Original Article

Intrapartum Fetal Compromise, Cesarean Delivery, and Early Neonatal Outcomes in Pregnancies with Low Amniotic Fluid Index: A Prospective Observational Study

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Abstract

Background: Low amniotic fluid index (AFI) is associated with concerns regarding fetal compromise, increased obstetric intervention, and adverse neonatal outcomes. However, its clinical significance remains uncertain, particularly when associated maternal and fetal conditions are present. The objective is to evaluate intrapartum fetal surveillance findings, cesarean delivery, and early neonatal outcomes in pregnancies complicated by low AFI. **Material and Methods:** This prospective observational study included 120 women with singleton pregnancies at or beyond 28 weeks of gestation and AFI below 8 cm at a tertiary care hospital in Rajasthan, India. Maternal characteristics, associated obstetric conditions, non-stress test (NST) findings, amniotic fluid characteristics, delivery mode, cesarean indications, birth weight, Apgar scores, and neonatal intensive care unit (NICU) admission were evaluated using descriptive statistics. **Results:** Pregnancy-induced hypertension and intrauterine growth restriction were documented in 29.17% and 21.67% of pregnancies, respectively. Non-reactive NST findings occurred in 29.17%, while meconium-stained amniotic fluid was observed in 25.83%. Cesarean delivery was performed in 65.83% of women, with suspected fetal distress accounting for 43.04% of cesarean indications. Among 120 deliveries, 116 (96.67%) were live births and four (3.33%) were stillbirths. Among liveborn infants, 25.86% had five-minute Apgar scores below seven, and 37.07% required NICU admission. **Conclusion:** Pregnancies with low AFI demonstrated considerable frequencies of abnormal fetal surveillance findings, cesarean delivery, and early neonatal morbidity.

Keywords: Amniotic fluid index, Oligohydramnios, Intrapartum fetal compromise, Cesarean section, Non-stress test, Neonatal outcomes, NICU admission.

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Introduction

Amniotic fluid plays an essential role in maintaining a favourable intrauterine environment for fetal growth, development, and well-being. It provides mechanical protection against external pressure, facilitates fetal movement, supports pulmonary development, and helps prevent umbilical cord compression. During the second half of pregnancy, amniotic fluid volume is largely regulated by fetal urine production, fetal swallowing, intramembranous absorption, and placental function. Alterations in these physiological processes may result in abnormal amniotic fluid volume and indicate underlying maternal, placental, or fetal abnormalities. Ultrasonographic assessment of amniotic fluid has therefore become an important component of antenatal fetal surveillance. The amniotic fluid index (AFI), introduced by Phelan et al., is calculated by summing the deepest vertical fluid pockets in four uterine quadrants. An AFI of 5 cm or less is commonly used to define oligohydramnios, whereas a single deepest vertical pocket measuring less than 2 cm represents an alternative diagnostic criterion.[1,2] Although these measurements provide useful information during pregnancy assessment, their ability to predict adverse outcomes in individual pregnancies remains limited.[3]

Reduced amniotic fluid volume is particularly important during the late third trimester and intrapartum period because of its possible association with impaired placental function, fetal growth restriction, and abnormal fetal heart rate patterns. Inadequate amniotic fluid may reduce the protective space surrounding the umbilical cord, potentially increasing susceptibility to intermittent cord compression during uterine contractions. This mechanism may contribute to variable fetal heart rate decelerations, non-reassuring cardiotocographic findings, and suspected intrapartumfetal compromise. Chauhan et al., in a meta-analysis involving 10,551 pregnancies, reported that an AFI of 5 cm or less was associated with an increased risk of cesarean delivery for fetal distress and a five-minute Apgar score below seven. The pooled relative risk of cesarean

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delivery for fetal distress was 2.2 for antepartum oligohydramnios and 1.7 for intrapartumoligohydramnios. However, the available evidence concerning neonatal acidemia was insufficient to establish a reliable relationship between reduced AFI and objective fetal metabolic compromise.[4]

The relationship between oligohydramnios and adverse obstetric outcomes has also been demonstrated in observational studies. Casey et al. evaluated 6,423 pregnancies at or beyond 34 weeks of gestation and identified oligohydramnios in 147 cases (2.3%). Pregnancies complicated by oligohydramnios demonstrated higher frequencies of labour induction, non-reassuring fetal heart rate patterns, neonatal intensive care unit (NICU) admission, and other adverse perinatal outcomes compared with pregnancies with normal amniotic fluid volume. Non-reassuring fetal heart rate patterns occurred in 48% of pregnancies with oligohydramnios compared with 39% of those with normal AFI, while NICU admission occurred in 7% and 2%, respectively. These findings suggest that reduced AFI may identify pregnancies requiring closer surveillance during labour. Nevertheless, the relationship between oligohydramnios and fetal compromise is influenced by gestational age, maternal disorders, fetal growth, and the presence of associated obstetric complications.[5]

The risk of adverse perinatal outcomes may differ between isolated oligohydramnios and oligohydramnios associated with maternal or fetal disease. Rabie et al., in a systematic review and meta-analysis, reported that isolated oligohydramnios was associated with increased risks of cesarean delivery for fetal distress, meconium aspiration syndrome, and NICU admission. The relative risks were 2.16, 2.83, and 1.71, respectively, compared with pregnancies with normal AFI. In complicated pregnancies, adverse outcomes may also reflect underlying conditions such as hypertensive disorders or placental dysfunction rather than reduced amniotic fluid alone. These findings highlight the importance of distinguishing the independent association of low AFI with pregnancy outcomes from the effects of accompanying maternal and fetal risk factors.[6]

Despite these reported associations, the clinical significance of isolated oligohydramnios remains controversial. Rossi and Prefumo, in a systematic review of term and post-term pregnancies, found that isolated oligohydramnios was associated with increased obstetric intervention, particularly for non-reassuring fetal heart rate patterns. However, significant differences were not demonstrated for several neonatal outcomes, including meconium-stained amniotic fluid, low Apgar scores, neonatal acidemia, NICU admission, and perinatal mortality. Similarly, Shrem et al., in a systematic review and meta-analysis involving 35,999 pregnancies, reported higher rates of labour induction and cesarean delivery among women with isolated oligohydramnios. Although short-term neonatal morbidity was increased for some outcomes, the available randomised evidence did not establish that routine induction improved maternal or neonatal outcomes compared with expectant management.[7,8]

Further uncertainty arises from the possibility that increased obstetric intervention may be influenced by the diagnosis of oligohydramnios itself. Once reduced AFI is identified, clinicians may adopt more intensive fetal monitoring, recommend earlier delivery, or maintain a lower threshold for cesarean delivery in the presence of abnormal fetal heart rate patterns. Consequently, higher cesarean delivery rates may reflect both genuine intrapartumfetal compromise and clinical decision-making influenced by antenatal ultrasound findings. Naveiro-Fuentes et al., in a retrospective analysis of 27,708 term pregnancies, observed an increased frequency of cesarean delivery among women undergoing induction for isolated oligohydramnios compared with those entering spontaneous labour. However, when compared with pregnancies induced for late-term gestation, important differences in neonatal outcomes were not demonstrated. These findings raise questions regarding whether routine obstetric intervention for low AFI consistently produces measurable neonatal benefits.[9]

Another important consideration is the method used to identify reduced amniotic fluid volume. Although AFI is widely used in clinical practice, its diagnostic performance and relationship with perinatal outcomes have been questioned. Nabhan and Abdelmoula, in a meta-analysis of randomised controlled trials, demonstrated that AFI assessment identified significantly more cases of oligohydramnios than the single deepest vertical pocket method. AFI-based assessment was also associated with increased labour induction and cesarean delivery for fetal distress without a corresponding improvement in major neonatal outcomes. These observations were further supported by the multicentre SAFE trial conducted by Kehl et al., which demonstrated a higher frequency of oligohydramnios diagnosis and induction of labour in the AFI group without a significant reduction in NICU admission. These findings indicate that the diagnostic approach may influence obstetric intervention rates and complicate the interpretation of associations between low AFI and adverse outcomes.[10,11]

Early neonatal outcomes are particularly relevant when evaluating the clinical significance of reduced AFI. Parameters such as birth weight, Apgar scores at one and five minutes, requirement for neonatal resuscitation, NICU admission, respiratory complications, and early neonatal morbidity provide important information regarding neonatal condition following delivery. However, these outcomes are influenced by multiple factors, including gestational maturity, intrapartum events, maternal complications, and neonatal care practices. Moreover, non-reassuring fetal heart rate patterns and cesarean delivery for suspected fetal distress do not necessarily establish the presence of neonatal hypoxia or acidemia. Assessment of maternal, intrapartum, and neonatal outcomes together is therefore necessary to determine whether reduced AFI represents an independent marker of clinically important fetal compromise or primarily identifies pregnancies subjected to increased obstetric surveillance and intervention.[3,4,7,8]

Given these uncertainties, prospective observational evaluation is important for understanding the relationship between reduced AFI, intrapartumfetal condition, delivery decisions, and early neonatal outcomes. Prospective documentation can provide a clearer temporal relationship between antenatal AFI measurements, fetal heart rate abnormalities during labour,

indications for cesarean delivery, and immediate neonatal condition. It also allows consideration of potentially important confounding factors, including gestational age, parity, maternal medical disorders, and fetal growth. Such evidence may contribute to more balanced clinical decision-making by identifying pregnancies that require closer intrapartum monitoring while reducing potentially unnecessary obstetric intervention.

Therefore, the present prospective observational study aims to evaluate the association of low amniotic fluid index with intrapartumfetal compromise, cesarean delivery, and early neonatal outcomes. Particular emphasis is placed on identifying non-reassuring fetal heart rate patterns, assessing the frequency and indications for cesarean delivery, and examining immediate neonatal outcomes. The study seeks to clarify the clinical significance of reduced AFI and contribute evidence supporting appropriate intrapartum surveillance and obstetric management.

Materials and Methods

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology at Ananta Institute of Medical Sciences and Research Centre, Rajsamand, Rajasthan, India. The study was undertaken over 18 months following institutional ethical approval and university permission. A total of 120 pregnant women with a low amniotic fluid index (AFI) were enrolled to assess maternal, intrapartum, and early neonatal outcomes. The investigation focused on fetal surveillance findings, mode of delivery, indications for cesarean section, and immediate neonatal condition.

Study Population and Eligibility Criteria: Pregnant women attending the antenatal outpatient department or presenting for delivery at or beyond 28 weeks of gestation were assessed for eligibility. Participants were enrolled when ultrasonography demonstrated an AFI below 8 cm and the other eligibility criteria were satisfied.

Inclusion criteria

- Singleton pregnancy at a gestational age of 28 weeks or more.
- Ultrasonographically confirmed AFI below 8 cm.
- Intact fetal membranes at admission.
- Willingness to participate and provision of informed consent.

Exclusion criteria

- Premature rupture of membranes (PROM) or preterm premature rupture of membranes (PPROM).
- Antepartum haemorrhage.
- Documented fetal congenital anomalies.

Pregnancies complicated by pregnancy-induced hypertension, intrauterine growth restriction, or prolonged gestation were retained in the study population, allowing the outcomes of low AFI to be examined in the presence of associated obstetric conditions.

Clinical Assessment and Data Collection: Following enrolment, relevant demographic, obstetric, and clinical information was obtained through patient interviews, clinical examinations, and review of available medical records. Data were documented using the structured study proforma.

Maternal characteristics included age, gravidity, parity, gestational age, menstrual and obstetric history, previous pregnancy complications, and relevant medical conditions. Clinical assessment included maternal vital signs, general and systemic examination, abdominal examination, fetal presentation, and fetal heart rate assessment.

The clinical evaluation also considered conditions potentially associated with reduced amniotic fluid volume, particularly pregnancy-induced hypertension, intrauterine growth restriction, and post-dated pregnancy. Cases without an identified associated condition were classified as idiopathic in the original study.

Ultrasonographic Assessment of Amniotic Fluid Index: Amniotic fluid volume was evaluated ultrasonographically using the four-quadrant technique described by Phelan et al. A curvilinear ultrasound transducer was used, with the uterus divided into four quadrants by the maternal midline and an imaginary transverse line between the uterine fundus and symphysis pubis.

The transducer was positioned perpendicular to the maternal coronal plane and parallel to the sagittal plane. The deepest clear vertical pocket of amniotic fluid was identified within each quadrant, and its depth was measured in centimetres using electronic ultrasound calipers. The AFI was calculated as the sum of the four vertical pocket measurements.

An AFI below 8 cm constituted the eligibility threshold for the study. This definition encompassed pregnancies with markedly reduced amniotic fluid volume as well as those within the borderline low-AFI range. The assessment was performed as part of the obstetric evaluation before documentation of delivery and neonatal outcomes.

Fetal Surveillance and Intrapartum Assessment: Fetal well-being was evaluated through clinical assessment and available fetal surveillance investigations. Non-stress test (NST) findings were documented and classified as reactive or non-reactive. These findings were analysed as indicators of fetal surveillance status rather than definitive evidence of fetal hypoxia.

Delivery records were reviewed for suspected fetal compromise and associated obstetric findings. Particular attention was given to cesarean deliveries performed for clinically documented fetal distress. The appearance of amniotic fluid at delivery was classified as clear or meconium-stained liquor.

The study also documented indications for operative delivery, including fetal distress, cephalopelvic disproportion, malpresentation, non-progress of labour, and intrauterine growth restriction. Suspected fetal distress was retained as a clinical indication for cesarean delivery without assuming biochemical confirmation of fetal hypoxia.

Maternal and Delivery Outcomes: Maternal outcomes were assessed primarily through the mode of delivery and documented indications for cesarean section.

Delivery was categorised as spontaneous vaginal delivery, instrumental vaginal delivery, or cesarean section. Among women undergoing cesarean delivery, the recorded clinical indication was examined to determine the contribution of suspected fetal compromise relative to other obstetric indications.

The frequency of cesarean delivery and the proportion attributed to fetal distress were considered important measures of obstetric intervention among pregnancies with reduced AFI.

Early Neonatal Outcomes: Neonatal outcomes were evaluated using birth status, birth weight, Apgar scores, and requirement for neonatal intensive care.

The following parameters were recorded:

- **Birth status:** Live birth or stillbirth.
- **Birth weight:** Recorded in kilograms and grouped according to the categories used in the original study.
- **Apgar scores:** Assessed at one and five minutes after birth, with scores below seven identified as indicating an unfavourable immediate neonatal condition.
- **Neonatal intensive care unit (NICU) admission:** Recorded as admission to the NICU or postnatal care alongside the mother.

Apgar scores and NICU admission were evaluated among liveborn infants, while birth status was assessed across the entire study population.

These neonatal measures were considered alongside fetal surveillance findings and delivery indications to describe the clinical outcomes associated with low AFI.

Outcome Assessment: The principal outcomes of interest were the frequency of non-reactive NST findings, cesarean delivery, cesarean delivery for suspected fetal distress, and early neonatal outcomes.

Additional outcomes included meconium-stained amniotic fluid, birth weight distribution, one-minute and five-minute Apgar scores, NICU admission, and stillbirth.

Maternal characteristics and associated obstetric conditions were recorded to describe the clinical profile of the study population. As the study enrolled only pregnancies with AFI below 8 cm, the analysis was designed to characterise outcomes within this low-AFI cohort rather than establish differences from pregnancies with normal amniotic fluid volume.

Statistical Analysis: Data were organised and summarised using descriptive statistics. Categorical variables, including maternal age groups, parity, gestational age categories, associated obstetric conditions, NST findings, delivery mode, cesarean indications, and neonatal outcomes, were expressed as frequencies and percentages.

The total enrolled population of 120 pregnancies constituted the denominator for maternal and delivery outcomes. Neonatal outcomes applicable only to liveborn infants, including Apgar scores and NICU admission, were summarised using the corresponding live-birth denominator.

The original thesis presented descriptive frequency distributions without specifying a statistical software package, inferential testing strategy, or multivariable adjustment procedure. Accordingly, no unreported statistical tests or adjusted associations were attributed to the study.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee of Ananta Institute of Medical Sciences and Research Centre, Rajsamand, Rajasthan, India (Approval No. AIMS/IEC/2022/50, dated 20 August 2022).

Results

A total of 120 pregnant women with reduced amniotic fluid index (AFI) were included in the study. Review of the individual patient records showed AFI values ranging from 1.2 to 5.0 cm, with a mean of 3.87 ± 0.82 cm. Most participants were aged 21–25 years (54.17%), followed by those aged 26–30 years (31.67%). Multigravidae represented 62.50% of the study population, whereas 37.50% were primigravidae. Regarding gestational age, 57.50% of pregnancies were between 37 and 40 weeks, while 16.67% extended beyond 40 weeks. The remaining pregnancies occurred before 37 weeks of gestation [Table 1].

Table 1: Baseline maternal and obstetric characteristics of pregnancies with low amniotic fluid index (N = 120)

Characteristic	Category	n	Percentage (%)
Maternal age (years)	≤20	9	7.50
	21–25	65	54.17
	26–30	38	31.67
	>30	8	6.67
Gestational age (weeks)	28–34	16	13.33
	35–36	15	12.50
	37–40	69	57.50
	>40	20	16.67
Gravidity	Primigravida	45	37.50
	Multigravida	75	62.50

Idiopathic low AFI was recorded in 40 pregnancies (33.33%), representing the largest category. Pregnancy-induced hypertension was documented in 35 women (29.17%), followed by intrauterine growth restriction in 26 (21.67%) and post-dated pregnancy in 19 (15.83%). These findings describe the distribution of associated clinical conditions within the study population and do not establish causation [Table 2].

Table 2: Distribution of obstetric conditions associated with low amniotic fluid index (N = 120)

Associated obstetric condition	n	Percentage (%)
Pregnancy-induced hypertension	35	29.17
Intrauterine growth restriction	26	21.67
Post-dated pregnancy	19	15.83
Idiopathic	40	33.33

Total	120	100.00

The non-stress test (NST) was reactive in 85 pregnancies (70.83%) and non-reactive in 35 (29.17%). Regarding amniotic fluid appearance, clear liquor was documented in 89 deliveries (74.17%), whereas meconium-stained liquor was observed in 31 (25.83%). The frequency of non-reactive NST findings and meconium-stained liquor provides descriptive information concerning fetal surveillance and the intrapartum clinical profile of pregnancies with low AFI [Table 3].

Table 3: Fetal surveillance findings and amniotic fluid characteristics (N = 120)

Parameter	Category	n	Percentage (%)
Non-stress test	Reactive	85	70.83
	Non-reactive	35	29.17
Amniotic fluid appearance	Clear liquor	89	74.17
	Meconium-stained liquor	31	25.83

Cesarean section was the most frequently recorded mode of delivery, accounting for 79 of 120 pregnancies (65.83%). Vaginal delivery occurred in 37 women (30.83%), and instrumental vaginal delivery was performed in four (3.33%). Among the 79 cesarean deliveries, suspected fetal distress was the leading documented indication, accounting for 34 cases (43.04%). Other indications included intrauterine growth restriction (22.78%), non-progress of labour (18.99%), malpresentation (8.86%), and cephalopelvic disproportion (6.33%). Thus, suspected fetal distress represented the largest individual category of cesarean indication in this cohort [Table 4].

Table 4: Mode of delivery and indications for cesarean section

Parameter	Category	n	Percentage (%)
Mode of delivery (N = 120)	Vaginal delivery	37	30.83
	Instrumental vaginal delivery	4	3.33
	Cesarean section	79	65.83
Indications for cesarean section (n = 79)	Suspected fetal distress	34	43.04
	Intrauterine growth restriction	18	22.78
	Non-progress of labour	15	18.99
	Malpresentation	7	8.86
	Cephalopelvic disproportion	5	6.33

Among the 120 deliveries, 116 infants (96.67%) were liveborn, while four (3.33%) were recorded as stillbirths. The most frequently recorded birth-weight category was 2.1–3.0 kg, comprising 75 infants (62.50%). Twenty-three infants (19.17%) weighed 1.0–2.0 kg, while 19 (15.83%) weighed more than 3.0 kg. Three infants (2.50%) were recorded in the category below 1.0 kg. Birth-weight categories were obtained from the original master chart and are presented according to the study's recorded classification [Table 5].

Table 5: Birth status and neonatal birth-weight distribution (N = 120)

Parameter	Category	n	Percentage (%)
Birth status	Live birth	116	96.67
	Stillbirth	4	3.33
Birth weight	<1.0 kg	3	2.50
	1.0–2.0 kg	23	19.17
	2.1–3.0 kg	75	62.50
	>3.0 kg	19	15.83

Early neonatal outcomes were evaluated among 116 liveborn infants. At one minute after delivery, 44 neonates (37.93%) had an Apgar score below seven, while 72 (62.07%) were recorded with scores above seven. At five minutes, the number of neonates with Apgar scores below seven decreased to 30 (25.86%), while 86 (74.14%) were recorded with scores above seven.

Review of the master chart identified 43 neonates (37.07%) recorded as requiring NICU admission, while 73 (62.93%) remained with their mothers. These findings indicate that a substantial proportion of liveborn neonates required additional postnatal assessment or care. However, the available records do not permit reliable assessment of the duration of NICU admission, specific neonatal diagnoses, or objective biochemical evidence of intrapartum hypoxia [Table 6].

Table 6: Apgar scores and neonatal intensive care admission among liveborn infants (n = 116)

Neonatal outcome	Category	n	Percentage (%)
Apgar score at 1 minute	<7	44	37.93
	>7	72	62.07
Apgar score at 5 minutes	<7	30	25.86
	>7	86	74.14

Postnatal care	NICU admission	43	37.07
	Care alongside mother	73	62.93

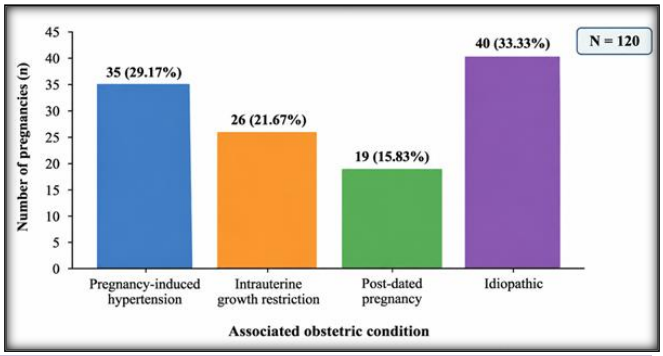


Figure 1: Distribution of associated obstetric conditions among pregnancies with low amniotic fluid index

[Figure 1] The frequencies of pregnancy-induced hypertension, intrauterine growth restriction, post-dated pregnancy, and idiopathic low AFI among the 120 enrolled women.

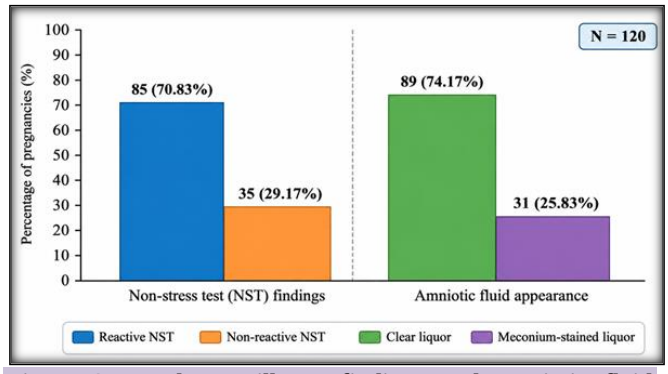


Figure 2: Fetal surveillance findings and amniotic fluid characteristics in pregnancies with low amniotic fluid index

[Figure 2] showing the distribution of vaginal, instrumental vaginal, and cesarean deliveries, together with the recorded indications for cesarean section. Indications are expressed as percentages of the 79 cesarean deliveries.

Discussion

The present prospective observational study evaluated intrapartumfetal surveillance findings, cesarean delivery, and early neonatal outcomes among 120 pregnancies complicated by low amniotic fluid index (AFI). The principal findings were a non-reactive non-stress test (NST) in 29.17% of pregnancies, meconium-stained amniotic fluid in 25.83%, and cesarean delivery in 65.83%. Suspected fetal distress accounted for 43.04% of cesarean deliveries. Among liveborn infants, 25.86% had a five-minute Apgar score below seven, and 37.07% required neonatal intensive care unit (NICU) admission according to the individual patient records. These findings indicate a considerable burden of fetal surveillance abnormalities, obstetric intervention, and early neonatal morbidity within the study population. However, the absence of a normal-AFI comparison group limits conclusions regarding the independent contribution of reduced amniotic fluid volume to these outcomes.

Most participants were aged 21–25 years (54.17%), and 62.50% were multigravidae. Approximately three-quarters of pregnancies occurred at or beyond 37 weeks of gestation, while 16.67% extended beyond 40 weeks. Twesigomwe et al,[12] in a hospital-based study involving 426 pregnant women in Uganda, reported an oligohydramnios prevalence of 9.4%. Increasing gestational age and primigravidity were significantly associated with oligohydramnios, particularly among women beyond 40 weeks. Although multigravidae predominated in the present study, this difference may reflect variations in population characteristics, obstetric referral patterns, and eligibility criteria. Since all participants had low AFI, the present findings cannot establish parity or gestational age as independent predictors of oligohydramnios.

Regarding associated obstetric conditions, pregnancy-induced hypertension was documented in 29.17% of participants, intrauterine growth restriction (IUGR) in 21.67%, and post-dated pregnancy in 15.83%, while 33.33% were classified as idiopathic. These findings suggest that reduced amniotic fluid frequently coexists with conditions potentially involving impaired uteroplacental perfusion and altered fetalhaemodynamics. Molla et al,[13] in a study involving 264 women with third-trimester oligohydramnios, reported adverse perinatal outcomes in 46.6% of participants. Hypertensive disorders of pregnancy and IUGR were independently associated with adverse outcomes, with adjusted odds ratios of 4.9 and 8.4, respectively. These observations indicate that accompanying maternal and fetal disorders are important when evaluating the clinical significance of oligohydramnios. The present study documented these conditions but did not undertake adjusted analyses to distinguish their effects from those of reduced AFI.

A non-reactive NST was observed in 29.17% of pregnancies, indicating that nearly one-third demonstrated an abnormal fetal surveillance result. Reduced amniotic fluid may increase susceptibility to umbilical cord compression during uterine contractions, potentially contributing to fetal heart rate abnormalities. Panda et al,[14] in a prospective study involving 308 pregnancies, reported non-reactive cardiotocography in 27% of women with AFI ≤5 cm compared with 11% of those with higher AFI values. Their study also demonstrated increased frequencies of cesarean delivery for fetal distress and several adverse neonatal outcomes in the oligohydramnios group. The frequency of non-reactive fetalsurveillance findings in the present study was comparable to that reported by Panda et al. Nevertheless, NST reactivity and intrapartumcardiotocographic interpretation represent different aspects of fetal assessment. A non-reactive NST alone does not confirm fetal hypoxia, and the absence of detailed intrapartum tracing classifications limits further interpretation.

Cesarean delivery was performed in 65.83% of participants, representing the predominant mode of delivery. Suspected fetal distress was the leading indication, accounting for 43.04% of cesarean sections, followed by IUGR (22.78%) and non-

progress of labour (18.99%). Teka et al,[15]in a study conducted at academic hospitals in Ethiopia, similarly reported that nearly 70% of women with oligohydramnios underwent cesarean delivery. Their investigation identified a composite adverse perinatal outcome rate of 29.7% and emphasised that cesarean delivery did not necessarily improve perinatal outcomes. The similarity in operative delivery rates suggests that pregnancies complicated by oligohydramnios frequently undergo surgical intervention in tertiary obstetric settings. However, the present findings do not establish whether the observed cesarean rate resulted from low AFI itself, accompanying obstetric complications, or clinical decisions made during fetal surveillance.

Meconium-stained amniotic fluid was documented in 25.83% of deliveries. Although meconium passage may occur in response to fetal stress, it is also associated with fetal maturity and is not independently diagnostic of intrapartum hypoxia. Rathod and Samal,[16] evaluated maternal and perinatal outcomes among women with borderline oligohydramnios and normal amniotic fluid volume at term. Meconium-stained liquor occurred in 48% of women with borderline oligohydramnios compared with 30% of controls, representing a statistically significant difference. However, most other maternal and neonatal outcomes did not differ significantly between groups. The lower frequency observed in the present study may reflect differences in gestational age, patient characteristics, and AFI classification. These findings support evaluating meconium-stained liquor alongside fetal heart rate patterns and neonatal condition rather than interpreting its presence as conclusive evidence of fetal compromise.

Birth outcomes demonstrated 116 live births (96.67%) and four stillbirths (3.33%). The most frequently recorded birth-weight category was 2.1–3.0 kg, accounting for 62.50% of births. Figueroa et al,[17] in a multicountry investigation involving 12,940 women who underwent third-trimester ultrasound assessment, reported that oligohydramnios was associated with increased odds of stillbirth (odds ratio 5.16), neonatal death (odds ratio 3.18), and low birth weight (odds ratio 2.10). Their findings suggest that reduced amniotic fluid may identify pregnancies with underlying fetal or placental pathology. Nevertheless, the four stillbirths observed in the present study cannot be attributed directly to oligohydramnios because information on the timing of fetal death, underlying causes, and relevant maternal complications was insufficient. Furthermore, the birth-weight categories recorded in the thesis do not permit accurate determination of the conventional low-birth-weight prevalence below 2.5 kg.

Assessment of immediate neonatal condition demonstrated that 37.93% of liveborn infants had an Apgar score below seven at one minute, decreasing to 25.86% at five minutes. This reduction in frequency suggests improvement in recorded neonatal condition between the two assessment points, although individual transitions and resuscitation details were not available. Vyas et al,[18] in a prospective observational study conducted in Odisha, reported one-minute and five-minute Apgar scores below seven in 22% and 12% of pregnancies with borderline oligohydramnios, respectively. Their study also reported NICU admission in 24% of the borderline-AFI group, without statistically significant differences in several neonatal outcomes compared with controls. The greater proportion of low Apgar scores in the present cohort may reflect differences in the severity of reduced AFI, gestational maturity, coexisting maternal conditions, and obstetric management. Direct comparisons require caution because the populations and AFI thresholds were not equivalent.

NICU admission was documented in 43 of 116 liveborn infants (37.07%) in the individual patient records. This represents a substantial requirement for specialised neonatal assessment and care. The observed frequency may reflect several contributing factors, including prematurity, fetal growth abnormalities, suspected intrapartum compromise, and institutional admission practices. The present study did not record the specific reasons for NICU admission, duration of hospitalisation, respiratory support requirements, or neonatal biochemical findings in sufficient detail to determine the underlying mechanisms. Consequently, NICU admission should be interpreted as an indicator of healthcare utilisation and possible neonatal morbidity rather than direct evidence of hypoxic injury.

The clinical implications of reduced AFI also require consideration of evidence showing that increased obstetric intervention does not consistently translate into improved neonatal outcomes. Levin et al,[19] in a cohort involving 17,709 deliveries, identified 529 pregnancies with isolated oligohydramnios. Although labour induction and preterm delivery were more frequent among affected pregnancies, the overall rate of adverse neonatal outcomes did not differ significantly from pregnancies with normal amniotic fluid volume. Induction at 36 weeks among pregnancies with isolated oligohydramnios was associated with increased adverse neonatal outcomes. These findings indicate that the timing of delivery and accompanying clinical conditions may influence neonatal outcomes independently of the diagnosis of oligohydramnios. The high cesarean delivery frequency in the present study should therefore not be interpreted as evidence that surgical delivery is universally required or beneficial in pregnancies with reduced AFI.

The present findings have implications for obstetric surveillance and delivery planning. The considerable frequencies of non-reactive NST findings, suspected fetal distress as an indication for cesarean delivery, and neonatal intensive care admission indicate the clinical importance of comprehensive maternal and fetal assessment in pregnancies with reduced AFI. However, management decisions should consider fetal growth, gestational age, maternal medical conditions, fetal heart rate patterns, and the overall obstetric situation rather than AFI alone. Detailed documentation of fetal surveillance findings and indications for intervention is particularly important to distinguish suspected fetal compromise from objectively confirmed neonatal morbidity.

Several limitations should be considered. First, the study was conducted at a single tertiary care institution with a relatively small sample of 120 pregnancies, potentially limiting generalisability. Second, the absence of a normal-AFI control group prevented estimation of relative risks or independent associations between low AFI and adverse outcomes. Third, the

inclusion of pregnancies across different gestational ages and with associated conditions such as pregnancy-induced hypertension and IUGR introduced clinical heterogeneity. Fourth, detailed intrapartumcardiotocographic classifications, umbilical arterial blood gas measurements, neonatal resuscitation data, and longer-term neonatal outcomes were unavailable. Fifth, the eligibility criterion was AFI below 8 cm, although the recorded AFI measurements in the master chart were all ≤5 cm, limiting comparisons with studies of borderline oligohydramnios. Finally, inconsistencies between some summary tables and individual patient records require reconciliation before publication. These limitations restrict causal interpretation and the precision of neonatal outcome classification.

Despite these limitations, the prospective observational design and systematic documentation of maternal characteristics, fetal surveillance findings, delivery indications, and immediate neonatal outcomes provide a clinically relevant description of pregnancies complicated by low AFI in a tertiary care setting. The findings demonstrate that suspected fetal compromise, cesarean delivery, and early neonatal care requirements were frequently documented within this cohort. Further prospective comparative studies with standardised AFI assessment, clearly defined intrapartumfetal heart rate abnormalities, objective neonatal measurements, and adjustment for maternal and fetal confounding factors are required to establish the independent prognostic value of low AFI and guide appropriate obstetric intervention.

Conclusion

The present prospective observational study demonstrated a substantial frequency of abnormal fetal surveillance findings, cesarean delivery, and adverse early neonatal outcomes among pregnancies complicated by low amniotic fluid index (AFI). Non-reactive non-stress test findings were observed in 29.17% of pregnancies, while meconium-stained amniotic fluid was present in 25.83%. Cesarean delivery occurred in 65.83% of cases, with suspected fetal distress accounting for 43.04% of cesarean indications. Among liveborn infants, 25.86% had a five-minute Apgar score below seven, and 37.07% required neonatal intensive care unit admission. These findings highlight the clinical importance of careful fetal surveillance and individualised delivery planning in pregnancies with reduced amniotic fluid volume.

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Conflicts of interest

There are no conflicts of interest.

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