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MATERNAL AND FETAL OUTCOMES IN LOW VERSUS NORMAL AMNIOTIC FLUID INDEX IN POST-DATE PREGNANCIES

Original Research

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ABSTRACT

Background: Amniotic fluid assessment remains a fundamental component of obstetric evaluation, yet uncertainty persists regarding whether low Amniotic Fluid Index (AFI) in post-date pregnancies acts as an independent determinant of adverse outcomes or simply reflects underlying pathology. This ambiguity often leads to uniform clinical interventions that may not be tailored to individual risk. Given the widespread use of ultrasound-based AFI estimation in routine obstetric care, further clarification is essential to support informed decision-making and optimize perinatal outcomes.

Objective: To determine the fetomaternal outcomes of post-date pregnancies with low AFI and compare these outcomes with those of post-date pregnancies exhibiting normal AFI.

Methods: A descriptive study was conducted in the Department of Obstetrics and Gynecology, Khyber Teaching Hospital, Peshawar, from 1 January to 30 June 2023. A total of 156 women aged 20–40 years with gestational ages between 38 and 42 weeks were recruited and categorized into low-AFI (<5 cm) and normal-AFI groups based on ultrasonographic four-quadrant AFI measurement. Maternal outcomes included mode of delivery and wound infection, while fetal outcomes included low Apgar score at 5 minutes and low birth weight (<2500 g). Ethical approval was obtained, informed consent was ensured, and data were analyzed using SPSS v.26, with categorical variables compared using chi-square testing at a 5% significance level.

Results: Among the 156 participants, 54 (34.6%) had low AFI and 102 (65.4%) had normal AFI. The mean age was 31.04 ± 4.01 years in the low-AFI group and 32.04 ± 5.32 years in the normal-AFI group. Mean gestational age was 39.47 ± 1.17 weeks versus 39.86 ± 1.46 weeks, respectively. Low birth weight occurred in 18 (33.3%) women with low AFI compared with 10 (9.8%) in the normal-AFI group ($p < 0.001$). Low Apgar score (<7 at 5 minutes) was found in 22 (40.7%) versus 8 (7.8%) participants ($p < 0.001$). Cesarean delivery was required in 24 (44.4%) of low-AFI women compared with 12 (11.8%) with normal AFI ($p < 0.001$). Wound infection occurred in 12 (22.2%) and 12 (11.8%) women, respectively ($p = 0.085$).

Conclusion: Low AFI in post-date pregnancies was strongly associated with adverse fetal outcomes, particularly low birth weight and low Apgar scores, highlighting its significance as a marker of compromised intrauterine conditions. Maternal complications showed no statistically significant differences, suggesting that oligohydramnios primarily influences fetal well-being. Routine AFI assessment may therefore play a crucial role in risk stratification and timely obstetric intervention.

Keywords: Apgar Score, Cesarean Section, Fetal Development, Fetal Growth Retardation, Oligohydramnios, Pregnancy Outcome, Ultrasonography.

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INTRODUCTION

Amniotic fluid serves as a critical indicator of fetoplacental well-being throughout intrauterine life, functioning as a protective medium that cushions the fetus and facilitates normal structural and physiological development (1). Composed of water, carbohydrates, proteins, electrolytes, and shed fetal cells derived from the skin, respiratory tract, and urinary system, it originates primarily from transudation across fetal membranes and later from fetal urine production as gestation advances (2). Its optimal volume is essential for fetal growth, musculoskeletal development, and the prevention of cord compression. Clinically, this volume is assessed using the Amniotic Fluid Index (AFI), with mean values approximating 14 cm and a normal range of 5–25 cm. An AFI below 5 cm is classified as oligohydramnios, a state associated with multiple maternal and fetal risks including premature rupture of membranes (PROM), intrauterine growth restriction (IUGR), and congenital anomalies (3-5). Oligohydramnios is consistently linked with adverse perinatal outcomes due to restricted fetal movement, impaired lung maturation, and increased susceptibility to cord compression. Depending on severity and gestational age, it may result in growth delays, structural deformities, intrapartum fetal distress, or even perinatal mortality (6). A markedly low AFI in early gestation often portends poor outcomes, including spontaneous abortion, whereas outcomes in the second and third trimesters vary considerably based on underlying etiologies (7). Evidence from comparative studies demonstrates significantly higher rates of cesarean section, wound infection, low APGAR scores, and low birth weight among post-date pregnancies complicated by low AFI compared with those maintaining normal fluid levels—highlighting the clinical burden and complexity of decision-making in such cases (8). Despite its documented associations, a clear consensus has not been reached regarding whether low AFI in post-date pregnancies represents an independent predictor of adverse outcomes or merely a coincidental finding amid other pathological contributors. This uncertainty contributes to variability in clinical management, where interventions may be applied uniformly without adequate risk stratification. To address this ambiguity, the current study aims to determine the outcomes of post-date patients with low AFI and to compare these outcomes with those of post-date patients exhibiting normal AFI, thereby providing evidence to guide more tailored and informed clinical decision-making.

METHODS

This descriptive study was conducted in the Department of Obstetrics and Gynecology at Khyber Teaching Hospital, Peshawar, over a six-month period from 1 January to 30 June 2023. Women aged 20 to 40 years with a gestational age between 38 and 42 weeks and a confirmed singleton pregnancy on ultrasonography were eligible for inclusion. Patients were excluded if they had premature rupture of membranes, congenital uterine anomalies, fetal structural anomalies, or known hormonal disorders, ensuring that amniotic fluid levels were not influenced by confounding pathological conditions. For the purpose of this study, post-date pregnancy was operationally defined as a gestational age of 38 to 42 weeks based on the last menstrual period, although it is noteworthy that the conventional definition of post-date or post-term pregnancy typically refers to gestation beyond 40–42 weeks—an important distinction that may affect the generalizability of the findings and should be acknowledged as a methodological limitation. Amniotic fluid volume was assessed using ultrasonography with the standard four-quadrant technique. The largest vertical pocket in each quadrant was measured, and the sum of these measurements was recorded as the Amniotic Fluid Index (AFI). An AFI of less than 5 cm was classified as low AFI, whereas values above 5 cm were considered normal. Maternal outcomes included mode of delivery—categorized as spontaneous vaginal delivery or cesarean section—and wound infection, which was defined as erythema of at least 1 cm around the incision margin accompanied by tenderness and serosanguinous discharge occurring within 15 days postpartum. Fetal outcomes included low birth weight, defined as a birth weight below 2500 grams, and low Apgar score, defined as a score below 7 at 5 minutes.

A total sample size of 156 was calculated using the WHO sample size calculator, based on an anticipated wound infection rate of 17.7% in women with low AFI (8), a 6% margin of error, and a 95% confidence level. Participants were enrolled through non-probability consecutive sampling. Ethical approval was obtained from the institutional research review board before data collection commenced, and written informed consent was obtained from all participants. Baseline demographic and clinical information was recorded prior to delivery. Each participant underwent an abdominal ultrasound to document AFI, after which the cohort was stratified into low-AFI and normal-AFI groups. All women were initially allowed trial of spontaneous labor; however, induction, instrumental delivery, or cesarean section were performed where clinically indicated. Newborn birth weight and Apgar scores were recorded immediately after delivery,

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and postoperative wounds in cesarean section cases were monitored for up to 15 days to identify signs of infection. Data were analyzed using IBM SPSS version 26. Continuous variables were summarized as means and standard deviations, while categorical variables—including fetomaternal outcomes—were expressed as frequencies and percentages. Effect modifiers were controlled through stratification, and the chi-square test was applied post-stratification with a significance threshold of 0.05.

RESULTS

A total of 156 women aged 20 to 40 years were included, of whom 54 (34.6%) had low amniotic fluid index (AFI) and 102 (65.4%) had normal AFI. The mean age in the low-AFI group was 31.04 ± 4.01 years compared with 32.04 ± 5.32 years in the normal-AFI group. The mean gestational age was 39.47 ± 1.17 weeks in the low-AFI group and 39.86 ± 1.46 weeks in the normal-AFI group, while the mean BMI remained comparable between groups at 22.14 ± 1.86 kg/m² and 22.11 ± 1.71 kg/m², respectively. Women aged 20–30 years constituted 85.2% of the low-AFI group but only 39.2% of the normal-AFI group. Gestational age above 40 weeks was recorded in 59.3% of low-AFI cases compared with 76.5% of normal-AFI pregnancies. Parity distribution differed, with 55.6% of women in the low-AFI group having parity 3–4 compared with 30.4% in the normal-AFI group. Low birth weight <2500 g was significantly more frequent among women with low AFI, recorded in 18 (33.3%) compared with 10 (9.8%) among those with normal AFI ($p < 0.001$). Low Apgar score at 5 minutes (<7) also occurred more commonly in the low-AFI group, affecting 22 (40.7%) compared with 8 (7.8%) in the normal-AFI cohort ($p < 0.001$). Mode of delivery varied substantially between groups: 44.4% of women with low AFI required cesarean section compared with only 11.8% among those with normal AFI ($p < 0.001$). Wound infection occurred in 12 participants (22.2%) with low AFI and 12 (11.8%) with normal AFI; this difference did not reach statistical significance ($p = 0.085$). Stratified analysis showed that low birth weight remained significantly associated with low AFI among women aged 20–30 years (34.7% vs 10.0%, $p = 0.006$) and among those with parity 1–2 (33.3% vs 9.8%, $p = 0.006$) as well as among parity 3–4 (33.3% vs 9.7%, $p = 0.024$). A similar pattern was observed across BMI subgroups, where AFI status significantly influenced low birth weight for BMI ≤23 (35.3% vs 10.2%, $p = 0.001$) and BMI >23 (40.0% vs 8.3%, $p = 0.012$). Low Apgar scores were consistently higher in low-AFI pregnancies across age and parity categories ($p < 0.05$ for all), although the difference did not reach significance among participants with BMI >23 kg/m² ($p = 0.063$). Cesarean section remained significantly more frequent in the low-AFI group across all age, parity, and BMI categories ($p < 0.05$). Stratification of wound infection did not show statistically significant differences across any subgroup ($p > 0.05$).

Table 1: Descriptive Statistics of Study Participants (n = 156)

Baseline Characteristics	Mean ± Standard Deviation	
	Low AFI Group	Normal AFI Group
Age (yrs)	31.04±4.014	32.04±5.323
Gestational Age (wks)	39.47 ± 1.171	39.86 ± 1.462
BMI (Kg/m2)	22.137±1.8570	22.111±1.7124

Table 2: Baseline Characteristics of Study Participants (n = 156)

Parameters	**Subgroups**	**Low AFI Group N = 54**		**Normal AFI Group N = 102**	
		Frequency	**Percent**	**Frequency**	**Percent**
Age (Years)	20-30 Years	46	85.2	40	39.2
	31-40 Years	8	14.8	62	60.8
Gestational Age (Weeks)	≤ 40 (Weeks)	22	40.7	24	23.5
	> 40 (Weeks)	32	59.3	78	76.5
Parity	1-2	24	44.4	71	69.6

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Parameters	Subgroups	Low AFI Group N = 54		Normal AFI Group N = 102	
		Frequency	Percent	Frequency	Percent
	3-4	30	55.6	31	30.4
BMI (Kg/M2)	≤23.0	34	62.9	78	76.5
	>23.0	20	37.1	24	23.5

Table 3: Comparison of Feto-Maternal Outcomes in Patients with Low and Normal AFI (N = 156)

Feto-Maternal Outcomes		Low AFI Group N = 54		Normal AFI Group N = 102		P Value
		Frequency	Percent	Frequency	Percent	<0.001
Low Birth Weight	Yes	18	33.3	10	9.8	
	No	36	66.7	92	90.2	
Low Apgar	Yes	22	40.7	08	7.8	<0.001
	No	32	59.3	94	92.2	
Mod	NVD	30	55.6	90	88.2	<0.001
	CS	24	44.4	12	11.8	
Wound Infection	Yes	12	22.2	12	11.8	0.085
	No	42	77.8	90	88.2	

Table 4: Stratification of Low Birth Weight with Baseline Parameters (N = 156)

Parameters	Subgroups	Group	Low Birth Weight			P Value
			Yes	No	Total	
Age (Years)	20-30	Low AFI	16 (34.7%)	30 (65.3%)	46 (100.0%)	0.006
		Normal AFI	4 (10.0%)	36 (90.0%)	40 (100.0%)	
	31-40	Low AFI	02 (25.0%)	06 (75.0%)	08 (100.0%)	0.199
		Normal AFI	6 (9.7%)	56 (90.3%)	62 (100.0%)	
Parity	1-2	Low AFI	08 (33.3%)	16 (66.7%)	24 (100.0%)	0.006
		Normal AFI	7 (9.8%)	64 (90.2%)	71 (100.0%)	
	3-4	Low AFI	10 (33.3%)	20 (66.7%)	30 (100.0%)	0.024
		Normal AFI	3 (9.7%)	28 (90.3%)	31 (100.0%)	
BMI (Kg/M2)	≤23.0	Low AFI	12 (35.3%)	22 (64.7%)	34 (100.0%)	0.001
		Normal AFI	8 (10.2%)	70 (89.8%)	78 (100.0%)	
	>23.0	Low AFI	08 (40.0%)	12 (60.0%)	20 (100.0%)	0.012
		Normal AFI	2 (8.3%)	22 (91.7%)	24 (100.0%)	

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Table 5: Stratification of Low Apgar with Baseline Parameters (N = 156)

Parameters	Subgroups	Group	Low Apgar			P Value
			Yes	No	Total	
Age (Years)	20-30	Low AFI	18 (82.6%)	28 (17.4%)	46 (100.0%)	<0.001
		Normal AFI	02 (97.5%)	38 (2.5%)	40 (100.0%)	
	31-40	Low AFI	04 (75.0%)	04 (25.0%)	08 (100.0%)	0.002
		Normal AFI	06 (92.8%)	56 (7.2%)	62 (100.0%)	
Parity	1-2	Low AFI	10 (82.6%)	14 (17.4%)	24 (100.0%)	<0.001
		Normal AFI	05 (97.5%)	66 (2.5%)	71 (100.0%)	
	3-4	Low AFI	12 (75.0%)	18 (25.0%)	30 (100.0%)	0.005
		Normal AFI	03 (92.8%)	28 (7.2%)	31 (100.0%)	
BMI (Kg/M2)	≤23.0	Low AFI	16 (82.6%)	18 (17.4%)	34 (100.0%)	<0.001
		Normal AFI	06 (97.5%)	72 (2.5%)	78 (100.0%)	
	>23.0	Low AFI	06 (75.0%)	14 (25.0%)	20 (100.0%)	0.063
		Normal AFI	02 (92.8%)	22 (7.2%)	24 (100.0%)	

Table 6: Stratification of Mode of Delivery with Baseline Parameters (N = 156)

Parameters	Subgroups	Group	Mode Of Delivery			P Value
			NVD	CS	Total	
Age (Years)	20-30	Low AFI	27 (82.6%)	19 (17.4%)	46 (100.0%)	0.001
		Normal AFI	36 (97.5%)	04 (2.5%)	40 (100.0%)	
	31-40	Low AFI	03 (75.0%)	05 (25.0%)	08 (100.0%)	<0.001
		Normal AFI	54 (92.8%)	08 (7.2%)	62 (100.0%)	
Parity	1-2	Low AFI	12 (82.6%)	12 (17.4%)	24 (100.0%)	<0.001
		Normal AFI	62 (97.5%)	09 (2.5%)	71 (100.0%)	
	3-4	Low AFI	18 (75.0%)	12 (25.0%)	30 (100.0%)	0.005
		Normal AFI	28 (92.8%)	03 (7.2%)	31 (100.0%)	
BMI (Kg/M2)	≤23.0	Low AFI	24 (82.6%)	10 (17.4%)	34 (100.0%)	0.035
		Normal AFI	68 (97.5%)	10 (2.5%)	78 (100.0%)	
	>23.0	Low AFI	06 (75.0%)	14 (25.0%)	20 (100.0%)	<0.001
		Normal AFI	22 (92.8%)	02 (7.2%)	24 (100.0%)	

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Table 7: Stratification of Wound Infection with Baseline Parameters (N = 156)

Parameters	Subgroups	Group	Wound Infection			P Value
			Yes	No	Total	
Age (Years)	20-30	Low AFI	10 (21.7%)	36 (78.3%)	46 (100.0%)	0.065
		Normal AFI	03 (7.5%)	37 (92.5%)	40 (100.0%)	
	31-40	Low AFI	02 (25.0%)	06 (75.0%)	08 (100.0%)	0.443
		Normal AFI	09 (14.5%)	53 (85.5%)	62 (100.0%)	
Parity	1-2	Low AFI	06 (25.0%)	18 (75.0%)	24 (100.0%)	0.100
		Normal AFI	08 (11.3%)	63 (88.7%)	71 (100.0%)	
	3-4	Low AFI	06 (20.0%)	24 (80.0%)	30 (100.0%)	0.454
		Normal AFI	04 (12.9%)	27 (87.1%)	31 (100.0%)	
BMI (Kg/M2)	≤23.0	Low AFI	07 (20.6%)	27 (79.4%)	34 (100.0%)	0.292
		Normal AFI	10 (12.8%)	68 (87.2%)	78 (100.0%)	
	>23.0	Low AFI	05 (25.0%)	15 (75.0%)	20 (100.0%)	0.132
		Normal AFI	02 (8.3%)	22 (91.7%)	24 (100.0%)	

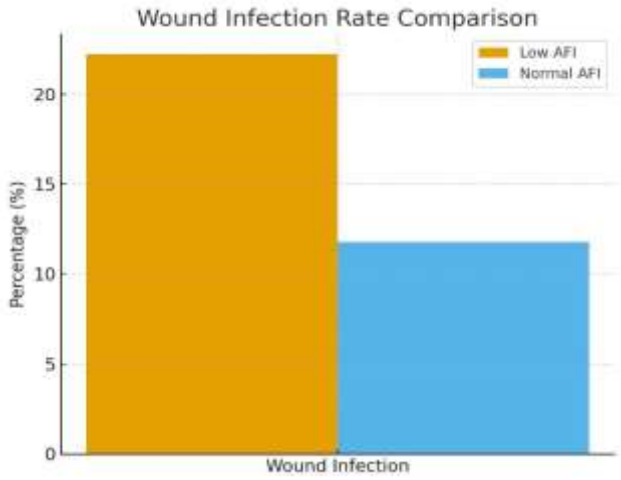


Figure 2 Wound Infection Rate Comparison

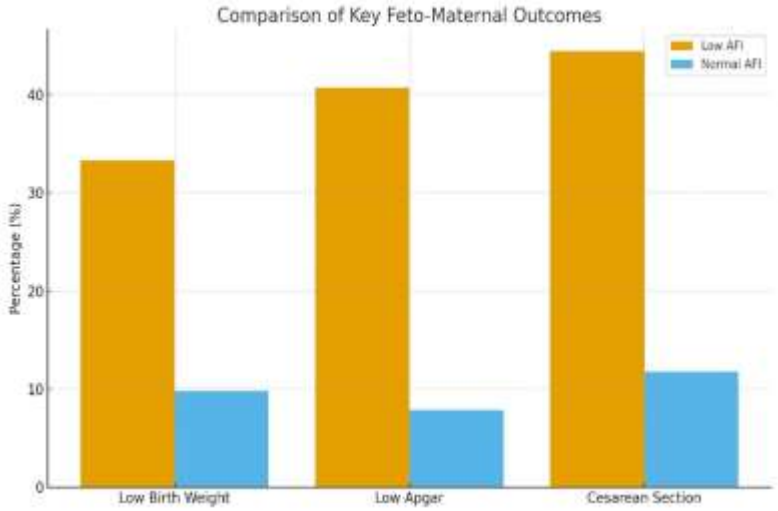


Figure 2 Comparison of Key Feto-Maternal Outcomes

DISCUSSION

The findings of this study demonstrated a clear association between low amniotic fluid index and adverse fetomaternal outcomes, with significantly higher frequencies of low birth weight, low Apgar scores, and cesarean delivery among women with low AFI compared with those having normal AFI. These observations aligned with the broader understanding that extremities of abnormal amniotic fluid volume, rather than borderline variations within the normal range, are most strongly associated with increased perinatal morbidity (9). Contemporary obstetric practice increasingly emphasizes risk stratification and optimization of pregnancy outcomes while minimizing unnecessary intervention, yet a consistent challenge persists in determining the precise contribution of AFI to adverse outcomes independent of other clinical factors. A large retrospective analysis concluded that amniotic fluid abnormalities were not uniformly

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linked to poor pregnancy outcomes, suggesting that only markedly abnormal volumes confer significant risk (10-12). The present study supports this notion, as the low-AFI group demonstrated considerably higher adverse outcomes than those with normal AFI values. A substantial portion of the existing literature has evaluated oligohydramnios in the context of prelabour rupture of membranes, where lower amniotic fluid levels have been associated with increased neonatal infection, low Apgar scores, and neonatal mortality (13). Other retrospective analyses in similar clinical scenarios documented higher risks of neonatal sepsis, early neonatal death, and Apgar scores below 7 at one minute when severe oligohydramnios was present (14). Although the current study excluded pregnancies with ruptured membranes, the elevated rates of low Apgar scores and low birth weight in the low-AFI group reinforced the broader pattern that diminished amniotic fluid is an important clinical marker of compromised intrauterine conditions.

AFI remains preferred in many settings due to its numerical quantification of amniotic fluid volume, allowing structured categorization of oligohydramnios. Numerous studies have demonstrated its association with poor fetal outcomes, including fetal distress and increased obstetric intervention (15-17). The present findings similarly indicated that low AFI was accompanied by a substantial rise in cesarean delivery and low Apgar scores at five minutes. Although a proportion of women with low AFI still delivered newborns with normal Apgar scores, the imbalance between groups remained statistically meaningful and clinically relevant. Other research involving pregnancies with high-risk features found worse delivery outcomes when oligohydramnios coexisted, reinforcing the current study's results (18). However, the literature remains heterogeneous. Studies comparing high-risk pregnancies with AFI below and above 5 cm reported no significant differences in neonatal outcomes or intrapartum complications (19). Another analysis involving pregnancies complicated by HELLP syndrome concluded that AFI had limited predictive value for subsequent fetal impairment (20). These discrepancies may reflect variations in study design, patient selection, and differing obstetric management approaches. The present findings echoed these debates, indicating that low AFI was associated with adverse outcomes, yet the extent to which AFI alone contributed—independent of other risk factors—remains uncertain. Many high-risk conditions may predispose to both reduced amniotic fluid and adverse neonatal outcomes, making AFI a marker rather than a causative factor (21). Additional work indicated that oligohydramnios alone did not reliably predict poor neonatal outcomes such as low Apgar scores or NICU admission when intensive intrapartum monitoring and timely intervention were available, suggesting that high-quality obstetric care may mitigate the risks associated with reduced amniotic fluid (22).

Ultrasonography-based assessment methods also warrant critical appraisal. Some studies noted that while AFI has low sensitivity for predicting adverse outcomes, it may still perform better than the single deepest pocket measurement (23). However, increased use of ultrasound at term could prompt higher rates of obstetric intervention without commensurate improvement in fetal outcomes. The present study’s higher rates of cesarean delivery in the low-AFI group may partly reflect such practice patterns. This study had several strengths, including clearly defined inclusion criteria, standardized AFI assessment, and systematic analysis of maternal and fetal outcomes. Its stratified analyses enriched understanding of how baseline characteristics modified the relationship between AFI and adverse outcomes. However, limitations must also be recognized. The study did not evaluate several clinically important neonatal indicators such as NICU admission, fetal distress patterns, meconium-stained amniotic fluid, or perinatal mortality, which would have added depth to outcome assessment. The definition of post-date pregnancy beginning at 38 weeks differed from widely accepted definitions, which may influence the applicability of the findings. Moreover, the cross-sectional design limited causal interpretation, and unmeasured confounders may have contributed to observed associations. Future research should incorporate larger multicenter cohorts, adjust for coexisting maternal comorbidities, and evaluate broader neonatal outcomes to better delineate the prognostic value of AFI. Prospective designs, including standardized intrapartum monitoring protocols, may clarify whether reduced amniotic fluid is a direct determinant of poor outcomes or predominantly a marker of underlying pathology. Overall, the findings emphasize the need for balanced clinical judgment in the management of oligohydramnios, ensuring timely intervention while avoiding unnecessary procedural escalation.

CONCLUSION

This study demonstrated that evaluation of amniotic fluid remains a vital component of obstetric assessment, offering meaningful insight into both maternal and fetal well-being. By categorizing pregnancies based on amniotic fluid volume, the study reinforced that oligohydramnios is associated with a higher likelihood of adverse fetomaternal outcomes, including indicators of compromised neonatal condition and increased obstetric intervention. These findings highlight the practical value of routine sonographic AFI assessment in identifying pregnancies that may benefit from closer surveillance. Continued research into abnormal amniotic fluid volumes is essential to refine risk stratification and support timely, evidence-based clinical decision-making aimed at improving perinatal outcomes.

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AUTHOR CONTRIBUTION

Author	Contribution
Noor Saba Zafar*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Tayyaba Mazhar	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

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