

ASSOCIATION OF THE AMNIOTIC FLUID INDEX (AFI) WITH ADVERSE PERINATAL FETAL AND MATERNAL OUTCOMES IN PREGNANCIES COMPLICATED BY PRETERM PREMATURE RUPTURE OF MEMBRANES (PPROM)

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DOI: <https://doi.org/10.5281/zenodo.17607169>

Keywords

Amniotic fluid index, PPRM, preterm birth, perinatal outcome, chorioamnionitis.

Article History

Received: 10 July 2025

Accepted: 25 August 2025

Published: 02 September 2025

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Abstract

Background: Preterm premature rupture of membranes (PPROM) is a significant obstetric complication contributing to preterm birth and adverse perinatal outcomes.

Objective: To determine the association of amniotic fluid index (AFI) with adverse perinatal and maternal outcomes in pregnancies complicated by PPRM.

Methodology: This prospective cohort study was conducted at the Department of Obstetrics and Gynecology, Sahiwal Teaching Hospital, Sahiwal, from March 2025 to June 2025, on 60 women diagnosed with PPRM. Participants were divided into two groups: AFI < 5 cm (n = 30) and AFI ≥ 5 cm (n = 30). Data on maternal and neonatal outcomes, including cesarean delivery, chorioamnionitis, birth weight, NICU admission, respiratory distress syndrome (RDS), and Apgar score <7 at 5 minutes, were recorded.

Results: The mean birth weight was significantly lower in the AFI < 5 cm group (1455.2 ± 325.6 g) compared to the AFI ≥ 5 cm group (1618.9 ± 285.4 g; p = 0.03). Low Apgar scores (<7 at 5 minutes) were more frequent in the low AFI group (46.7% vs. 20.0%; p = 0.04). RDS (40.0% vs. 16.7%; p = 0.05) and NICU admissions (53.3% vs. 30.0%; p = 0.07) were also more common among low AFI cases. Maternal complications, including cesarean delivery (56.7% vs. 33.3%) and chorioamnionitis (33.3% vs. 13.3%), were higher in the AFI < 5 cm group.

Conclusion: It is concluded that low AFI (<5 cm) in pregnancies complicated by PPRM is associated with a higher risk of adverse perinatal and maternal outcomes. Regular AFI monitoring can assist in timely decision-making, guiding delivery planning, and improving neonatal survival and maternal safety.

INTRODUCTION

Preterm premature rupture of the membranes (PPROM) occurs in 3% of pregnancies and causes around 25-30% of all preterm deliveries. Due to PPRM being an important cause of perinatal morbidity and mortality, it is noteworthy to mention that it has a shorter time gap between PPRM and delivery [1]. In this timeframe, there is the potential for pre-existing pathogenic microorganisms to ascend the lower genitourinary tract which may cause intrauterine infections [2]. Moreover, several authors have described PROM as an associated pathological sequela of inflammatory and infectious processes involving the membranes. After the premature rupture of membranes, involvement of the brief amnion and choriodecidual bacterial infection has been documented [3]. It has been documented that amniocentesis performed with no clinical signs of chorioamnionitis with PPRM has up to 25-30% positive amniotic fluid culture [4]. Since the amniotic fluid index (AFI), a commonly used tool for assessment of fetal well-being, has shown the ability of predicting poor outcomes, it is useful in the case argues to the deciding the optimal type of delivery for pregnancies complicated with PPRM [5]. Following PPRM, the presence of oligohydramnios (AFI < 5 cm) has been suggested in the literature to correlate with a greater likelihood for poor fetal (i.e. intrauterine growth restriction, fetal distress, pulmonary hypoplasia, respiratory distress syndrome, neonatal sepsis, necrotizing enterocolitis, intraventricular hemorrhage, bronchopulmonary dysplasia, and other) and maternal (i.e. chorioamnionitis) poor outcomes during the perinatal period, which increases the neonatal sepsis and mortality [6,7]. In the AFI < 5 cm group, fetal birth weight was significantly lower (1622.86 ± 273.75 vs 1440.74 ± 336.33 , $p = 0.042$) compared to the AFI ≥ 5 cm group.8 Overall, 41.7% of women were observed to have maternal complications, a large portion of which included chorioamnionitis (33.3%), endometritis (25.0%), and were documented. Most neonates were noted to have fetal complications (72.9%), which include having a 5-minute Apgar score ≤ 5 (52.1%), having an ICU stay (66.7%), and having respiratory distress syndrome (52.1%) [8]. Another research recorded an Apgar score of < 7 at 5 min in 5.6% of neonates in the AFI ≤ 5 cm group and in

1.2% of neonates in the AFI > 5 cm group, with a p-value of 0.02. NICU admissions were recorded in 14.2% of neonates in the AFI < 5 cm group, and in 5.5% of the neonates in the AFI > 5 cm group (p-value 0.005) [9]. This and previous studies pertaining to this topic are available, however, local data is lacking, and in this regard, research should be conducted to properly manage these specific patients to arrange all essential resources in order to improve the fetomaternal outcomes.

Objectives

- To determine the association of the amniotic fluid index (AFI) with adverse perinatal fetal and maternal outcomes in pregnancies complicated by preterm premature rupture of membranes (PPROM).

Methodology

This was a prospective cohort study conducted at the Department of Obstetrics and Gynecology, Sahiwal Teaching Hospital, Sahiwal, from March 2025 to June 2025. A total of 60 pregnant women (30 exposed and 30 unexposed) were included. The sample size was calculated using a 5% level of significance, 80% study power, and the expected mean fetal birth weights of 1622.86 ± 273.75 g in the AFI ≥ 5 cm group and 1440.74 ± 336.33 g in the AFI < 5 cm group. Non-probability consecutive sampling technique was used to collect the data.

Inclusion Criteria:

- Exposed and unexposed participants as per operational definition.
- Women aged 18–45 years presenting with preterm premature rupture of membranes (PPROM) according to the defined criteria.
- Both booked and unbooked cases.
- Both primiparous and multiparous women.

Exclusion Criteria:

- Multiple pregnancy, cervical cerclage, major congenital anomalies, oligohydramnios, polyhydramnios, pregnancy-induced hypertensive disorders, cervical dilatation ≥ 6 cm on admission, and those delivering immediately upon admission.

Data Collection

After approval from the Institutional Ethical Review Committee, 60 eligible patients meeting the inclusion criteria were enrolled after obtaining written informed consent. Detailed maternal history and examination findings were recorded, including age, parity, booking status, smoking status, and duration since PPRM. Fetal data such as gestational age at delivery, birth weight (grams), and gender were documented. Maternal complications like cesarean delivery and chorioamnionitis, and neonatal outcomes including NICU stay, sepsis, respiratory distress syndrome (RDS), and Apgar score < 7 at 5 minutes, were noted. All patients were managed as per the hospital standardized protocol. Data were recorded in a predesigned proforma.

Data Analysis

Data were analyzed using SPSS version 25.0. The Shapiro-Wilk test was applied to assess normality. Continuous variables such as age, gestational age, PPRM duration, and birth weight were presented as mean $\pm$ SD or median (IQR), while categorical variables (booking status, smoking, cesarean delivery, chorioamnionitis, NICU stay, sepsis, RDS, and Apgar < 7 at 5 minutes) were presented as frequencies and

percentages. Comparisons between the exposed and unexposed groups were performed using the Chi-square test, with a p-value $\leq$ 0.05 considered statistically significant. Relative risk (RR) was also calculated. Potential confounding variables (age, gestational age, parity, PPRM duration, booking status, and smoking) were stratified, followed by post-stratification Chi-square or Fisher's exact tests to assess their effects on maternal and perinatal outcomes.

Results

Data were collected from 60 patients, mean maternal age was comparable between the two groups (28.4 ± 5.9 years in AFI < 5 cm vs. 27.9 ± 5.6 years in AFI $\geq$ 5 cm). A majority of women in both groups were multigravida (63.3% vs. 60.0%), and most were unbooked cases (66.7% vs. 63.3%). The mean gestational age at delivery was lower among women with AFI < 5 cm (33.1 ± 2.3 weeks) compared to those with AFI $\geq$ 5 cm (34.5 ± 2.0 weeks), indicating earlier delivery in the low AFI group. Similarly, the mean latency period after PPRM was shorter in the AFI < 5 cm group (31.8 ± 12.4 hours) than in the AFI $\geq$ 5 cm group (42.6 ± 15.7 hours).

Table 1. Baseline Maternal and Obstetric Characteristics of the Study Participants (n = 60)

Variable	AFI < 5 cm (n = 30)	AFI $\geq$ 5 cm (n = 30)
Age (years), mean $\pm$ SD	28.4 ± 5.9	27.9 ± 5.6
Parity		
• Primigravida	11 (36.7%)	12 (40.0%)
• Multigravida	19 (63.3%)	18 (60.0%)
Booking status		
• Booked	10 (33.3%)	11 (36.7%)

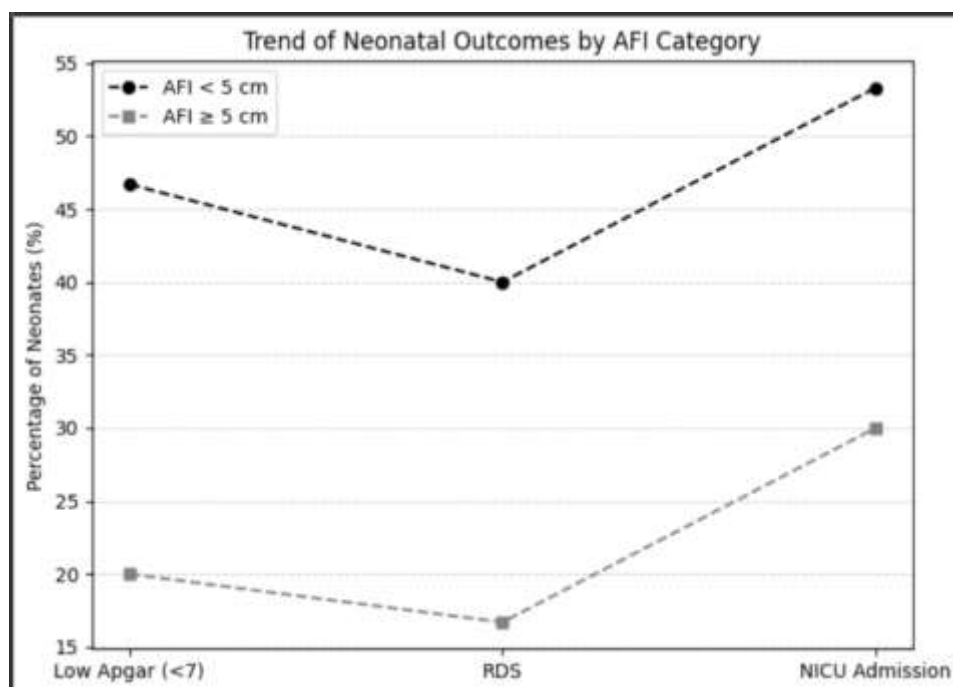
• Unbooked	20 (66.7%)	19 (63.3%)
Gestational age at delivery (weeks), mean $\pm$ SD	33.1 $\pm$ 2.3	34.5 $\pm$ 2.0
Latency period after PPROM (hours), mean $\pm$ SD	31.8 $\pm$ 12.4	42.6 $\pm$ 15.7

Neonates of mothers with AFI < 5 cm had significantly lower mean birth weights (1455.2 $\pm$ 325.6 g) compared to those with AFI ≥ 5 cm (1618.9 $\pm$ 285.4 g; $p = 0.03$). Low Apgar scores (< 7 at 5 minutes) were also more frequent in the low AFI group (46.7% vs. 20.0%; $p = 0.04$). Respiratory distress syndrome (RDS) was observed in 40.0% of the low AFI group versus 16.7% of the normal AFI group ($p = 0.05$). Although neonatal sepsis (36.7% vs. 16.7%; $p = 0.08$)

and NICU admissions (53.3% vs. 30.0%; $p = 0.07$) were more frequent in the low AFI group, these differences did not reach statistical significance. Among maternal outcomes, cesarean delivery (56.7% vs. 33.3%; $p = 0.09$) and chorioamnionitis (33.3% vs. 13.3%; $p = 0.08$) were both higher in women with AFI < 5 cm, showing a consistent trend toward increased maternal complications.

Table 2. Neonatal and maternal Outcomes According to Amniotic Fluid Index

Outcome	AFI < 5 cm (n = 30)	AFI ≥ 5 cm (n = 30)	p-value
Birth weight (g), mean $\pm$ SD	1455.2 $\pm$ 325.6	1618.9 $\pm$ 285.4	0.03 *
Apgar score < 7 at 5 minutes	14 (46.7%)	6 (20.0%)	0.04 *
Neonatal sepsis	11 (36.7%)	5 (16.7%)	0.08
Respiratory distress syndrome	12 (40.0%)	5 (16.7%)	0.05 *
NICU admission	16 (53.3%)	9 (30.0%)	0.07
Maternal Outcomes			
Cesarean delivery	17 (56.7%)	10 (33.3%)	0.09
Chorioamnionitis	10 (33.3%)	4 (13.3%)	0.08



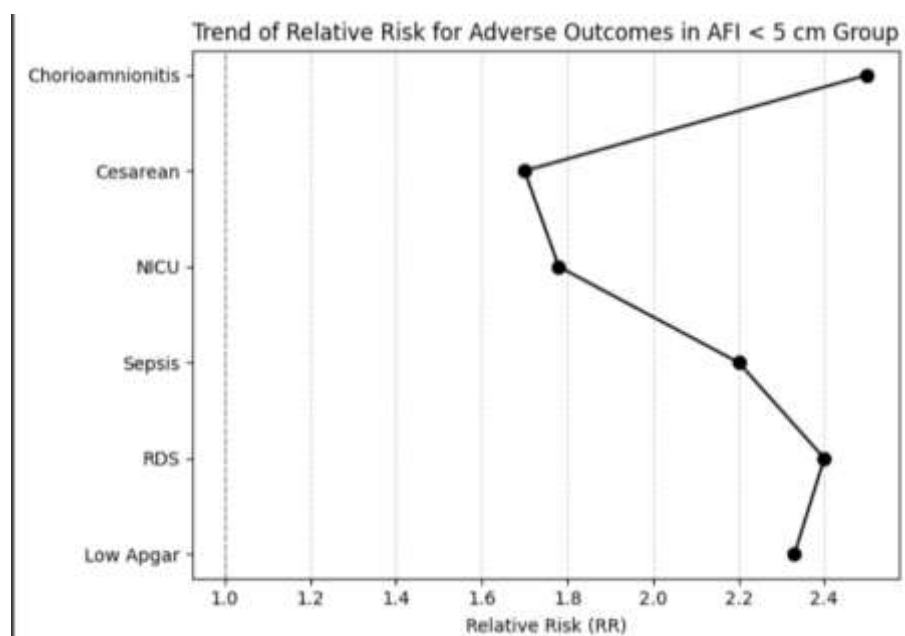
A low Apgar score at 5 minutes had a significant RR of 2.33 (95% CI: 1.03–5.26; $\chi^2 = 4.11$; $p = 0.04$), and RDS showed an RR of 2.40 (95% CI: 0.97–5.95; $\chi^2 = 3.78$; $p = 0.05$). Neonatal sepsis and NICU admission

had elevated but non-significant risks (RR = 2.20 and 1.78, respectively). Similarly, cesarean delivery and chorioamnionitis had higher but non-significant relative risks (RR = 1.70 and 2.50, respectively).

Table 3. Relative Risk and Test Statistics for Adverse Perinatal and Maternal Outcomes in AFI < 5 cm Group (n = 30)

Adverse Outcome	Relative Risk (RR)	95% Confidence Interval (CI)	Test Statistic	p-value
Apgar score <7 at 5 minutes	2.33	1.03 – 5.26	$\chi^2 = 4.11$	0.04 *
Respiratory distress syndrome (RDS)	2.40	0.97 – 5.95	$\chi^2 = 3.78$	0.05 *
Neonatal sepsis	2.20	0.87 – 5.55	$\chi^2 = 3.03$	0.08
NICU admission	1.78	0.89 – 3.54	$\chi^2 = 3.29$	0.07
Cesarean delivery	1.70	0.93 – 3.11	$\chi^2 = 2.90$	0.09
Chorioamnionitis	2.50	0.89 – 7.01	$\chi^2 = 3.15$	0.08

*Significant at $p \leq 0.05$.



Discussion

This study evaluated the association between the amniotic fluid index (AFI) and adverse perinatal fetal and maternal outcomes in pregnancies complicated by preterm premature rupture of membranes (PPROM). Findings indicated that AFI < 5 cm, or Low AFI, is consistently correlated to more frequent and severe negative maternal and neonatal outcomes, such as lower-birth-weight neonates, shorter latency periods, greater RDS, lower Apgar scores, NICU admissions, cesarean deliveries, and chorioamnionitis, compared to cases where AFI was greater or equal to 5 cm. Describing the association found between Low AFI and negative outcomes on neonates in this study is consistent with previous literature that reduced volumes of amniotic fluid in PPRM was indicative of prolonged fluid leakage, diminished fetal urinary output, and risks of cord compression, intrauterine hypoxia, and growth restriction due to hypoxia. Authors of previous studies have also reported that neonates with AFI < 5 cm had birth weights that were significantly lower and Apgar scores that were rated lower, thus supporting the results of the present study [10]. In terms of growth and perinatal adaptability, the birth weight means of the group with Low AFI (1455 g) and the Normal AFI Group (1619 g) demonstrate that oligohydramnios is

in fact a contributive, negative factor. The biological reasoning on the greater RDS and NICU admissions in the AFI < 5 cm group is also compelling. Amniotic fluid is crucial for the development of the lungs as it keeps the alveoli expanded and promotes surfactant production. A deficiency can cause pulmonary hypoplasia and maturation of surfactant can be delayed. Past studies indicate that after PPRM, low AFI is linked with greater chances of developing complications related to neonatal respiration and an extended stay in the NICU; these findings corroborate the results of the present study. [11-13]. Among those of low amniotic fluid index (AFI), maternal complications such as chorioamnionitis were more pronounced. This finding confirms prior conclusions that lower volume fluid increases the risks of ascending intrauterine infection as there is a weakened protective barrier along with prolonged latency. The increased cesarean section rate in the AFI < 5 cm group may be explained by common characteristics seen with oligohydramnios such as fetal distress, cord compression, and non-reassuring fetal heart rate patterns [14]. Similar trends have been documented in the literature where decreased AFI in preterm premature rupture of the membranes (PPROM) is associated with increased likelihood of emergency cesarean sections and

intrapartum complications. Although not all associations in this investigation attained statistical significance, the magnitude of the associations was considerable. The consistent pattern of increased risks in the low AFI group strengthens the prognostic value of AFI in the management of PPROM [15-17]. AFI is a straightforward, non-invasive ultrasound technique that assists in the identification of specific high-risk pregnancies [18]. The current findings corroborate the prior conclusions on the relevance of AFI as a key determinant of perinatal outcomes in the context of PPROM. The divergences in statistical significance in the literature may be due to differences in gestational age at rupture, latency management strategies, and the use of prophylactic antibiotics and steroids. The ability to replicate trends across several studies affirms the trustworthiness of the AFI as a prognostic indicator.

Conclusion

It is concluded that a low amniotic fluid index (AFI < 5 cm) in pregnancies complicated by preterm premature rupture of membranes (PPROM) is significantly associated with an increased risk of adverse perinatal and maternal outcomes. These include lower birth weight, low Apgar scores, higher incidence of respiratory distress syndrome, increased NICU admissions, and greater likelihood of chorioamnionitis and cesarean delivery. Although some associations did not achieve statistical significance, the consistent trend indicates that AFI serves as a reliable prognostic marker in PPROM. Regular assessment of AFI can therefore assist clinicians in timely risk stratification, optimizing management decisions, and improving overall perinatal prognosis.

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