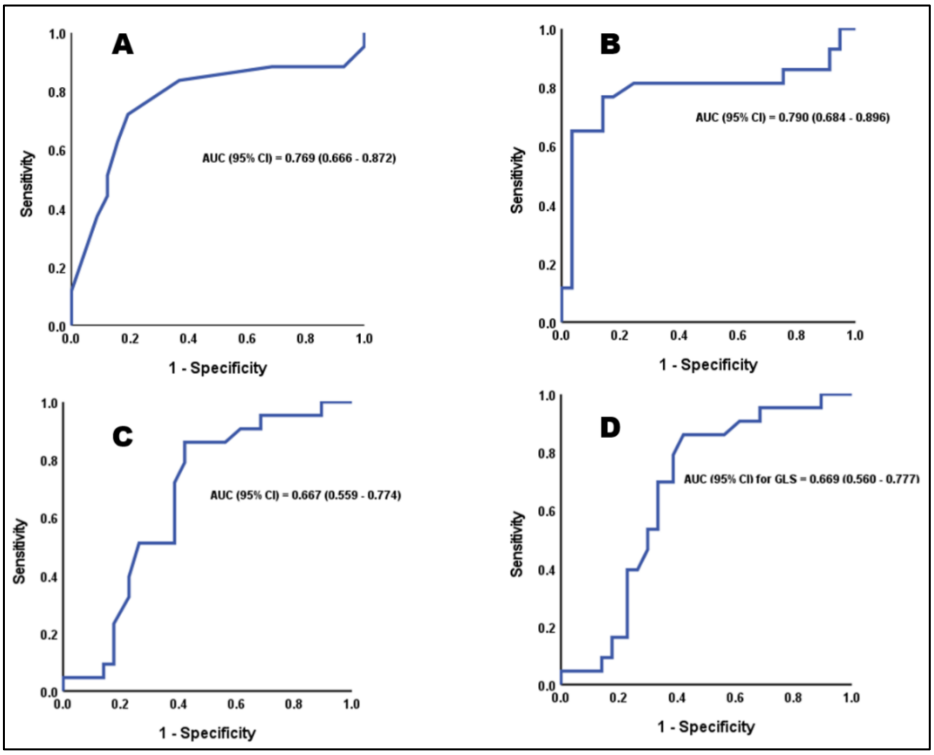

Figure 3: ROC analysis of a) AFI; b) Uterocervical angle; c) Doppler PI; d) Doppler S/D to predict latency period ≥ 7 days.

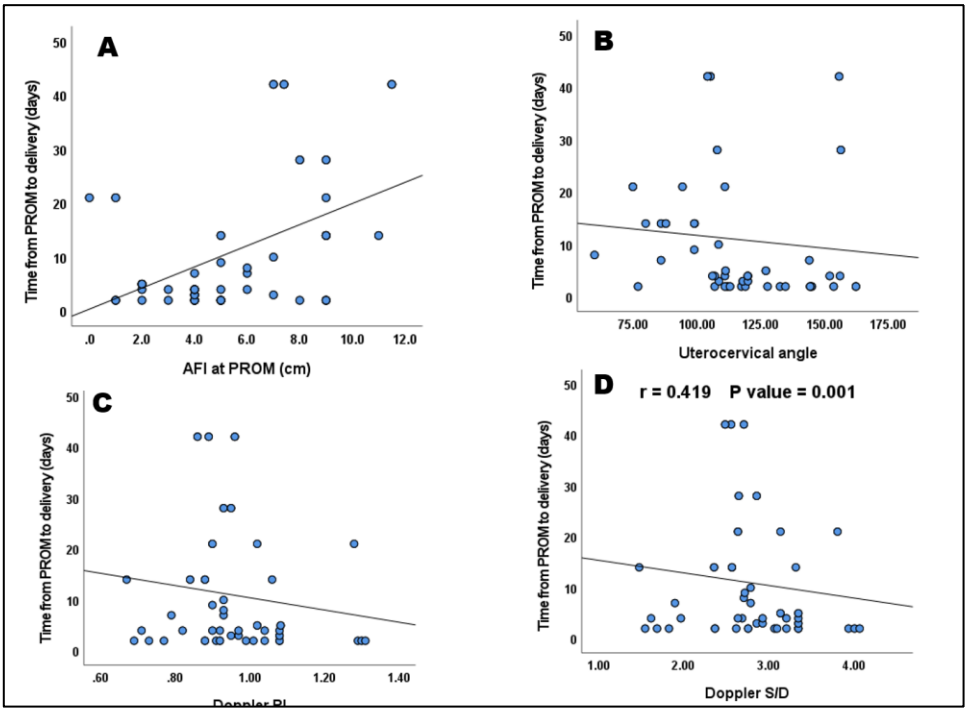

Figure 4: Correlation between latency period and a) AFI; b) Uterocervical angle; c) Doppler PI; d) Doppler S/D.

Discussion

PPROM poses significant risks, including infection and neonatal complications. Non-invasive indices like AFI, UCA and UA doppler are crucial for effective management and predicting the latency period in PPROM cases (12). In this study, we examined the correlation between AFI, uterocervical angle, and umbilical artery Doppler with the latency period in 100 PPROM cases.

In the present study, females had a mean age of 28 years, mean weight of 73 kg, mean height of 161 cm, and a mean BMI of 27.95. Median parity was 1 (0-5), and median gravidity was 2 (1-6). In terms of the interval between PROM and delivery (latency period), 57 participants (57%) delivered within 7 days (group I), while 43 participants (43%) delivered 7 or more days after PROM (group II. The analysis revealed no significant differences found in age, BMI, parity, gravidity, and gestational age at PROM.

In a similar study, Abedini et al. (2022), explored the relationship between the AFI and the uterocervical angle in patients with PROM. This study included 50 pregnant women with PROM, with a mean patient age of 25.14 ± 5.32 years. The participants were categorized into two groups based on delivery latency: those with a latency period of ≤ 7 days and those with a latency period of > 7 days. Among the participants, 23 (46%) experienced a delivery latency of ≤ 7 days. The study found no statistically significant differences in baseline characteristics between the two groups (P > 0.05) (13).

A study by Lee et al. (2018), indicated that the mean age for the ≤3 days latency group is 33.64 ± 4.01 years and 34.57 ± 3.62 years for the >3 days group (p = 0.229). The mean BMI for the ≤3 days group is 26.60 ± 3.08 kg/m², significantly higher than the 24.99 ± 3.62 kg/m² for the >3 days group (p = 0.020). Gravidity and parity showed no significant differences between the groups, with gravidity at 1.84 ± 1.26 versus 2.00 ± 1.06 (p = 0.179) and parity at 0.40 ± 0.69 versus 0.50 ± 0.69 (p = 0.357) (14). Our study patients appear younger with a slightly higher BMI, possibly reflecting differences in sample demographics or regional health patterns or might be attributed to variations in study populations and specific inclusion criteria (14).

Chorioamnionitis, an infection of the amniotic fluid and membranes, shortens the latency period by triggering an inflammatory response that weakens fetal membranes and prompts uterine contractions, leading to earlier labor. This accelerated delivery reduces the risk of severe maternal and fetal complications (15).

Patients with preterm PROM the most likely outcome is preterm delivery within one week with its associated morbidity and mortality risk such as respiratory distress necrotising enterocolitis, intra ventricular haemorrhage and sepsis (16). The incidence of neonatal infection for infants born to women with PROM range from 1–2.6% (17).

article in press

In the present study, females with a PROM to delivery time of less than 7 days had a significantly higher rate of urgent caesarean sections and spontaneous deliveries compared to those with 7 or more days.

The difference in outcomes based on the time from PROM to delivery can be attributed to varying risks and labor progression rates. A shorter interval from PROM to delivery often necessitates urgent interventions, such as cesarean sections, due to increased complications. Conversely, a shorter interval can also mean quicker labor progression, leading to a higher rate of spontaneous deliveries.

In our study, the median AFI at PROM was significantly lower in group I compared to group II. The mean uterocervical angle was significantly larger in group I. Doppler measurements showed higher PI and S/D ratio in group I.

Similarly, Abedini et al. (2022), revealed that participants who delivered within 7 days had a mean uterocervical angle of 114.52 ± 7.82 degrees, while those who delivered after 7 days had a mean angle of 97.11 ± 7.98 degrees and also according to AFI showing a mean of 4.54 ± 1.97 for participants who delivered within 7 days, while those who delivered after 7 days had a mean AFI of 8.45 ± 2.89 ($P < 0.001$) (13).

Blood flow in the ductus arteriosus, as assessed by Doppler ultrasound, is altered by breathing movements; in a study of 12 cases of PPROM and severe oligohydramnios, the alteration in ductal blood flow by breathing movements was normal in seven cases with normal lungs, and reduced in all five cases with pulmonary hypoplasia (18). Rizzo et al. measured the PI in the peripheral pulmonary arteries in 20 pregnancies complicated by amniorrhexis at < 24 weeks' gestation and reported that in fetuses that subsequently developed pulmonary hypoplasia, the PI was increased from as early as 2 weeks after amniorrhexis (19).

A higher PI is associated with a shorter latency period following PROM, indicating increased vascular resistance and compromised placental function. This impairment reduces oxygen and nutrient supply to the fetus, prompting earlier delivery to prevent adverse outcomes for both mother and baby (20).

The S/D ratio measures blood flow resistance in the umbilical artery. An elevated S/D ratio indicates placental insufficiency, suggesting the placenta is not delivering adequate oxygen and nutrients to the fetus. This may prompt earlier intervention and delivery to prevent fetal distress and ensure maternal and fetal safety (6).

The mean gestational age at diagnosis of premature rupture of membranes (PROM) was 211 ± 23 days, and the mean gestational age at delivery was 221 ± 25 days. The median time from PROM to delivery was 4 days, ranging from 0 to 42 days. In terms of the interval between PROM and delivery (latency period), 57 participants (57%) delivered within 7 days, while 43 participants (43%) delivered 7 or more days after PROM.

Lee et al. (14) found that preterm premature rupture of membranes (PPROM) for the ≤3 days latency group is 32.9 weeks (range: 27.2–34.6) and 30.6

weeks (range: 28.6–34.5) for the >3 days group, with no significant difference. However, the GA at delivery shows a significant difference, with the ≤3 days group at 33.2 weeks (range: 27.3–34.8) compared to 34.0 weeks (range: 30.5–35.2) for the >3 days group.

ROC analysis for predicting a latency period of >7 days showed significant results for several parameters. AFI had an AUC of 0.769, with a cutoff point >5 showing sensitivity, specificity, PPV, and NPV of 80%, 100%, 100%, and 83.3%, respectively. The uterocervical angle had an AUC of 0.790 with similar predictive values. PI showed an AUC of 0.667, and S/D revealed an AUC of 0.669, both with a cutoff point >5 and the same sensitivity, specificity, PPV, and NPV values.

Our study's findings align with those of Lee et al. (2018), who aimed to predict the latency period in 121 patients with PPROM. They found that a mean AFI of less than 5.4, with a sensitivity of 81.5% and a specificity of 65.5%, was a significant predictive factor. The AUC for AFI was 0.866, indicating its strong predictive capability (14). Similarly, Daskalakis et al. 2018, reported that UCA cut-off of 95 or 105 degrees is effective in predicting gestational length. Consistent with these findings, our study identified a UCA above 107.7 degrees, with a sensitivity of 87.0% and a specificity of 88.9%, as a predictive factor, and an AUC of 0.912, demonstrating high predictive power (21). In the United States, Knight et al. 2018, conducted a study involving 259 pregnant women, revealing that a UCA greater than 110 degrees, with a sensitivity of 80% and a specificity of 82%, could predict gestational lengths of less than 32 weeks in twin pregnancies (22). Additionally, Dziadosz et al. 2016, found that a UCA of ≥95 degrees were significantly associated with spontaneous preterm birth before 37 weeks, with a sensitivity of 80% (P < .001; confidence interval, 0.70-0.81; negative predictive value, 95%). A UCA of ≥105 degrees predicted spontaneous preterm birth before 34 weeks, with a sensitivity of 81% (P < .001; confidence interval, 0.72-0.86; negative predictive value, 99%) (23).

Our study found significant correlations between the latency period and several variables. A positive correlation was observed with AFI at PROM, while the uterocervical angle, Doppler PI, and Doppler S/D ratio were negatively correlated, indicating that larger uterocervical angles and higher Doppler PI and S/D ratios are associated with shorter latency periods and increased vascular resistance.

This study has some limitations including its single-centre design, which may limit generalizability, and the relatively small sample size.

Conclusion

Our study demonstrates that AFI and UCA are significant predictors of the latency period in PPROM, with higher AFI and smaller UCA associated with prolonged latency. These parameters can aid in better management of PPROM, improving maternal and fetal outcomes.

References

1. Patil S, Patil V. Maternal and foetal outcome in premature rupture of membranes. IOSR-JDMS. 2014;13:56-81.
2. Sirak B, Mesfin E. Maternal and Perinatal Outcome of Pregnancies with Preterm

article in press

Premature Rupture of Membranes (PPROM) at Tikur Anbessa Specialized Teaching Hospital, Addis Ababa, Ethiopia. Ethiop Med J. 2014;52:165-72.
3. Lorthe E, Kayem G. Tocolysis in the management of preterm prelabor rupture of membranes at 22-33 weeks of gestation: study protocol for a multicenter, double-blind, randomized controlled trial comparing nifedipine with placebo (TOCOPROM). BMC Pregnancy Childbirth. 2021;21:614.
4. Günay T, Erdem G, Bilir RA, Hocaoglu M, Ozdamar O, Turgut A. The association of the amniotic fluid index (AFI) with perinatal fetal and maternal outcomes in pregnancies complicated by preterm premature rupture of membranes (PPROM). Ginekologia Polska. 2020;91:465-72.
5. Wagner P, Schlechtendahl J, Hoopmann M, Prodan N, Abele H, Kagan KO. Measurement of the uterocervical angle for the prediction of preterm birth in symptomatic women. Arch Gynecol Obstet. 2021;304:663-9.
6. Sharma M, Sharma G, Verma A. Umbilical Artery Systolic/Diastolic Ratio and Amniotic Fluid Index in Prediction of Adverse Perinatal Outcome in Term Pregnancies. Int J Appl Basic Med Res. 2022;12:76-81.
7. Conde-Agudelo A, Romero R, Jung EJ, Garcia Sánchez Á J. Management of clinical chorioamnionitis: an evidence-based approach. Am J Obstet Gynecol. 2020;223:848-69.
8. Phelan JP, Ahn MO, Smith CV, Rutherford SE, Anderson E. Amniotic fluid index measurements during pregnancy. J Reprod Med. 1987;32:601-4.
9. Moore TR, Cayle JE. The amniotic fluid index in normal human pregnancy. Am J Obstet Gynecol. 1990;162:1168-73.
10. Luechathananon S, Songthamwat M, Chaiyarach S. Uterocervical Angle and Cervical Length as a Tool to Predict Preterm Birth in Threatened Preterm Labor. Int J Womens Health. 2021;13:153-9.
11. Berkley E, Chauhan SP, Abuhamad A. Doppler assessment of the fetus with intrauterine growth restriction. Am J Obstet Gynecol. 2012;206:300-8.
12. Bohilțea RE, Cioca AM, Dima V, Ducu I, Grigoriu C, Varlas V, et al. Expectant Management of PPROM Improves Neonatal Outcome-A Retrospective Study of 562 Patients. J Clin Med. 2021;11.
13. Abedini F, Mohammadian Amiri M, Danaei M, Eshraghi N. Assessment of Communication AFI and Uterocervical Angle with Pregnancy Duration in Patients with Pretem Premature Rupture of Membranes 24-34 Weeks. Journal of Obstetrics, Gynecology and Cancer Research. 2022;7:489-96.
14. Lee YJ, Kim SC, Joo JK, Lee DH, Kim KH, Lee KS. Amniotic fluid index, single deepest pocket and transvaginal cervical length: Parameter of predictive delivery latency in preterm premature rupture of membranes. Taiwan J Obstet Gynecol. 2018;57:374-8.
15. Jung E, Romero R, Suksai M, Gotsch F, Chaemsaithong P, Erez O, et al. Clinical chorioamnionitis at term: definition, pathogenesis, microbiology, diagnosis, and treatment. Am J Obstet Gynecol. 2024;230:S807-s40.
16. Kifah AQQ, Fatin AA. Neonatal outcome and prenatal antibiotic treatment in premature rupture of membranes. 2005.
17. Seaward PG, Hannah ME, Myhr TL, Farine D, Ohlsson A, Wang EE, et al. International multicenter term PROM study: evaluation of predictors of neonatal infection in infants born to patients with premature rupture of membranes at term. Premature Rupture of the Membranes. Am J Obstet Gynecol. 1998;179:635-9.
18. van Eyck J, van der Mooren K, Wladimiroff JW. Ductus arteriosus flow velocity modulation by fetal breathing movements as a measure of fetal lung development. Am J Obstet Gynecol. 1990;163:558-66.
19. Rizzo G, Capponi A, Angelini E, Mazzoleni A, Romanini C. Blood flow velocity waveforms from fetal peripheral pulmonary arteries in pregnancies with preterm premature rupture of the membranes: relationship with pulmonary hypoplasia. Ultrasound Obstet Gynecol. 2000;15:98-103.
20. Thompson RS, Trudinger BJ. Doppler waveform pulsatility index and resistance, pressure and flow in the umbilical placental circulation: an investigation

using a mathematical model. Ultrasound Med Biol. 1990;16:449-58.
21. Daskalakis G, Theodora M, Antsaklis P, Sindos M, Grigoriadis T, Antsaklis A, et al. Assessment of Uterocervical Angle Width as a Predictive Factor of Preterm Birth: A Systematic Review of the Literature. Biomed Res Int. 2018;2018:1837478.
22. Knight JC, Tenbrink E, Onslow M, Patil AS. Uterocervical Angle Measurement Improves Prediction of Preterm Birth in Twin Gestation. Am J Perinatol. 2018;35:648-54.
23. Dziadosz M, Bennett TA, Dolin C, West Honart A, Pham A, Lee SS, et al. Uterocervical angle: a novel ultrasound screening tool to predict spontaneous preterm birth. Am J Obstet Gynecol. 2016;215:376.e1-7.

To cite this article: Omar K. Naser, Amina E. Elfakharany, Wagdy M. Amer, and Diaa M. El-Mowafi. Correlation between Amniotic Fluid Index, Uterocervical Angle and Umbilical Artery Doppler with Latency Period in Preterm Premature Rupture of Membranes. BMFJ XXX, DOI: 10.21608/bmfj.2025.317060.2188

article in press