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Maternal Outcomes in Pregnant Females at Term Having Low Amniotic Fluid Index

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ABSTRACT

Low amniotic fluid index (AFI) at term is associated with increased obstetric intervention, but its relationship with maternal outcomes remains uncertain. **Objectives:** To assess maternal outcomes in term pregnancies with low AFI and evaluate their association with maternal age, BMI, parity, and previous cesarean section. **Methods:** This analytical cross-sectional study included 137 singleton term pregnancies with low AFI (<5 cm) admitted to a tertiary care hospital in Quetta from 22-09-2025 to 30-12-2025. Sample size was estimated using $n = Z^2P(1-P)/d^2$ at a 95% confidence level with P = 65% and d = 8%. Outcomes included induction of labor, mode of delivery, prolonged labor, instrumental delivery, postpartum hemorrhage, infection, and hospital stay. Chi-square or Fisher's exact test was applied as appropriate. **Results:** Mean age was 28.39 ± 6.65 years, and mean BMI was 27.00 ± 4.82 kg/m^2. Median hospital stay was 3 days (IQR: 2–4). Labor was induced in 101 (73.7%) patients, cesarean section occurred in 94 (68.6%), prolonged labor in 32 (23.4%), instrumental delivery in 13 (9.5%), postpartum hemorrhage in 11 (8.0%), and infection in 7 (5.1%). No statistically significant association was found between maternal outcomes and age group, BMI, parity, or previous cesarean section (all p>0.050). **Conclusions:** In this analytical cross-sectional study, pregnancies with low AFI at term showed high rates of induction and cesarean delivery; however, maternal age, BMI, parity, and previous cesarean section were not significantly associated with adverse maternal outcomes within the study sample.

INTRODUCTION

The amniotic fluid is essential for fetal growth and maintenance of a stable intrauterine environment. It provides mechanical protection, facilitates fetal movement, helps maintain temperature, and supports normal pulmonary and musculoskeletal development. The amniotic fluid index (AFI) is widely used to assess fetal well-being, and an AFI <5 cm is generally considered oligohydramnios or low AFI [1]. Low AFI at term is increasingly recognized in routine obstetric practice because of the widespread availability of ultrasonography [2]. It may arise in association with placental insufficiency, fetal growth restriction, post-term pregnancy, or membrane-related abnormalities. In otherwise low-risk term pregnancies, low AFI has been associated with higher rates of obstetric intervention and adverse perinatal outcomes, although the extent to which it independently affects maternal outcomes remains uncertain [3-5]. Several studies suggest that low AFI does not merely represent a numerical ultrasonographic finding, but may also act as a marker of impaired placental function and fetal

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compromise. In this context, labor induction, cesarean delivery, and closer fetal surveillance may be undertaken because of concern for non-reassuring fetal status, cord compression, or reduced uteroplacental perfusion [6-8]. From a maternal perspective, pregnancies complicated by low AFI may be accompanied by prolonged labor, operative delivery, postpartum hemorrhage, infection, and longer hospitalization. However, these outcomes may be influenced not only by AFI itself, but also by maternal age, BMI, parity, previous cesarean history, and local institutional practices [9-11].

Despite the recognized clinical importance of low AFI, most published work has focused predominantly on fetal and neonatal outcomes, whereas maternal outcome data remain relatively limited. Therefore, the present study was designed to assess maternal outcomes among term pregnant women with low AFI and to evaluate their association with maternal demographic and obstetric characteristics to address this knowledge gap and support evidence-based clinical decision-making.

METHODS

This analytical cross-sectional study was conducted in the Department of Obstetrics and Gynecology, Tertiary Care Hospital, Quetta, from 22-09-2025 to 30-12-2025. The primary objective was to evaluate maternal outcomes in pregnant women at term with low amniotic fluid index (AFI). Study approval was obtained from the Ethical Committee (No. CMH QTA-IERB/117/2025; dated 22nd September 2025, and written informed consent was obtained from every patient. The study included pregnant women aged 18 to 40 years with singleton pregnancies who delivered at term (37-40 weeks) and had low AFI (<5 cm) on transabdominal ultrasonography using the standard four-quadrant technique. Women with medical comorbidities, including hypertension, gestational diabetes mellitus, thyroid disorders, and multiple gestations, were excluded to reduce confounding and improve internal validity; however, this may limit the generalizability of the findings. The sample size was estimated by using Open Epi version 3.01 and the single population proportion formula $n = Z^2P(1-P)/d^2$, where Z = 1.96 for a 95% confidence level, P = 0.65 based on the reported cesarean section proportion in women with low AFI, and d = 0.08 as the margin of error. The calculated minimum sample size was 136.56, which was rounded to 137 participants [12]. Enrollment was performed through non-probability consecutive sampling. After written consent, data were recorded on a predesigned proforma. Maternal outcome measures included induction of labor, mode of delivery (vaginal or cesarean), prolonged labor, instrumental delivery, postpartum hemorrhage (PPH), puerperal fever/infection, and hospital stay. Other variables recorded were maternal age, parity, BMI, gestational age at delivery, and history of previous cesarean section.

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Normality of quantitative variables was assessed before selecting summary statistics. Age and BMI are presented as mean ± standard deviation, while hospital stay is presented as median with interquartile range (IQR). Categorical variables are presented as frequencies and percentages in n (%) format. Stratification was performed according to age group, BMI category, parity, and previous cesarean section. Chi-square test was applied for categorical associations, while Fisher's exact test was used for 2×2 tables with small expected cell frequencies. A p-value ≤ 0.050 was considered statistically significant.

RESULTS

A total of 137 patients with low AFI at term were included in the study. The mean age of the participants was 28.39 ± 6.65 years (range: 18-40 years), and the mean BMI was 27.00 ± 4.82 kg/m^2 (range: 19-35 kg/m^2). Hospital stays ranged from 2 to 6 days, with a median of 3 days (IQR: 2-4). Among the study population, induction of labor was performed in 101/137 (73.7%) patients, cesarean section was observed in 94/137 (68.6%), prolonged labor in 32/137 (23.4%), instrumental delivery in 13/137 (9.5%), postpartum hemorrhage in 11/137 (8.0%), and infection in 7/137 (5.1%) (Table 1).

Table 1: Frequency Distribution of Maternal Outcomes (n=137)

Variables	Category	n (%)
Induction of Labor	Yes	101 (73.7%)
	No	36 (26.3%)
Mode of Delivery	Vaginal	43 (31.4%)
	Cesarean	94 (68.6%)
Prolonged Labor	Yes	32 (23.4%)
	No	105 (76.6%)
Instrumental Delivery	Yes	13 (9.5%)
	No	124 (90.5%)
Postpartum Hemorrhage (PPH)	Yes	11 (8.0%)
	No	126 (92.0%)
Infection	Yes	7 (5.1%)
	No	130 (94.9%)

Maternal outcomes were compared across age groups. Induction of labor ranged from 21/31 (67.7%) in women aged ≥35 years to 24/27 (88.9%) in those aged 30-34 years, while cesarean delivery ranged from 20/31 (64.5%) to 31/44 (70.5%). Prolonged labor was highest in women aged 30-34 years, 9/27 (33.3%), followed by those aged ≥35 years, 9/31 (29.0%). Instrumental delivery, postpartum hemorrhage, and infection remained uncommon across all age groups. No statistically significant association was found between age group and any maternal outcome (all p>0.050) (Table 2).

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Table 2: Association of Maternal Outcomes with Age Group (n=137)

Outcome Variables	Subgroup	<25 Years (n=44)	25-29 Years (n=35)	30-34 Years (n=27)	≥35 Years (n=31)	p-value
Induction of Labor	Yes	31 (70.5%)	25 (71.4%)	24 (88.9%)	21 (67.7%)	0.249
	No	13 (29.5%)	10 (28.6%)	3 (11.1%)	10 (32.3%)	
Mode of Delivery	Vaginal	13 (29.5%)	11 (31.4%)	8 (29.6%)	11 (35.5%)	0.950
	Cesarean	31 (70.5%)	24 (68.6%)	19 (70.4%)	20 (64.5%)	
Prolonged Labor	Yes	7 (15.9%)	7 (20.0%)	9 (33.3%)	9 (29.0%)	0.303
	No	37 (84.1%)	28 (80.0%)	18 (66.7%)	22 (71.0%)	
Instrumental Delivery	Yes	5 (11.4%)	2 (5.7%)	2 (7.4%)	4 (12.9%)	0.725
	No	39 (88.6%)	33 (94.3%)	25 (92.6%)	27 (87.1%)	
Postpartum Hemorrhage	Yes	4 (9.1%)	2 (5.7%)	1 (3.7%)	4 (12.9%)	0.572
	No	40 (90.9%)	33 (94.3%)	26 (96.3%)	27 (87.1%)	
Infection	Yes	1 (2.3%)	3 (8.6%)	1 (3.7%)	2 (6.5%)	0.610
	No	43 (97.7%)	32 (91.4%)	26 (96.3%)	29 (93.5%)	

The association of maternal outcomes with BMI category (non-obese versus obese) also showed no statistically significant differences. Induction of labor occurred in 69/94 (73.4%) non-obese and 32/43 (74.4%) obese women, while cesarean section was observed in 67/94 (71.3%) and 27/43 (62.8%), respectively. Prolonged labor was numerically more frequent among obese women, 14/43 (32.6%) versus 18/94 (19.1%), whereas instrumental delivery, postpartum hemorrhage, and infection remained infrequent in both groups. Fisher's exact test was used for instrumental delivery, postpartum hemorrhage, and infection because of small expected cell counts (Table 3).

Table 3: Association of Maternal Outcomes with BMI Groups

Outcome Variables	Subgroup	Non-obese (n=94)	Obese (n=43)	p-value
Induction of Labor	Yes	69 (73.4%)	32 (74.4%)	0.900
	No	25 (26.6%)	11 (25.6%)	
Mode of Delivery	Vaginal	67 (71.3%)	27 (62.8%)	0.321
	Cesarean	27 (28.7%)	16 (37.2%)	
Prolonged Labor	Yes	18 (19.1%)	14 (32.6%)	0.085
	No	76 (80.9%)	29 (67.4%)	
Instrumental Delivery	Yes	10 (10.6%)	3 (7.0%)	0.754
	No	84 (89.4%)	40 (93.0%)	
Postpartum Hemorrhage (PPH)	Yes	8 (8.5%)	3 (7.0%)	1.000
	No	86 (91.5%)	40 (93.0%)	
Infection	Yes	6 (6.4%)	1 (2.3%)	0.433
	No	88 (93.6%)	42 (97.7%)	

Note: Fisher's exact test was used for instrumental delivery, postpartum hemorrhage, and infection because of small expected cell frequencies

Similarly, no statistically significant differences in maternal outcomes were found between primigravida and multigravida women. Induction of labor was performed in 46/64 (71.9%) primigravidas and 55/73 (75.3%) multigravidas, while cesarean delivery occurred in 40/64 (62.5%) and 54/73 (74.0%), respectively. Prolonged labor was more frequent in primigravidas, 19/64 (29.7%), than in multigravidas, 13/73 (17.8%), but the difference was not statistically significant. Instrumental delivery, postpartum hemorrhage, and infection were uncommon in both parity groups, and Fisher's exact test was applied for these outcomes (Table 4).

Table 4: Association of Maternal Outcomes with Parity (n=137)

Outcome Variables	Subgroup	Primigravida, n (%)	Multigravida, n (%)	p-value
Induction of Labor	Yes	46 (71.9%)	55 (75.3%)	0.645
	No	18 (28.1%)	18 (24.7%)	
Mode of Delivery	Vaginal	24 (37.5%)	19 (26.0%)	0.149
	Cesarean	40 (62.5%)	54 (74.0%)	
Prolonged Labor	Yes	19 (29.7%)	13 (17.8%)	0.101
	No	45 (70.3%)	60 (82.2%)	
Instrumental Delivery	Yes	6 (9.4%)	7 (9.6%)	1.000
	No	58 (90.6%)	66 (90.4%)	
Postpartum Hemorrhage (PPH)	Yes	6 (9.4%)	5 (6.8%)	0.755
	No	58 (90.6%)	68 (93.2%)	
Infection	Yes	2 (3.1%)	5 (6.8%)	0.448
	No	62 (96.9%)	68 (93.2%)	

*Indicates statistical significance at $p \leq 0.050$. No statistically significant associations were observed in this table. Fisher's exact test was used for instrumental delivery, postpartum hemorrhage, and infection

Maternal outcomes also did not differ significantly between women with and without a history of previous cesarean section. Induction of labor occurred in 25/32 (78.1%) women with previous cesarean section and 76/105 (72.4%) women without, while cesarean delivery was observed in 23/32 (71.9%) and 71/105 (67.6%), respectively. Prolonged labor was reported in 8/32 (25.0%) versus 24/105 (22.9%), instrumental delivery in 1/32 (3.1%) versus 12/105 (11.4%), postpartum hemorrhage in 2/32 (6.3%) versus 9/105 (8.6%), and infection in 2/32 (6.3%) versus 5/105 (4.8%). Again, none of the associations were statistically significant, and Fisher's exact test was used for sparse cell frequencies where appropriate (Table 5).

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Table 5: Association of Previous Cesarean Section with Maternal Outcomes (n=137)

Maternal Outcomes	Previous CS	Yes, n (%)	No, n (%)	p-value
Induction of Labor	Yes	25 (78.1%)	76 (72.4%)	0.518
	No	7 (21.9%)	29 (27.6%)	
Mode of Delivery	Vaginal	9 (28.1%)	34 (32.4%)	0.650
	Cesarean	23 (71.9%)	71 (67.6%)	
Prolonged Labor	Yes	8 (25.0%)	24 (22.9%)	0.802
	No	24 (75.0%)	81 (77.1%)	
Instrumental Delivery	Yes	1 (3.1%)	12 (11.4%)	0.299
	No	31 (96.9%)	93 (88.6%)	
Postpartum Hemorrhage (PPH)	Yes	2 (6.3%)	9 (8.6%)	<0.001
	No	30 (93.8%)	96 (91.4%)	
Infection	Yes	2 (6.3%)	5 (4.8%)	0.665
	No	30 (93.8%)	100 (95.2%)	

*Indicates statistical significance at $p \leq 0.050$. No statistically significant associations were observed in this table. Fisher's exact test was used for instrumental delivery, postpartum hemorrhage, and infection

DISCUSSION

In this cohort of 137 term pregnancies with low AFI, induction of labor occurred in 101/137 (73.7%) and cesarean section in 94/137 (68.6%), whereas prolonged labor, instrumental delivery, postpartum hemorrhage, and puerperal infection were less frequent at 32/137 (23.4%), 13/137 (9.5%), 11/137 (8.0%), and 7/137 (5.1%), respectively. None of these outcomes showed a statistically significant association with maternal age, BMI, parity, or previous cesarean section. Although prolonged labor appeared numerically higher among obese women (32.6% vs. 19.1%) and primigravidas (29.7% vs. 17.8%), these differences did not reach statistical significance. Overall, the pattern suggests that once low AFI is identified at term, the decision to intervene may be influenced more by concern for fetal compromise and institutional management protocols than by baseline maternal demographic characteristics alone. Similar findings were reported by Rehman *et al.* who documented a cesarean section rate of 65% among women with low AFI at term [12]. Chaudhary *et al.* likewise found higher intervention rates in oligohydramnios, reporting induction of labor in 50% versus 38% and cesarean delivery in 46% versus 20% compared with women having normal AFI [13]. Vyas *et al.* also reported increased cesarean delivery and meconium-stained liquor in pregnancies with borderline AFI. Compared with these studies, the intervention rates in our cohort were somewhat higher, which may reflect tertiary-care referral patterns, differences in case selection, and local thresholds for induction or operative delivery [14]. Patil *et al.* reported cesarean delivery in more than half of pregnancies complicated by oligohydramnios [15], while Sawant *et al.* documented a 69.1% cesarean section rate, largely in association with fetal distress and abnormal surveillance findings [16]. Shiferaw *et al.* similarly found cesarean delivery in 40.8% of late-term and post-term pregnancies with oligohydramnios [17]. These reports support the interpretation that reduced AFI frequently acts as a clinical trigger for intervention, especially when accompanied by non-reassuring fetal assessment, rather than serving as a direct determinant of maternal morbidity by itself. Mathuriya *et al.* observed that elective and emergency cesarean section rates were approximately twice as high in term pregnancies with low AFI compared with controls [18], whereas Majumdar *et al.* emphasized declining AFI in late gestation as a marker warranting closer surveillance [19]. Khan and Iftikhar reported that borderline AFI was not associated with a higher cesarean rate, but it was linked with increased NICU admission and meconium-stained liquor [20]. Taken together, the available evidence and the present findings indicate that low AFI at term may serve both as a surrogate marker of placental insufficiency and as a practical trigger for intensified surveillance and delivery planning. However, because this was a single-center study without a normal-AFI comparison group and without multivariable adjustment, the present results should not be interpreted as proving an independent causal effect of low AFI on maternal outcomes.

The present study has several limitations. It was a single-center hospital-based study without a comparison group of women with normal AFI. AFI was determined using a single ultrasonographic measurement, which may be affected by operator variability and short-term fluid fluctuation. In addition, women with medical comorbidities were excluded to improve internal validity, which may reduce generalizability. Finally, multivariable regression was not performed, so residual confounding cannot be excluded. These limitations should be considered when interpreting the findings.

CONCLUSIONS

In this analytical cross-sectional study of term pregnancies with low AFI, induction of labor and cesarean section were common maternal outcomes. However, maternal age, BMI, parity, and previous cesarean section were not significantly associated with prolonged labor, instrumental delivery, postpartum hemorrhage, or infection. These findings suggest that the high intervention rates observed in low-AFI pregnancies may be related more to the clinical significance of low AFI and local management protocols than to baseline maternal demographic or obstetric characteristics. Larger comparative studies with serial AFI assessment and multivariable adjustment are needed to clarify causal pathways and improve evidence-based management.

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Authors' Contribution

Conceptualization: SI
Methodology: SI, MS
Formal analysis: SI, MS
Writing and Drafting: SI, UA, HS, MZA, MS, MA
Review and Editing: SI, UA, HS, MZA, MS, MA

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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