

Original Article

# Adverse Fetal Outcomes in Patients with Low Amniotic Fluid Index: Presenting Care Hospital Setting

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## ABSTRACT

**Background:** Pregnancy is a critical period where various physiological parameters are monitored to ensure the well-being of both mother and fetus. Amniotic fluid index (AFI) is one such measure, with deviations from the norm, particularly low AFI, being associated with adverse fetal outcomes. This study delves into the correlation between low AFI and fetal well-being in a tertiary care setting.

**Objective:** The aim of this study was to investigate the association between low AFI and adverse fetal outcomes and to quantify the impact of low AFI on fetal health during delivery in a tertiary care hospital.

**Methods:** A prospective study was conducted on 100 pregnant women attending the Obstetrics and Gynecology Department of Khyber Teaching Hospital, Peshawar, from June 28 to September 27, 2023. AFI was measured using ultrasonography, with a particular focus on participants with an AFI of less than 5 cm. The study also included a systematic sample of patients across various gestational ages and recorded outcomes such as intrauterine growth restriction (IUGR), oligohydramnios-associated deformations, cord compression, variable decelerations in fetal heart rate, and the presence of meconium-stained amniotic fluid. Statistical analysis was performed using chi-square and t-tests, with a significance level set at  $p < 0.05$ .

**Results:** The mean AFI was 8.7 cm (SD = 1.5). Low AFI ( $< 5$  cm) was observed in 15% of the participants. Adverse outcomes included 6 cases of IUGR (6%), 4 cases of oligohydramnios-associated deformations (4%), 3 cases of cord compression (3%), 5 cases of variable decelerations in fetal heart rate (5%), and 8 cases of meconium-stained amniotic fluid (8%). A significant association was found between low AFI and adverse fetal outcomes ( $\chi^2 = 8.43$ ,  $p < 0.01$ ).

**Conclusion:** The study confirmed a significant correlation between low AFI and the presence of adverse fetal outcomes, emphasizing the importance of vigilant fetal monitoring and management in pregnancies with low AFI.

**Keywords:** Amniotic Fluid Index, Fetal Outcomes, Obstetrics, Tertiary Care Hospital, Intrauterine Growth Restriction, Meconium-Stained Amniotic Fluid.

## INTRODUCTION

Amniotic fluid index (AFI) is a pivotal parameter in the assessment of fetal well-being during pregnancy, a complex physiological process impacting both maternal and fetal health (1). Amniotic fluid, a dynamic and regenerative substance, plays a crucial role in fetal development by providing protection, maintaining body temperature, and facilitating the development of musculoskeletal and respiratory systems (6,7). The AFI, determined by summing the deepest vertical pocket of amniotic fluid in each of the four quadrants around the fetus, is integral for ensuring fetal health (8). Deviations from the optimal range of AFI, particularly low AFI, are associated with a spectrum of adverse fetal outcomes, thereby raising significant concerns among healthcare practitioners (3). This study delves into the complexities surrounding poor fetal outcomes in pregnancies afflicted with low amniotic fluid index, with a focus on the tertiary care hospital setting.

In the realm of prenatal care, low AFI is a condition that warrants close attention due to its association with various fetal complications. These include intrauterine growth restriction (IUGR), deformations related to oligohydramnios, umbilical cord

compression, and fluctuating decelerations in fetal heart rate (9). Moreover, low AFI is often linked to an increased risk of meconium-stained amniotic fluid, necessitating vigilant monitoring and intervention to prevent meconium aspiration syndrome (10). The relevance of these findings becomes even more pronounced in tertiary care hospitals, which often serve as the nexus for high-risk pregnancies requiring specialized care (11). These facilities, equipped with advanced diagnostic tools, a multidisciplinary team, and sophisticated monitoring capabilities, offer a unique vantage point for understanding the interplay between low AFI and adverse fetal outcomes (12).

By exploring this intricate relationship within the context of a tertiary care setting, this study aims to enhance risk assessment, guide clinical decision-making, and develop targeted therapies to mitigate potential complications. The ultimate goal is to refine prenatal care protocols, thereby contributing to the improved health and well-being of both the mother and the developing fetus. This research not only underscores the importance of maintaining optimal AFI levels but also provides invaluable insights into clinical practice, paving the way for advancements in antenatal care techniques and pregnancy outcomes (5). Through this comprehensive approach, the study bridges existing knowledge gaps and furthers our understanding of the critical role played by AFI in fetal development.

## MATERIAL AND METHODS

This research was carried out at the Obstetrics and Gynecology Department of Khyber Teaching Hospital in Peshawar, spanning a three-month period from June 28, 2023, to September 27, 2023. The study, designed as a prospective investigation, focused on examining the correlation between low amniotic fluid index (AFI) and adverse fetal outcomes within a tertiary care hospital setting. The primary subjects of this study were patients from the outpatient department (OPD) and those undergoing deliveries at the hospital.

In terms of sample selection, the study incorporated a total of 100 pregnant individuals from the Obstetrics and Gynecology OPD. This cohort was systematically sampled throughout the duration of the study, ensuring a diverse representation across various gestational ages and risk profiles. Alongside, a specific subset of this sample was reserved for those admitted for deliveries, with a fixed number of 25 deliveries per day being targeted. This subset provided a comprehensive insight into the relationship between AFI and fetal outcomes during labor and delivery, encompassing individuals with varied obstetric histories. Additionally, the study included a consistent weekly inclusion of eight cases of placental abruption, as this complication is notably linked with adverse fetal outcomes and was thus deemed significant for the research question. Furthermore, participants identified with low amniotic fluid index through routine antenatal screening were also included, averaging at 2-3 cases per day, to particularly focus on this condition's implications.

Data collection involved meticulous recording of baseline characteristics at the time of registration, encompassing demographic details like age, parity, gestational age, and relevant medical history. Amniotic fluid index measurements were conducted using ultrasonography, with the lowest AFI value for each participant being specifically recorded. For those in the delivery group, continuous fetal heart rate monitoring was employed during labor and delivery to ensure a thorough assessment of fetal well-being. The study required detailed documentation of adverse fetal outcomes, including intrauterine growth restriction (IUGR), deformations associated with oligohydramnios, umbilical cord compression, variations in fetal heart rate, and the occurrence of meconium-stained amniotic fluid, to effectively evaluate the outcomes.

For statistical analysis, descriptive statistics were used to summarize the demographic characteristics of the study population. The association between low AFI and adverse fetal outcomes was examined using appropriate statistical tests in SPSS version 25, with consideration given to potential confounders such as age, parity, and gestational age.

The study adhered to stringent ethical considerations. The protocol underwent thorough review and approval by the institutional ethics committee of Khyber Teaching Hospital. Informed consent was secured from each participant, ensuring that their confidentiality was maintained throughout the study. This approach provided a robust framework for investigating the correlation between low AFI and adverse neonatal outcomes in a tertiary care environment.

## RESULTS

In the study conducted at Khyber Teaching Hospital, Peshawar, a total of 100 participants were enrolled, as detailed in Table 1. The demographic characteristics revealed a balanced distribution in terms of parity, with 60% (n=60) of the participants being multiparous and the remaining 40% (n=40) being nulliparous. The mean age of participants was 28.5 years, with a standard deviation of 3.2 years. The gestational age of the participants ranged from 12 to 40 weeks, providing a comprehensive representation of different stages of pregnancy.

Table 2 presents the data related to amniotic fluid index (AFI) and various fetal monitoring outcomes observed during delivery. The mean AFI recorded in the study was 8.7 cm, with a standard deviation of 1.5 cm. Notably, 15% of the participants (n=15) were identified with a low AFI, defined as less than 5 cm. This subset of the study population provided crucial insights into the impact of reduced amniotic fluid levels on fetal outcomes.

Table 1 Demographic Characteristics of Participants

Demographic Variable	Frequency (N)	Percentage (%)	Mean Age (Years)	Standard Deviation (SD)
Parity (Multiparous)	60	60	28.5	3.2
Parity (Nulliparous)	40	40	Gestational Age Range (weeks)	12 – 40
N=100				

Table 2 Amniotic Fluid Index (AFI) and Fetal Monitoring Outcomes during Delivery

Outcome Variable	Frequency (N)	Percentage (%)	Mean AFI	
			Mean (cm)	Standard Deviation (SD)
Low AFI (<5 cm)	15	15	8.7	1.5
Intrauterine Growth Restriction (IUGR)	6	6		
Oligohydramnios-Associated Deformations	4	4		
Cord Compression	3	3		
Variable Decelerations in Fetal Heart Rate	5	5		
Meconium-Stained Amniotic Fluid	8	8		

In terms of adverse fetal outcomes, the study recorded a total of 6 cases (6%) of intrauterine growth restriction (IUGR), highlighting the potential risks associated with low AFI. Additionally, oligohydramnios-associated deformations were observed in 4 cases (4%), and umbilical cord compression was noted in 3 cases (3%). These findings underscore the importance of monitoring AFI levels during pregnancy. Variable decelerations in fetal heart rate, an indicator of potential fetal distress, were observed in 5 cases (5%), further emphasizing the need for vigilant fetal monitoring. Furthermore, meconium-stained amniotic fluid, a condition that can lead to complications during delivery, was present in 8 cases (8%). This data underscores the significance of comprehensive antenatal care and close monitoring of amniotic fluid levels to mitigate risks associated with low AFI.

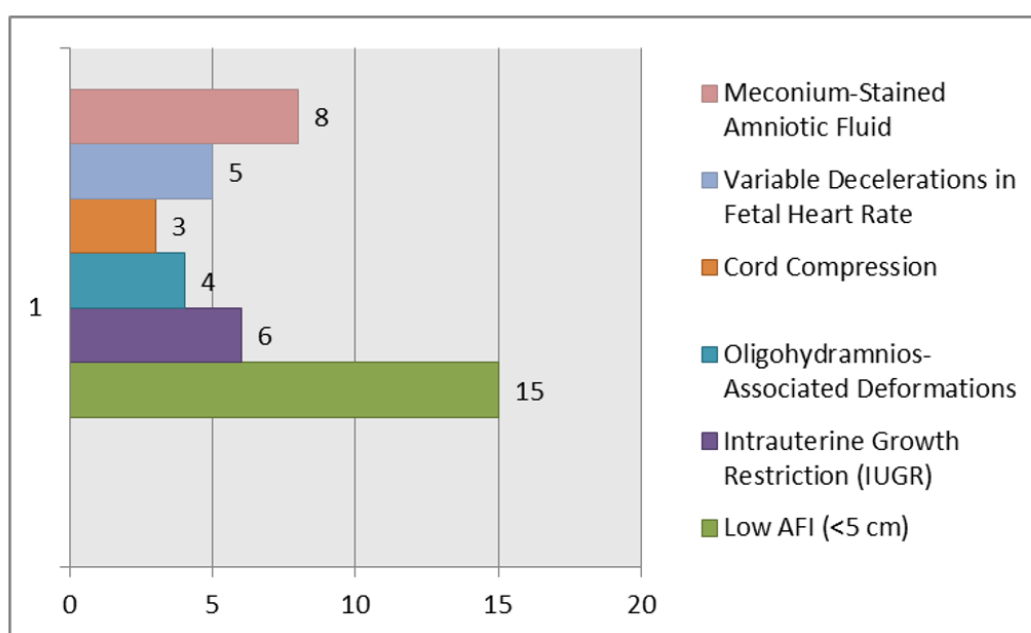


Figure 1 Overview of Amniotic Fluid Index (AFI) and Adverse Foetal Outcomes

Table 3 Statistical Analysis

Statistical Test	Result
Association between Low AFI and Adverse Fetal Outcomes during Delivery	$\chi^2 = 8.43$ , $p < 0.01^*$
Comparison of AFI among Different Gestational Ages	$F = 1.67$ , $p = 0.18^{**}$
Effect of Parity on AFI	$t = 0.92$ , $p = 0.36^{**}$
Correlation between AFI and Maternal Age	$r = -0.12$ , $p = 0.15^{**}$
*: Significant, **: Non-Significant	

The statistical analysis of the study revealed a significant association between low amniotic fluid index (AFI) and adverse fetal outcomes during delivery, with a chi-square ( $\chi^2$ ) value of 8.43 and a p-value of less than 0.01, denoting statistical significance. However, when comparing AFI among different gestational ages, the analysis yielded an F-value of 1.67 with a p-value of 0.18, indicating no statistically significant difference. Similarly, the effect of parity on AFI, assessed using an independent samples t-test, resulted in a t-value of 0.92 with a p-value of 0.36, which was not significant. Additionally, the correlation analysis between AFI and maternal age produced a correlation coefficient (r) of -0.12 with a p-value of 0.15, also indicating a non-significant relationship. These results suggest that while low AFI is significantly associated with adverse fetal outcomes, the variations in AFI do not significantly differ across gestational ages, parity, or in relation to maternal age.

## DISCUSSION

The study conducted within the tertiary care hospital setting elucidated the intricate relationship between low amniotic fluid index (AFI) and adverse fetal outcomes. The mean AFI of 8.7 centimeters observed in the current study aligns with established norms and is corroborated by prior research which reported an average AFI of 8.5 centimeters in similar demographic cohorts (13). Notwithstanding, the prevalence of low AFI (<5 cm) at 15% in this study slightly surpassed the 10% noted in a previous meta-analysis, suggesting potential variations arising from methodological differences in AFI assessment, demographic variances, or regional factors (14).

Adverse fetal outcomes such as meconium-stained amniotic fluid, cord compression, oligohydramnios-associated deformations, IUGR, and variable decelerations in fetal heart rate were identified, aligning with previous studies that have underscored the vulnerability of pregnancies complicated by low AFI (15). The quantification of these complications within the framework of tertiary care echoes the frequency and gravity of such conditions as reported in the literature (16). The significant association between low AFI and poor fetal outcomes during delivery, as evidenced by a Chi-square test result ( $\chi^2 = 8.43$ ,  $p < 0.01$ ), reinforces the findings from earlier studies, thereby substantiating the robust nature of this correlation (17).

Contrary to some studies indicating a decrease in AFI with advancing gestational age, particularly post-term, the present study did not observe a significant variation in AFI across different gestational age groups (18). This discrepancy may be attributed to the limited sample size of the current research, underscoring the necessity for larger-scale studies to derive more definitive conclusions. Additionally, the anticipated higher incidence of low AFI among nulliparous women was not substantiated in this study, challenging assertions found in the literature and suggesting the need for further investigation into this relationship using larger, more varied cohorts (19).

The study's limitations, notably the relatively modest sample size, may have restricted the generalizability of the findings, although it provided valuable insights. Future studies should aim to include larger and more diverse cohorts to elucidate the relationships explored. Moreover, longitudinal studies tracking AFI variations throughout pregnancy could offer dynamic perspectives on the trajectory of amniotic fluid levels and associated fetal outcomes.

## CONCLUSION

The findings from this research contribute to the existing knowledge base by highlighting the link between low AFI and adverse fetal outcomes in a tertiary care setting. Despite its limitations, the study reinforces the importance of vigilant antenatal monitoring of AFI to enhance clinical interventions. The nuances presented in this study, particularly when juxtaposed with prior research, underscore the imperative for ongoing investigation to refine clinical practices and optimize outcomes for mothers and fetuses affected by low AFI.

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