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FETOMATERNAL OUTCOME IN PATIENTS WITH LOW AMNIOTIC FLUID INDEX IN PREGNANCY

Original Research

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ABSTRACT

Background: Amniotic fluid plays a critical role in fetal development, serving as a protective medium and a marker of placental function. The amniotic fluid index (AFI), measured via ultrasound, is a widely accepted tool for assessing fluid volume. Oligohydramnios, defined as an AFI ≤5 cm, has been linked to several adverse perinatal outcomes, including intrauterine growth restriction (IUGR), low birth weight, and neonatal morbidity. Early identification through routine antenatal screening is essential for timely intervention and improved maternal and fetal outcomes.

Objective: To determine the frequency of low amniotic fluid index (AFI) in women presenting for routine antenatal checkups and to compare fetomaternal outcomes between patients with low AFI and those with normal AFI levels.

Methods: This descriptive case series was conducted at the Department of Obstetrics and Gynaecology, Ch. Muhammad Akram Teaching and Research Hospital, Lahore, from December 2024 to February 2025. A total of 205 pregnant women meeting the inclusion criteria were enrolled using non-probability consecutive sampling. The AFI was assessed by ultrasound, with ≤5 cm defined as low. Patients were monitored throughout pregnancy and childbirth. Data were collected using a structured proforma and analyzed using SPSS version 26. Chi-square test was applied, and a p-value ≤0.05 was considered statistically significant.

Results: The mean maternal age was 30.40 ± 5.76 years. The average gestational age was 36.33 ± 1.72 weeks, and the mean birth weight was 3.01 ± 0.42 kg. Low AFI was observed in 14 patients (6.83%). Among these, 9 (27.3%) neonates had low birth weight compared to 5 (2.9%) in the normal AFI group ($p < 0.001$). Significant associations were also found between low AFI and meconium staining (50.0% vs 4.1%, $p < 0.001$), IUGR (50.0% vs 4.1%, $p < 0.001$), neonatal ICU admissions (42.9% vs 5.6%, $p = 0.008$), low APGAR scores (42.9% vs 2.7%, $p < 0.001$), cesarean delivery (13.1% vs 2.5%, $p = 0.003$), and neonatal death (66.7% vs 5.9%, $p = 0.013$).

Conclusion: Low amniotic fluid was identified in a notable proportion of patients and was significantly associated with adverse fetomaternal outcomes. Routine AFI monitoring during antenatal visits is crucial for identifying high-risk pregnancies and initiating timely interventions.

Keywords: Amniotic Fluid Index, Cesarean Section, Fetal Growth Retardation, Neonatal Mortality, Oligohydramnios, Pregnancy Outcomes, Ultrasonography.

INTRODUCTION

Pregnancy is a complex physiological process requiring a harmonious interplay between maternal and fetal health to ensure favorable outcomes. Among the various parameters used to monitor fetal well-being, the Amniotic Fluid Index (AFI) plays a vital role. Amniotic fluid not only acts as a protective cushion for the fetus but also facilitates the exchange of nutrients, water, and biochemical substances, which are critical for fetal growth and development (1). The AFI, determined via ultrasound, provides a quantitative estimate of amniotic fluid by summing measurements from four uterine quadrants. Maintaining this index within a normal range is essential, as deviations can signal potential threats to fetal health (2,3). In the later stages of gestation, AFI becomes a cornerstone of fetal surveillance, especially in the absence of labor, offering valuable insight into placental function and fetal oxygenation (4). Globally, the prevalence of reduced AFI—commonly termed oligohydramnios—varies between 1% and 5% of all pregnancies, influenced by population characteristics and regional health practices (5). When oligohydramnios occurs early in pregnancy, it is often associated with congenital anomalies and adverse outcomes such as intrauterine growth restriction (IUGR) and skeletal or renal malformations. Conversely, late-onset oligohydramnios is more frequently linked to umbilical cord compression, malpresentation, thick meconium, fetal distress, or complications stemming from maternal conditions such as preeclampsia or vascular disorders (6,7). These risks underscore the importance of early detection and appropriate clinical intervention.

In resource-limited settings where access to advanced fetal monitoring techniques like Doppler studies, fetal scalp pH analysis, and continuous nonstress testing is restricted, the AFI serves as a cost-effective, non-invasive tool for identifying at-risk pregnancies. However, there remains a scarcity of research that comprehensively compares fetomaternal outcomes in pregnancies with low AFI to those with normal levels. Most existing studies narrowly focus on the consequences of low AFI in isolation, failing to provide a baseline for comparison, thus limiting their applicability across diverse clinical settings (8). This study aims to bridge this knowledge gap by evaluating the fetomaternal outcomes associated with low AFI (≤5 cm) and comparing them with those from pregnancies exhibiting normal AFI. Outcomes of interest include low birth weight, APGAR scores, meconium staining, IUGR, neonatal intensive care unit (NICU) admissions, neonatal mortality, and mode of delivery. Additionally, the study seeks to determine the prevalence of low AFI among women presenting for routine prenatal checkups. Through this comparative analysis, the research endeavors to provide clinically relevant insights that can guide obstetric decision-making in environments with limited diagnostic resources.

METHODS

This descriptive case series was conducted in the Department of Obstetrics and Gynaecology at Ch. Muhammad Akram Teaching and Research Hospital, Lahore, over a three-month period from December 2024 to February 2025. The study aimed to assess fetomaternal outcomes in patients with low versus normal amniotic fluid index (AFI), using a structured methodological approach. Amniotic fluid volume was measured via ultrasonography by calculating the anteroposterior diameter of the largest unobstructed fluid pocket in each of the four quadrants of the uterus, excluding any segments containing umbilical cord or fetal parts. The sum of these measurements constituted the AFI, with the normal range defined as 6–25 cm. Additionally, each individual pocket was expected to measure between 2 and 8 cm. An AFI value of ≤5 cm was labeled as low amniotic fluid, in line with standard clinical definitions. The calculated sample size was 205, based on a 95% confidence level, 3% margin of error, and an estimated prevalence of low amniotic fluid of 5% (5). Participants were selected using a non-probability consecutive sampling technique. The inclusion criteria encompassed pregnant women aged between 18 and 45 years, with a gestational age of at least 32 weeks (confirmed by last menstrual period), singleton pregnancies with intact placentas on ultrasound, and those who were either primigravida or multigravida, nulliparous or multiparous. Only women presenting for routine antenatal care were enrolled.

Exclusion criteria included women with pre-existing medical conditions known to influence pregnancy outcomes, such as diabetes mellitus, chronic hypertension, renal disease, autoimmune disorders, and other systemic illnesses. Additionally, women with diagnosed fetal anomalies or chromosomal abnormalities on antenatal screening, those with cognitive impairments or language barriers hindering consent or data collection, and women presenting with ruptured membranes or fetal malpresentation were excluded (9,10). Ethical approval was obtained from the Institutional Review Board of the hospital and the College of Physicians and Surgeons Pakistan (CPSP),

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ensuring adherence to ethical standards. Informed written consent was obtained from all participants following a thorough explanation of the study objectives and procedures. Demographic data and clinical variables were recorded using a structured, pre-designed proforma. Outcomes were evaluated in terms of APGAR scores, meconium staining, intrauterine growth restriction (IUGR), early neonatal mortality, and mode of delivery. Cases identified with low AFI were managed according to standard obstetric protocols and guidelines to mitigate risks during pregnancy and childbirth (11,12). Data were analyzed using SPSS version 26. The Chi-square test was applied to compare fetomaternal outcomes between groups with low and normal AFI, and a p-value of ≤0.05 was considered statistically significant.

RESULTS

A total of 205 pregnant women were included in the study. The mean maternal age was 30.40 ± 5.76 years, ranging from 20 to 40 years. The average gestational age at presentation was 36.33 ± 1.72 weeks. Regarding parity, 14.1% of women were primiparous, while 40.5%, 26.8%, and 18.5% had a parity of two, three, and four, respectively. The mean birth weight of neonates was 3.01 ± 0.42 kg. The prevalence of low amniotic fluid index (AFI ≤5 cm) was observed in 14 patients, accounting for 6.83% of the study population. Among neonates classified as low birth weight, 27.3% were born to mothers with low AFI, compared to only 2.9% in the normal AFI group ($p < 0.001$). Meconium-stained liquor was significantly associated with low AFI, noted in 50.0% of affected patients versus 4.1% among those with normal AFI ($p < 0.001$). Similarly, intrauterine growth restriction (IUGR) was present in 50.0% of the low AFI group, in contrast to 4.1% in patients with normal fluid levels ($p < 0.001$). Neonatal deaths were notably more common in cases with low AFI, observed in 66.7% of such cases, as compared to 5.9% in patients without neonatal death ($p = 0.013$). Cesarean section was the mode of delivery in 13.1% of patients with low AFI, while only 2.5% of those who delivered vaginally had low AFI ($p = 0.003$). Low APGAR scores were seen in 42.9% of neonates born to mothers with low AFI, compared to 2.7% with normal scores ($p < 0.001$). Furthermore, 42.9% of neonates requiring ICU admission were from the low AFI group, while the corresponding figure for those not admitted to ICU was 5.6% ($p = 0.008$).

Table 1: Descriptive statistics of demographic and outcome of the patients

		Frequency	Percent
Age (Years)		30.40 ± 5.76 (20-40)	
Gestational Age (Weeks)		36.33 ± 1.72 (34-39)	
Parity	One	29 (14.1%)	14.1
	Two	83 (40.5%)	40.5
	Three	55 (26.8%)	26.8
	Four	38 (18.5%)	18.5

Table 2: Comparison of outcome variables between low amniotic fluids of the patients

Outcome		Low Amniotic Fluid		Total	p-value
		Yes	No		
LBW	Yes	9(27.3%)	24(72.7%)	33(100.0%)	<0.001*
	No	5(2.9%)	167(97.1%)	172 (100.0%)	
Meconium Staining	Yes	6(50.0%)	6(50.0%)	12(100.0%)	<0.001*
	No	8(4.1%)	185(95.9%)	193(100.0%)	
IUGR	Yes	6(50.0%)	6(50.0%)	12(100.0%)	<0.001*
	No	8(4.1%)	185(95.9%)	193(100.0%)	
Neonatal Death	Yes	2(66.7%)	1(33.3%)	3(100.0%)	0.013*
	No	12(5.9%)	190(94.1%)	202(100.0%)	
MODE	C-Section	11(13.1%)	73(86.9%)	84(100.0%)	0.003*
	NVD	3(2.5%)	118(97.5%)	121(100.0%)	
Low APGAR	Yes	9(42.9%)	12(57.1%)	21(100.0%)	<0.001*
	No	5(2.7%)	179(97.3%)	184(100.0%)	
ICU Admission	Yes	3(42.9%)	4(57.1%)	7(100.0%)	0.008*
	No	11(5.6%)	187(94.4%)	198(100.0%)	

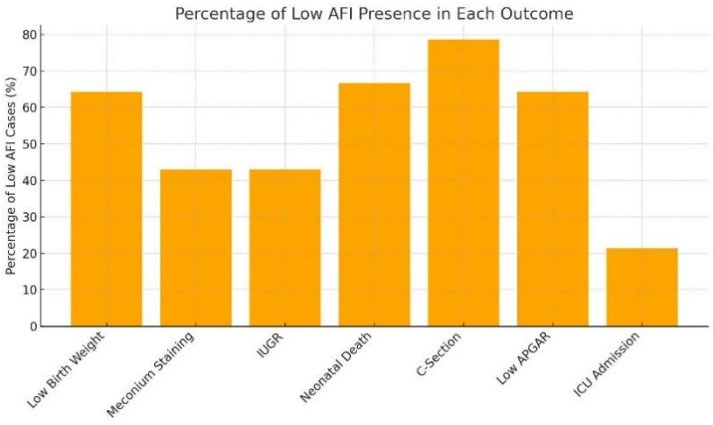

Figure 1 Percentage of Low AFI Presence in Each Outcome

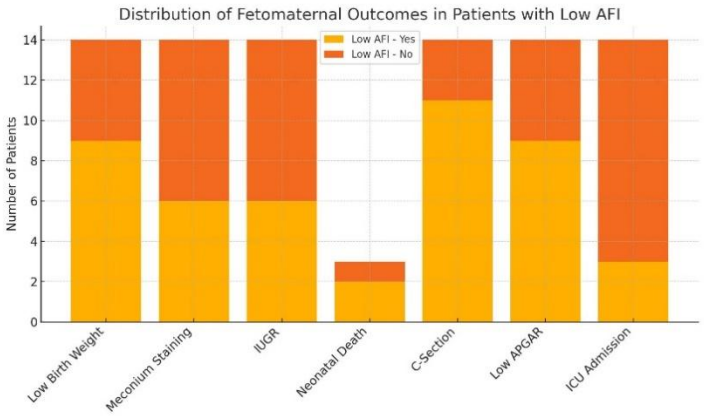

Figure 2 Distribution of Fetomaternal Outcomes in Patients with Low AFI

DISCUSSION

The present study highlighted a significant association between low amniotic fluid index (AFI) and adverse fetomaternal outcomes. The findings demonstrated that patients with oligohydramnios experienced higher rates of low birth weight (LBW), intrauterine growth restriction (IUGR), meconium staining, low APGAR scores, neonatal death, NICU admission, and cesarean deliveries. These outcomes are consistent with existing literature which has repeatedly shown that reduced AFI is a marker of compromised fetoplacental function, often leading to poor perinatal outcomes (13,14). Several earlier studies have emphasized that low AFI is significantly linked to unfavorable neonatal parameters, including LBW, small for gestational age (SGA), and low 1-minute APGAR scores. These findings were in alignment with the current study where nearly half of the neonates with low AFI had low APGAR scores and required NICU admission. Respiratory distress and NICU hospitalization, as frequently reported in literature, also emerged as prominent complications in the oligohydramnios group (15,16). Furthermore, fetal distress, one of the most cited reasons for emergency cesarean section in such cases, was indirectly supported by the higher cesarean section rate in patients with low AFI in the current analysis (17,18).

Conversely, some contrasting evidence exists where no statistically significant differences were found in birth weight or NICU admissions between oligohydramnios and normal AFI groups (19). These inconsistencies may be attributed to differences in study design, sample size, criteria for defining oligohydramnios, and obstetric practices across clinical settings. Despite this variability, the cumulative body of evidence—including the current study—largely supports the association between oligohydramnios and compromised fetal outcomes. The pathophysiological basis of these adverse outcomes is thought to be linked with placental insufficiency, as reduced perfusion leads to diminished fetal urine production—a primary contributor to amniotic fluid volume in the third trimester. This insufficiency subsequently manifests as oligohydramnios and serves as a clinical warning sign for fetal compromise (20,21). The current study's findings reinforce this mechanism by demonstrating that the majority of cases with reduced AFI also exhibited signs of IUGR, meconium-stained liquor, and neonatal morbidity, all of which are characteristic of suboptimal intrauterine environments.

A notable strength of this study lies in its comparative design, which provided a clear contrast between normal and low AFI groups, thus allowing the quantification of risk associated with oligohydramnios. Additionally, the use of uniform diagnostic criteria and a defined sample population from a single tertiary care center enhanced the internal consistency of the findings. However, the study has some limitations. Being a single-center study with a relatively limited duration, it may not be generalizable to broader populations or different healthcare settings. Moreover, stratification by gestational age, comorbid maternal factors, or mode of antenatal surveillance was not performed, which could have offered deeper insight into the nuances influencing outcomes. Further research incorporating multicenter data, stratified analyses, and long-term neonatal follow-up is needed to build on these findings and inform clinical guidelines more robustly. Overall, the study substantiates the importance of AFI monitoring in late pregnancy, especially in resource-constrained settings where access to advanced fetal surveillance tools may be limited. Routine use of ultrasound to monitor amniotic fluid volume offers a

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practical, non-invasive measure to anticipate and manage potential perinatal complications, thereby improving maternal and neonatal health outcomes.

CONCLUSION

This study concludes that a low amniotic fluid index (AFI) is strongly associated with unfavorable fetomaternal outcomes. Pregnancies complicated by reduced AFI showed a higher likelihood of adverse events such as low birth weight, intrauterine growth restriction, cesarean delivery, meconium-stained amniotic fluid, lower APGAR scores, and neonatal intensive care admissions. These findings emphasize the clinical value of routine AFI monitoring during antenatal care, particularly in identifying high-risk pregnancies and guiding timely interventions to improve maternal and neonatal outcomes.

AUTHOR CONTRIBUTION

Author	Contribution
Asma Hameed*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Rashida Sultana	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Narjis Mushtaq	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Hafsa Batool	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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