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To Investigate the Relationship Between Low Amniotic Fluid Index and Fetal Outcomes, Including Mode of Delivery, Fetal Well-Being (As Assessed By NST), Color of Amniotic Fluid, and NICU Admission, Among Patients Admitted Between 36 To 40 Weeks Gestation

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ABSTRACT

Aim: This study aimed to investigate the relationship between low AFI and fetal outcomes, including mode of delivery, fetal well-being, and NICU admission rates in pregnancies between 36 and 40 weeks gestation.

Methods: A prospective comparative study was conducted at the Department of Obstetrics and Gynecology, Government Medical College, Baramulla, Jammu and Kashmir, from December 2023 to December 2024. A total of 126 pregnant women with singleton, cephalic presentations at 36–40 weeks gestation were enrolled and divided into two equal groups: Group A (AFI <5 cm) and Group B (AFI ≥5 cm). AFI was measured twice within 24 hours prior to induction of labor. Fetal well-being was assessed using cardiotocography (CTG), and labor was induced using vaginal PGE2. Maternal and neonatal outcomes, including mode of delivery, Apgar scores, birth weight, complications, and NICU admissions, were recorded and analyzed using SPSS v22. A p-value <0.05 was considered statistically significant.

Results: A total of 126 patients (63 per group) were analyzed. The mean AFI was 2.8±1.1 cm in the low AFI group versus 9.1±1.7 cm in the normal AFI group (p<0.001). IUGR was present only in the oligohydramnios group (17.5%, p<0.001). Cesarean section rates were significantly higher in the AFI <5 cm group (66.7% vs. 33.3%, p<0.001), with acute fetal distress (24.4%) and non-progress of labor (26.8%) being the most common indications. Mean birth weight was lower in the low AFI group (2.9±0.7 kg vs. 3.1±0.6 kg, p<0.001). Apgar scores at 1 and 5 minutes were significantly lower in the oligohydramnios group (7.7 and 8.1, respectively) compared to controls (9.1 and 9.3, respectively) (p<0.001). Maternal infections were more frequent in the low AFI group (14.3% vs. 1.6%, p=0.008). Neonatal complications, including respiratory distress (30.2% vs. 11.1%) and NICU admissions (44.4% vs. 22.2%), were significantly higher in the AFI <5 cm group (p=0.041). Hospital stay was longer for patients with oligohydramnios (2.8±1.3 days vs. 1.9±1.2 days, p<0.001).

Conclusion: Oligohydramnios (AFI <5 cm) in late-term pregnancies is significantly associated with increased rates of cesarean delivery, lower birth weight, poor Apgar scores, higher maternal infections, and increased neonatal morbidity, including respiratory distress and NICU admissions. Routine AFI assessment in the third trimester is a valuable tool for antenatal surveillance. Early identification and timely management of low AFI can help improve perinatal outcomes and reduce the burden of obstetric interventions.

***Keywords**: Oligohydramnios, Amniotic Fluid Index (AFI), perinatal outcome, cesarean section, NICU admission, Apgar score.*

INTRODUCTION

Oligohydramnios is defined as deficiency in the amount of amniotic fluid with AFI<5^{th} percentile for gestational age or AFI<5cm regardless of gestational age.[1] It can also be defined as when the maximum vertical pockets of liquor is less than 2 cm.[2]

There are four quantitatively important amniotic inflows and outflows that include fetal urine production, lung liquid secretion, swallowing, and intramembranous absorption. Of these, amniotic fluid volume is regulated primarily by modulating the rate of intramembranous absorption of amniotic fluid water and solutes across the amniotic epithelial cells into the underlying fetal vasculature. Modulation of the rate of intramembranous absorption depends on the presence of stimulators and inhibitors present in the amniotic fluid. A stimulator of intramembranous absorption is present in fetal urine. In addition, amniotic fluid contains a non-renal, non-pulmonary inhibitor of intramembranous absorption presumably secreted by the fetal membranes. Although passive bidirectional movements of water and solutes occur across the intramembranous pathway, intramembranous absorption is primarily a unidirectional, vesicular, bulk transport process mediated through VEGF activation of transcytotic transport via caveolae. Further, the stimulators and inhibitors of intramembranous absorption alter only the active, unidirectional component of intramembranous absorption while the passive components are not altered under experimental conditions studied thus far. Future progress depends on identifying the cellular and molecular mechanisms that regulate active and passive intramembranous absorption as well as their regulatory components.[3]

Amniotic fluid has many important functions. It is integral to fetal development, including fetal pulmonary, gastrointestinal, and musculoskeletal maturation. It also acts to cushion the fetus from trauma. It is also believed to be sterile and possesses bacteriostatic properties.[4,5] This fluid provides several important benefits to the fetus in that it cushions the fetus against trauma, has antibacterial properties to lessen infections, and functions as a reservoir that may provide a short-term source of fluid and nutrients to the fetus. In addition, at least moderate amounts of amniotic fluid are required for the fetal musculoskeletal system to develop normally, for gastrointestinal system development, and for the fetal lungs to develop and mature as needed in preparation for the breathing of air that must commence abruptly at birth.[6]

Amniotic fluid is regulated by fetal swallowing, fetal urine production, lung secretions, and intramembranous absorption.[3] Amniotic fluid abnormalities (either increased or decreased fluid) are due to dysregulation of these processes from maternal or fetal disease. Nowadays oligohydramnios is most common occurrence in pregnant women. Amniotic fluid is a predictor of fetal tolerance in labour and its decrease is associated with increased rate of caesarean section.[7] Fetal health can be seriously compromised by oligohydramnios, with complications such as pulmonary hypoplasia, meconium aspiration syndrome, fetal compression and, in cases of prolonged rupture of membranes, infections. Women with oligohydramnios are more likely to have an infant with low birth weight.[8] Maternal conditions such as utero-placental insufficiency, hypertension, preeclampsia, diabetes, chronic hypoxia, rupture of amniotic membranes, dehydration and post-term gestation have been associated with oligohydramnios.[9] Anomalies of the kidneys including congenital absence of renal tissue, obstructive uropathy or decreased renal perfusion also may be contributing factors.[10]

In terms of burden of care, higher rates of cesarean delivery for fetal distress and neonatal admission to the intensive care unit have also been associated with oligohydramnios.[11] Early detection of oligohydramnios and its management may help in reduction of perinatal morbidity and decrease in Caeserian deliveries.[12,13] When detected, clinical management of women with oligohydramnios can include amnioinfusion, early induction of labor and even cesarean delivery. Hydration therapy can also be implemented considering maternal oral hydration is more effective than intravenous hydration and hypotonic solutions superior to isotonic.

An appropriate volume of amniotic fluid is one of the most important components of a healthy pregnancy, as it acts as a protective cushion for the fetus, prevents compression of the umbilical cord, and promotes fetal lung development. In settings where ultrasound use is widespread, rates of oligohydramnios have been reported between 0.5 and 8% among pregnant women.[14] When associated with a fetal anomaly, oligohydramnios is present in as many as 37% of pregnancies and is higher with other pregnancy complications.[15] The incidence of oligohydramnios is estimated between 0.5 to 5.5 per Cent of all pregnancies. Oligohydramnios is associated with a variety of maternal, fetal, and placental conditions. The association of decreased amniotic fluid Volume with intrauterine growth retardation is well-established. There is a 4-fold increased risk of growth delay when oligohydramnios is present. Fetal distress and neonatal depression also is increased 4-fold in patients with oligohydramnios. Whereas moderately decreased amniotic fluid increases perinatal mortality 10 to 15 times normal, severe oligohydramnios is associated with a perinatal mortality 40 to 50 times normal. Second trimester oligohydramnios is associated with a poor prognosis, especially if maternal serum alphafetoprotein is concurrently elevated. Congenital anomalies and chromosomal abnormalities also can produce decreased amniotic fluid, as illustrated in the classic Potter's syndrome. Preterm rupture of membranes can produce oligohydramnios of longstanding duration that can result in compression deformity, amniotic band syndrome, and pulmonary hypoplasia. Postmaturity is associated with decreased amniotic fluid, oligohydramnios, and its adverse perinatal sequelae.[16]

Most common cause of oligohydramnios is idiopathic and second most is Pregnancy Induced Hypertension. Incidence as well as operative morbidity is more in primipara. Operative morbidity is highest in PIH and significantly higher in NST non-reactive mothers. Hence Successful outcome of obstetric well-being is to assess by obtaining healthy mother and child in modern obstetrics. Assessment of fetal well-being is important in timely diagnosis of fetal compromise and management.[17] This can be possible by promoting more frequent ANC visits, regular screening and more importantly USG should be done in every trimester.

MATERIALS AND METHODS

Study setting: The present study was conducted in the Department of Obstetrics and Gynecology of Government Medical College, Kanthbagh, Baramulla, Jammu and Kashmir.

Study duration: The study was carried out from December 2023 to December 2024.

Study type and design: The present study was a prospective comparative study.

Study sample and grouping method: Patients presenting to the study institution for induction of labor. Two groups of patients were enrolled in the study, group A having patients with AFI <5 cm, and the group B having AFI ≥5 cm.

Inclusion criteria: The inclusion criteria for the present study were:

1. Pregnant women with singleton pregnancies with vertex presentation
2. Patients with no known fetal anomalies
3. Gestational age 36-40 weeks
4. Membranes intact
5. Not in labor
6. CTG done at admission

Exclusion Criteria: The exclusion criteria for the present study were:

1. Pregnant women with pre-existing medical conditions that might affect amniotic fluid volume
2. Pregnant women who do not provide written informed consent to take part in the study
3. Previous cesarean section
4. Intrauterine death
5. Fetus with congenital anomalies
6. Maternal complications
7. AFI >25 cm

Method of selection

A consecutive sampling technique was utilized in the present study. All the patients presenting to the study institution and fulfilling the inclusion and exclusion criteria were approached for the study. Those patients providing written informed consent were then recruited in the present study as participants.

Study procedure

Patients who had been admitted to the Department of Obstetrics and Gynecology at Government Medical College, Kanthbagh Baramulla, for induction of labor were screened to determine eligibility based on predefined inclusion criteria. The Amniotic Fluid Index (AFI) was measured on two separate occasions with a minimum interval of 24 hours between the assessments. The final AFI assessment was conducted within 24 hours preceding the induction of labor. The Bishop score, which reflects cervical readiness for induction, was evaluated immediately before initiating the induction protocol. Based on the findings of the AFI assessment, participants were divided into two groups of 63 patients each. Group A consisted of patients with AFI <5 cm and group B consisted of patients with AFI ≥5 cm.

Prior to the administration of vaginal Prostaglandin E2 (PGE2), each participant was subjected to a reactive 20-minute cardiotocogram (CTG) to assess fetal well-being. In instances where no response was observed within 6 hours, a repeat dose of PGE2 was administered. Continuous fetal heart rate monitoring was commenced once uterine contractions were established.

Although the attending medical staff were informed of the AFI values, they were not made aware of the participants' enrollment in the study, thereby maintaining partial blinding.

Comprehensive data were collected on a range of maternal parameters, including maternal age, parity, gestational age at induction, the presence of antenatal complications, and the clinical indication for labor induction. The characteristics of the amniotic fluid — whether clear or meconium-stained — were noted at the time of amniotomy. Details regarding the mode of delivery (vaginal or cesarean) and the specific indications leading to cesarean section were meticulously recorded.

Fetal distress was diagnosed by the attending obstetrician based on abnormal fetal heart rate patterns that were not resolved through standard interventions such as repositioning the mother, administering intravenous fluids for hydration, or providing nasal oxygen supplementation.

Neonatal outcomes were systematically documented and included birth weight, Apgar scores at one and five minutes after birth, and the requirement for admission to the Neonatal Intensive Care Unit (NICU).

Sample size:

The sample size was determined using the online open epi tool, with a power of 80% and a confidence level of 95%. Based on previous research findings, which indicated a sixfold increase in fetal distress among individuals with an Amniotic Fluid Index (AFI) of ≤5 cm compared to those with an AFI of ≥5 cm (i.e., odds ratio of 6), we anticipated this effect size.[18] This implies that the exposed group (AFI ≤5 cm) faces a 24% higher risk of fetal distress compared to the group with AFI ≥5 cm, which may have a fivefold risk. This calculation was essential to ensure adequate sample size for investigating associations between low amniotic fluid volumes and fetal outcomes. So, the total sample size calculated was 126. N=63 patients in each study groups.

Statistical Analysis:

The collected data were checked for consistency, completeness and entered into Microsoft Excel (MS-EXCEL, Microsoft Corp.) data sheet. Analyzed with the statistical program Statistical Package for the Social Sciences (IBM SPSS, version 22). Where analytical statistics were performed, a p-value of <0.05 was considered to be statistically significant for the purpose of the study. For analytical statistics, Chi-square test was used for categorical data and student's t-test was used for continuous data.

RESULTS

Table 1: Demographic and Baseline Characteristics

Parameter	Subgroup	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
Age (years)	<25	20 (31.7%)	34 (54.0%)	0.010*
	25-29	30 (47.6%)	23 (36.5%)	
	30-34	13 (20.6%)	4 (6.3%)	
	≥35	0 (0%)	2 (3.2%)	
Residence	Rural	53 (84.1%)	59 (93.7%)	0.089
	Urban	10 (15.9%)	4 (6.3%)	
Occupation	Housewife	59 (93.7%)	63 (100%)	0.062
	Teacher	4 (6.3%)	0 (0%)	
Parity	0	32 (50.8%)	31 (49.2%)	0.663
	1	13 (20.6%)	17 (27.0%)	
	2	18 (28.6%)	15 (23.8%)	

Of 126 patients, age distribution differed significantly (p=0.010): in the AFI<5 cm group, 31.7% were <25 years, 47.6% were 25–29, and 20.6% were 30–34, with none ≥35; in the AFI≥5 cm group, 54% were <25, 36.5% were 25–29, 6.3% were 30–34, and 3.2% were ≥35, indicating younger women had normal AFI more often. Most patients were rural residents (84.1% vs. 93.7%, p=0.089). Occupation (93.7% housewives in low AFI vs. 100% in normal AFI, p=0.062) and parity (primigravidas 50.8% vs. 49.2%, p=0.663) showed no significant differences.

Table 2: Gestational Age, AFI, and Comorbidities

Parameter	Subgroup	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
Gestational age (weeks)	<37	17 (27.0%)	0 (0%)	<0.001*
	37-40	46 (73.0%)	63 (100%)	
Mean AFI (cm)	Mean ± SD	2.8 ± 1.1	9.1 ± 1.7	<0.001*
IUGR	Present	11 (17.5%)	0 (0%)	<0.001*

Gestational age differed significantly (p<0.001): all patients with AFI≥5 cm were at term (37–40 weeks), while 27% of those with AFI<5 cm were preterm. Mean AFI was significantly lower in the oligohydramnios group (2.8±1.1 cm vs. 9.1±1.7 cm, p<0.001), validating the grouping criteria. IUGR was present in 17.5% of the AFI<5 cm group versus none in the AFI≥5 cm group (p<0.001), indicating a strong association between oligohydramnios and IUGR.

Table 3: Labor Induction and Mode of Delivery

Parameter	Subgroup	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
Mean induction time (hours)	Mean ± SD	10.1 ± 5.3	10.9 ± 4.6	0.329
Mode of delivery	LSCS	42 (66.7%)	21 (33.3%)	<0.001*
	NVD	21 (33.3%)	42 (66.7%)	

The mean induction time in the AFI <5 cm group was 10.1 hours (±5.3), slightly lower than 10.9 hours (±4.6) in the AFI ≥5 cm group. However, this difference was not statistically significant (p = 0.329), suggesting that AFI level did not influence induction duration. Regarding the mode of delivery, cesarean section was performed in 66.7% of patients with AFI <5 cm, while only 33.3% of patients in the AFI ≥5 cm group required LSCS. Conversely, normal vaginal delivery occurred in 66.7% of patients with normal AFI and only 33.3% with oligohydramnios. This difference was statistically significant (p < 0.001), indicating higher operative delivery rates in patients with oligohydramnios.

Table 4: Indications for Cesarean Section (n=63)

Indication	AFI <5 cm (n=41)	AFI ≥5 cm (n=22)	p-value
Acute fetal distress	10 (24.4%)	5 (22.7%)	<0.001*
Failure of induction	8 (19.5%)	6 (27.3%)	
Fetal bradycardia	3 (7.3%)	0 (0%)	
Fetal tachycardia	0 (0%)	2 (9.1%)	
Non-descent of head	4 (9.8%)	3 (13.6%)	
Non-progress of labor	11 (26.8%)	2 (9.1%)	

Indication	AFI <5 cm (n=41)	AFI ≥5 cm (n=22)	p-value
Non-reassuring CTG	5 (12.2%)	3 (13.6%)	

Among the 63 patients who underwent cesarean delivery, acute fetal distress was the most common indication in both groups—24.4% in the AFI <5 cm group and 22.7% in the AFI ≥5 cm group. Other indications included non-progress of labor (26.8% in AFI <5 cm vs. 9.1% in AFI ≥5 cm), failure of induction (19.5% vs. 27.3%), and non-reassuring CTG (12.2% vs. 13.6%). Fetal bradycardia occurred only in the oligohydramnios group (7.3%), while fetal tachycardia was noted only in the normal AFI group (9.1%). Non-descent of head accounted for 9.8% of cases in the low AFI group and 13.6% in the normal AFI group. The distribution of indications showed a statistically significant overall difference ($p < 0.001$).

Table 5: Birth Weight and Apgar Scores

Parameter	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
Mean birth weight (kg)	2.9 ± 0.7	3.1 ± 0.6	<0.001*
Mean APGAR at 1 min	7.7 ± 2.4	9.1 ± 1.8	<0.001*
Mean APGAR at 5 mins	8.1 ± 2.2	9.3 ± 1.6	<0.001*
Stillbirth	2 (3.2%)	0 (0%)	0.154

Neonates in the AFI <5 cm group had a significantly lower mean birth weight (2.9 ± 0.7 kg) compared to those in the AFI ≥5 cm group (3.1 ± 0.6 kg), with the difference being statistically significant ($p < 0.001$). Regarding Apgar scores, the mean score at 1 minute was significantly lower in the oligohydramnios group (7.7 ± 2.4) compared to the normal AFI group (9.1 ± 1.8). Similarly, the mean Apgar score at 5 minutes was significantly lower in the AFI <5 cm group (8.1 ± 2.2) versus the AFI ≥5 cm group (9.3 ± 1.6). Both differences were statistically significant ($p < 0.001$). Two stillbirths (3.2%) occurred in the low AFI group, while none were recorded in the control group; however, this difference was not statistically significant ($p = 0.154$).

Table 6: Maternal Complications

Complication	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
Meconium-stained liquor	19 (30.2%)	15 (23.8%)	0.422
PPH	7 (11.1%)	8 (12.7%)	0.783
Infection	9 (14.3%)	1 (1.6%)	0.008*

Meconium-stained liquor was more common in the oligohydramnios group (30.2%) compared to the normal AFI group (23.8%), although the difference was not statistically significant ($p = 0.422$). Postpartum hemorrhage (PPH) occurred at similar rates in both groups—11.1% in the AFI <5 cm group versus 12.7% in the AFI ≥5 cm group ($p = 0.783$). However, infections were significantly more frequent in the AFI <5 cm group (14.3%) compared to the AFI ≥5 cm group (1.6%), and this difference was statistically significant ($p = 0.008$), suggesting higher maternal morbidity associated with oligohydramnios.

Table 7: Neonatal Complications

Complication	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
Birth asphyxia	2 (3.2%)	3 (4.8%)	0.041*

Complication	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
MAS	3 (4.8%)	0 (0%)	
Neonatal death	2 (3.2%)	1 (1.6%)	
Respiratory distress	19 (30.2%)	7 (11.1%)	
Sepsis	2 (3.2%)	3 (4.8%)	
None	35 (55.6%)	49 (77.8%)	

Neonatal complications were significantly more frequent among infants born to mothers with AFI <5 cm. Respiratory distress was notably higher in neonates from the AFI <5 cm group (30.2%) compared to 11.1% in the normal AFI group. Meconium aspiration syndrome (MAS) was found only in the AFI <5 cm group (4.8%). Birth asphyxia occurred in 3.2% of the low AFI group versus 4.8% in the normal AFI group. Sepsis was observed in 3.2% of the oligohydramnios group and 4.8% of the control group. Neonatal death occurred in 3.2% of the AFI <5 cm group and 1.6% of the AFI ≥5 cm group. Overall, more neonates in the normal AFI group (77.8%) had no complications compared to the oligohydramnios group (55.6%), and this difference was statistically significant (p = 0.041).

Table 8: NICU Admission and Hospital Stay

Parameter	AFI <5 cm (n=63)	AFI ≥5 cm (n=63)	p-value
NICU admission	28 (44.4%)	14 (22.2%)	0.041*
Mean hospital stay (days)	2.8 ± 1.3	1.9 ± 1.2	<0.001*

NICU admission rates were significantly higher in the oligohydramnios group, with 44.4% of neonates requiring specialized care compared to only 22.2% in the normal AFI group (p = 0.041). Additionally, patients with oligohydramnios had significantly longer hospital stays (2.8 ± 1.3 days) compared to those with normal AFI (1.9 ± 1.2 days), and this difference was statistically significant (p < 0.001). This reflects the increased need for monitoring and management in the presence of low AFI, as well as the higher burden of neonatal complications requiring extended postnatal care.

DISCUSSION

The present study found a statistically significant association between maternal age and amniotic fluid index (AFI) levels, with women under 25 years more commonly represented in the normal AFI group. This is consistent with the findings of Thobbi et al., who noted a higher incidence of oligohydramnios among younger women aged 21–25 years, suggesting age may play a role in amniotic fluid regulation, possibly via vascular or hormonal factors influencing placental perfusion.[19]

In terms of gestational age, a significant proportion of women with oligohydramnios in the current study were below 37 weeks, reinforcing the strong association between low AFI and preterm gestation. This finding aligns with Bansal et al.[20], who reported a 17.8% preterm delivery rate among women with oligohydramnios, and with Talpur et al.[21], who found that a majority of cases with low AFI fell between 37 and 38 weeks, many nearing preterm thresholds. These results collectively highlight that oligohydramnios is not limited to post-term pregnancies and may appear earlier, warranting heightened surveillance even in late preterm periods.

No significant differences were observed between groups concerning parity or residence in the current study. These findings are in agreement with Madaan et al., who similarly found no statistically significant parity-related difference in AFI levels among their study population.[22] Moreover, several reviewed studies, including those by Ali et al. and Mohan et al., matched controls and cases by parity, implying that parity alone may not be a strong determinant of AFI.[23,24]

The present study demonstrated a statistically significant association between oligohydramnios (AFI <5 cm) and intrauterine growth restriction (IUGR), with 17.5% of cases in the low AFI group exhibiting IUGR compared to none in the normal AFI group (p < 0.001). This finding is in concordance with previous literature that has consistently shown that diminished amniotic fluid volume is frequently indicative of underlying placental insufficiency and impaired fetal growth.

Morris et al. conducted a meta-analysis of 43 studies and found a strong correlation between oligohydramnios and small for gestational age neonates (OR 6.31, 95% CI 4.15–9.58), reinforcing the predictive value of low AFI in identifying fetuses at risk for IUGR.[25] Mathuriya et al. also reported significantly higher rates of fetal growth restriction among patients with AFI ≤5 cm, further supporting the association.[26]

The pathophysiology of this association is believed to stem from chronic uteroplacental insufficiency, which compromises fetal renal perfusion and thus reduces fetal urine output, a primary source of amniotic fluid. This in turn leads to oligohydramnios, creating a feedback loop of worsening fetal growth. Madaan et al. similarly reported that women with IUGR had significantly lower mean AFI values (9.8 cm) compared to those with normal growth fetuses (12.1 cm; p < 0.01).[22] The present study thus supports the integration of serial AFI assessments in high-risk pregnancies as a means of early detection of IUGR, enabling timely interventions to optimize fetal outcomes and minimize complications.

In the current study, mode of delivery was significantly influenced by the level of amniotic fluid. Among women with AFI <5 cm, 66.7% underwent lower segment cesarean section (LSCS), compared to only 33.3% in the normal AFI group. Conversely, 66.7% of women in the normal AFI group had successful vaginal deliveries, compared to only 33.3% among those with oligohydramnios. This statistically significant difference (p < 0.001) strongly indicates that oligohydramnios substantially increases the likelihood of operative delivery. These findings align with multiple previous studies. Bhagat et al. reported a significantly elevated cesarean section rate in the oligohydramnios group (65.6%) compared to controls, primarily due to fetal distress.[27] Similarly, Bachhav et al. observed a cesarean rate of 66% in women with AFI <5 cm.[28]

Mohan et al. also found higher cesarean delivery rates in cases of isolated oligohydramnios (51.5% vs. 26.5%; p<0.001), underscoring that low AFI contributes to increased obstetric intervention even in the absence of additional risk factors.[24] The decision for cesarean delivery in such cases is frequently guided by non-reassuring fetal heart rate patterns and the obstetrician's concern for impending fetal compromise, especially during induction or labor progression. These observations emphasize the critical role of AFI as a determinant not only of fetal well-being but also of the mode of delivery. The current study revealed that acute fetal distress was the most common indication for cesarean section in both AFI groups. In the oligohydramnios group (AFI <5 cm), 24.4% of LSCS were due to acute fetal distress, followed by non-progress of labor (26.8%), failure of induction (19.5%), and non-reassuring cardiotocography (CTG) (12.2%). This distribution was significantly different from the normal AFI group, where fewer cases were attributed to non-progress of labor (9.1%) or fetal bradycardia (0%) and more to failure of induction and non-reassuring CTG. These findings highlight that fetal distress and mechanical complications of labor progression are more frequent in pregnancies complicated by oligohydramnios.

The literature corroborates this observation. Sardana et al. reported a significantly higher rate of cesarean deliveries for fetal distress in women with AFI ≤5 cm (p = 0.001), especially when the AFI was ≤1 cm.[29] Bhagat et al. similarly found a statistically significant increase in cesarean section due to fetal distress in oligohydramnios cases (p = 0.048).[27] Zosangpuii et al. noted that cesarean sections for fetal distress were notably common in women with very low AFI (0–1 cm; p = 0.01), mirroring the pattern seen in the present study.[30]

In the present study, the mean induction duration did not differ significantly between the two groups: 10.1 hours (±5.3) in the oligohydramnios group and 10.9 hours (±4.6) in the normal AFI group (p = 0.329). This observation suggests that amniotic fluid levels do not substantially influence the time required from initiation of induction to delivery. Although women with low AFI were more frequently induced for fetal indications, the progression of labor post-induction was not notably prolonged compared to their counterparts with normal AFI.

These findings are consistent with those of Singhal et al., who found that although induction was more frequently required in the oligohydramnios group, the duration of labor remained statistically comparable between groups.[31] Bachhav et al. reported that 86% of women in the oligohydramnios group were induced, but did not find differences in labor progression timing.[28]

In the current study, neonates born to mothers with an amniotic fluid index (AFI) <5 cm had a significantly lower mean birth weight of 2.9 ± 0.7 kg compared to 3.1 ± 0.6 kg in the normal AFI group (p < 0.001). This significant difference aligns with several previous studies that highlight the strong association between oligohydramnios and low birth weight (LBW). Bhagat et al. reported that 63.3% of neonates born to women with AFI <5 cm had birth weights below 2.5 kg, a statistically significant observation (p = 0.001), compared to 36.7% in those with normal AFI levels.[27] Similarly, Bachhav et al. found that 64% of babies in the low AFI group were LBW, reinforcing the correlation between amniotic fluid deficiency and compromised fetal growth.[28]

This relationship is likely rooted in the shared pathophysiology of chronic uteroplacental insufficiency, which reduces fetal perfusion, limits nutrient and oxygen supply, and subsequently impairs fetal growth. Madaan et al. also found that women with intrauterine growth restriction (IUGR) had significantly lower AFI values, suggesting a mechanistic link between amniotic fluid volume and fetal weight outcomes.[22] Mohan et al. further emphasized that low AFI significantly increases the prevalence of LBW (53% vs. 21.2%; p<0.001), a pattern consistent with the present study.[24] Low birth weight is an important determinant of neonatal morbidity and mortality. It is associated with increased risk of hypothermia, hypoglycemia, respiratory complications, and delayed development.

The current study revealed that maternal complications were more frequent in the oligohydramnios group (AFI <5 cm), particularly infection, which occurred in 14.3% of these patients compared to only 1.6% in the normal AFI group (p = 0.008). Although rates of meconium-stained liquor (30.2% vs. 23.8%) and postpartum hemorrhage (11.1% vs. 12.7%) were slightly higher in the low AFI group, these differences were not statistically significant. However, the significantly increased infection rate underscores the heightened maternal morbidity associated with oligohydramnios.

These findings are supported by Aslam et al., who observed higher maternal morbidity in women with decreased AFI, particularly related to increased intrapartum interventions and prolonged hospital stays, which may predispose to infections.[32] The higher rates of operative delivery in oligohydramnios, as shown in the current study, also contribute to infection risk due to surgical exposure and possible intrauterine manipulations.

In this study, mean Apgar scores at both one and five minutes were significantly lower in the oligohydramnios group (7.7 and 8.1, respectively) compared to 9.1 and 9.3 in the normal AFI group (p < 0.001). Although only two stillbirths occurred in the low AFI group and none in the control group, this difference was not statistically significant (p = 0.154). Nonetheless, the trend reflects compromised fetal condition at birth among those with oligohydramnios. These findings strongly support the growing consensus that low amniotic fluid is a marker for fetal distress and suboptimal neonatal outcomes.

Neonatal complications were significantly more frequent among infants born to mothers with AFI <5 cm in this study. Respiratory distress (30.2%) and meconium aspiration syndrome (MAS; 4.8%) were the most prevalent issues, while birth asphyxia (3.2%), neonatal death (3.2%), and sepsis (3.2%) were also reported. In contrast, 77.8% of neonates in the normal AFI group had no complications compared to only 55.6% in the oligohydramnios group (p = 0.041). These differences clearly reflect the heightened neonatal morbidity associated with low amniotic fluid volumes.

The findings echo those of Bansal et al., who found that 26.7% of neonates with oligohydramnios required NICU admission for complications such as respiratory distress, jaundice, and congenital pneumonia.[20] Aslam et al. reported a higher rate of MAS and need for neonatal resuscitation in patients with AFI <3 cm.[32] Sardana et al. also found that babies from the low AFI cohort had more NICU admissions and adverse outcomes, particularly when AFI dropped below 1 cm.[29]

In the present study, NICU admission rates were significantly higher in the oligohydramnios group, with 44.4% of neonates requiring specialized care compared to only 22.2% in the normal AFI group (p < 0.05). Additionally, the mean hospital stay was longer for the oligohydramnios group at 2.8 ± 1.3 days, compared to 1.9 ± 1.2 days in the control group (p < 0.001). These findings highlight the increased neonatal morbidity and need for extended postnatal care in pregnancies complicated by low AFI.

Mohan et al. reported similar trends, with NICU admissions significantly higher in the isolated oligohydramnios group (30.3% vs. 15.2%) and emphasized that adverse outcomes were more likely related to low birth weight and prematurity rather than AFI alone.[24] Talpur et al. found that 30 out of 70 liveborn neonates with AFI <5 cm required NICU care, with respiratory distress and birth asphyxia being the predominant causes.[21]

The extended hospital stay observed in the current study can be attributed not only to neonatal complications but also to increased maternal intervention, surgical recovery, and monitoring needs. This has implications for healthcare resource allocation and indicates that oligohydramnios, even in the absence of structural anomalies, increases both clinical and economic burdens.

CONCLUSION

This study concluded that oligohydramnios (AFI <5 cm) in late-term pregnancies is significantly associated with increased obstetric interventions and adverse perinatal outcomes. Cesarean delivery, particularly for fetal distress and labor complications, was notably higher among oligohydramnios patients. Neonates in the low AFI group exhibited lower birth weights, lower Apgar scores, and a higher incidence of respiratory distress, NICU admissions, and perinatal morbidity. Maternal complications, including infections, were also more frequent, leading to prolonged hospital stays.

These findings support routine AFI assessment as a key component of antenatal surveillance, particularly in the third trimester. Early identification and timely management of oligohydramnios—through close fetal monitoring, labor induction, or cesarean delivery when necessary—can help improve fetal outcomes. While oligohydramnios does not always predict poor neonatal outcomes, its association with increased risks warrants vigilant monitoring. The study reinforces the importance of individualized obstetric care and appropriate interventions based on AFI levels to ensure safe deliveries and healthy neonates.

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