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Original Research Article

Borderline Amniotic Fluid Index (AFI) in the Last Trimester and Its Association with Perinatal Outcome: A Prospective Observational Study

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Abstract:

Background and Objective: The volume of amniotic fluid is a crucial measure of fetal health. An AFI between 5 and 8 cm is known as the borderline amniotic fluid index, indicating a situation between normal liquor volume and oligohydramnios. The clinical significance of borderline AFI in term pregnancies remains uncertain. The goal of the current study was to assess the relationship between perinatal outcomes and borderline AFI during the last trimester.

Methods: This prospective observational study was conducted over a period of six months, from April to September 2025, in the Obstetrics and Gynecology Department of PMCH, Patna. The study included 100 women with singleton term pregnancies (≥37 weeks) identified as having a borderline AFI, defined as an AFI between 5 and 8 cm. Amniotic fluid index (AFI) is the preferred method for accessing amniotic fluid volume, measured using ultrasound with the standard four-quadrant method. Maternal and neonatal parameters were carefully recorded, including birth weight, mode of delivery, meconium-stained amniotic fluid, intrapartum fetal distress, Apgar scores, and the necessity of admission to a neonatal ICU. The collected data were analyzed to assess perinatal outcomes associated with borderline AFI.

Results: Most participants were aged between 21 and 30 years, with primigravida forming a substantial proportion. Pregnancies with borderline AFI were more likely to result in cesarean sections due to fetal distress. Higher rates of meconium-stained liquor, low Apgar scores, low newborn weight, and NICU admissions were all indicators of poor perinatal outcomes associated with borderline AFI.

Conclusion: In the last trimester, a borderline amniotic fluid index is linked to greater rates of obstetric interventions and perinatal morbidity. Careful antenatal surveillance and close intrapartum monitoring are crucial for optimizing maternal and neonatal outcomes.

Keywords: Amniotic fluid index, Borderline AFI, Term pregnancy, Perinatal outcome, Fetal distress, NICU admission.

Introduction

Amniotic fluid plays a crucial role during pregnancy by creating the immediate environment in which the fetus grows and develops. It gives the fetus mechanical protection, allows for the free movement necessary for musculoskeletal development, keeps the intrauterine temperature steady, and plays a major role in lung and gastrointestinal development. The volume of amniotic fluid is determined by a dynamic balance between fetal urine production, swallowing, intramembranous absorption, and transmembranous flow. Any disturbance in this balance may reflect underlying placental or fetal compromise. As pregnancy advances into the third trimester, assessment of amniotic fluid volume becomes an important component of antenatal surveillance, as reduced fluid levels have been linked to adverse obstetric and neonatal outcomes [1,2].

Ultrasonographic estimation of amniotic fluid index is widely accepted as a simple and non-invasive method for evaluating AFI. An AFI of less than 5 cm is referred to as oligohydramnios and is known to be linked to complications like fetal growth restriction, cord compression, meconium aspiration, operative delivery, and increased perinatal morbidity and mortality. An AFI between 8 and 18 cm is typically regarded as normal. An intermediate zone between

normal liquor volume and oligohydramnios is represented by borderline AFI, which is often characterized as a value between 5 and 8 cm. Unlike oligohydramnios, borderline AFI does not have clearly established clinical guidelines, and its prognostic significance remains a subject of debate among obstetricians [3,4].

The impact of borderline AFI on pregnancy outcome has been examined in a number of studies; however, the results have been mixed. Some authors have reported increased rates of fetal distress, meconium-stained liquor, cesarean section, Low Birth weight, and admission to the Neonatal critical care unit. Others have suggested that borderline AFI may not independently influence perinatal outcomes when confounding factors are excluded. This lack of consensus often leads to variability in clinical practice, with some clinicians opting for increased surveillance or early delivery, while others manage such cases expectantly. The uncertainty surrounding borderline AFI poses a challenge in balancing the risks of unnecessary intervention against the possibility of missing early signs of fetal compromise [5,6].

In developing countries, where access to regular antenatal care may be limited, and a significant proportion of patients present late in pregnancy, identifying reliable predictors of adverse perinatal outcome is particularly important. Data on borderline AFI from eastern India are limited, and the majority of available studies are retrospective in nature. A prospective observational approach allows for systematic assessment of maternal and neonatal outcomes while minimizing bias. The current study was carried out to evaluate the association between the borderline AFI in the last trimester and perinatal outcomes at a tertiary care center. The results of this study could enhance comprehension of the clinical significance of borderline AFI and help guide appropriate antenatal surveillance and intrapartum management strategies [7,8].

Materials and Methods

Study Design: The study aimed to evaluate perinatal outcomes associated with borderline AFI during late pregnancy.

Study Setting: The study was conducted in the tertiary-level hospital, PMCH, Department of Obstetrics and Gynecology.

Study Duration: The study was carried out between April 2025 and September 2025, a duration of six months.

Study Population and Sample Size: The study comprised 100 pregnant women who met the eligibility requirements. Participants were recruited consecutively from the antenatal ward and labor room during the study period.

Inclusion Criteria

1. Pregnant women with a singleton gestation
2. Gestational age of 37 to 40 weeks.
3. AFI between 5 and 8 cm
4. Cephalic presentation
5. Intact membranes

Exclusion Criteria

- Multiple pregnancies
- Amniotic fluid index less than 5 cm or more than 8 cm
- Presence of congenital fetal anomalies
- Previous caesarean section
- Pregnancy beyond 40 weeks of gestation
- Premature rupture of membranes or preterm labor
- Pregnancies complicated by severe maternal medical disorders

Method of Data Collection: After obtaining informed written consent, a detailed demographic and obstetric history was recorded for each participant. A thorough general physical and obstetric examination was performed. First-trimester ultrasonography and/or the last menstrual cycle were used to confirm gestational age.

AFI was assessed using ultrasonography by the four-quadrant technique, with the measurements taken in the vertical plane, avoiding fetal parts and umbilical cord, calculated by summing the deepest vertical pocket measurements from four uterine quadrants. Patients diagnosed with borderline AFI were followed prospectively until delivery.

Outcome Measures: Maternal outcomes assessed included the mode of delivery and intrapartum complications, including fetal distress. Perinatal outcomes that were evaluated were meconium-stained amniotic fluid, Apgar scores at one and five minutes, neonatal birth weight, admission to the neonatal ICU, and perinatal morbidity.

Statistical Analysis: Following data entry into Microsoft Excel, analysis was performed using SPSS. While categorical variables were displayed as frequencies and percentages, continuous data were summarized as mean ± SD. A p value of less than 0.05 was considered statistically significant, and pertinent statistical tests were used.

Ethical Considerations: The Patna Medical College and Hospital's Institutional Ethics Committee accepted the study protocol. Prior to participation, each subject provided written informed consent. Throughout the trial, patient information was kept private.

Results

One hundred pregnant women with singleton term pregnancies and a borderline AFI (5–8 cm)

participated in the study. Maternal and perinatal outcomes were examined, and all patients were monitored prospectively until delivery.

The majority of women belonged to the 21–30 years age group (62%), followed by women aged above 30 years (20%) and 18–20 years (18%). Primigravida constituted 56% of the study population, while 44% were multigravida, indicating a slight predominance of first-time mothers among women with borderline AFI.

Table 1: Demographic Characteristics of the Study Population

Variable	Number (n = 100)
Age 18–20 years	18
Age 21–30 years	62
Age >30 years	20
Primigravida	56
Multigravida	44

Regarding mode of delivery, cesarean section was the most common mode, accounting for 50% of cases. Normal vaginal delivery occurred in 38% of women, while instrumental vaginal delivery was required in 12% of cases. The higher cesarean section rate was primarily attributed to fetal distress and non-reassuring fetal Heart Rate patterns during labor.

Table 2: Mode of Delivery in Women with Borderline AFI

Mode of Delivery	Number (n = 100)
Normal vaginal delivery	38
Instrumental delivery	12
Cesarean section	50

Analysis of perinatal outcomes revealed a notable incidence of adverse neonatal events. Fetal distress was observed in 42% of cases, and meconium-stained amniotic liquor was present in 36% of deliveries. 28% of newborns had a low Apgar score (<7) at one minute. Of the newborns, 30% required admission to the neonatal critical care unit for further care, and 32% had low birth weights (less than 2.5 kg).

Table 3: Perinatal Outcomes in Borderline AFI Pregnancies

Outcome	Number (n = 100)
Fetal distress	42
Meconium-stained liquor	36
Apgar score <7 at 1 minute	28
Low birth weight (<2.5 kg)	32
NICU admission	30

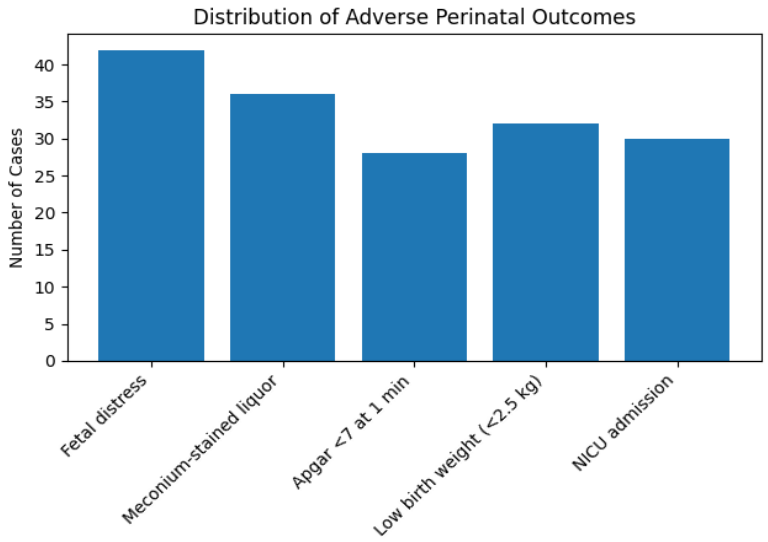

Figure 1: Distribution of Adverse Perinatal Outcomes

Discussion

The present prospective observational study evaluated the perinatal outcomes associated with borderline AFI in term pregnancies. The findings demonstrate that pregnancies complicated by borderline AFI have a higher frequency of unfavorable intrapartum and neonatal outcomes. The findings imply that borderline AFI is a clinically relevant condition rather than a benign variation of normal amniotic fluid volume, even though it does not fit the criteria for oligohydramnios. The increased rates of operative delivery, fetal compromise, and neonatal morbidity observed in this study underline the importance of careful assessment and surveillance in such cases [9,10].

In the current study, borderline AFI was more commonly observed in women aged between 21 and 30 years, with a slight predominance among primigravida. This finding may reflect the overall demographic profile of pregnant women presenting to a tertiary care hospital rather than a specific age-related predisposition. Primigravida are often subjected to closer intrapartum monitoring, which may increase the detection of fetal heart rate abnormalities and influence the decision for operative intervention. However, the presence of borderline AFI in this group raises concern, as a primigravida may have a lower threshold for obstetric intervention when fetal compromise is suspected [11,12].

The high risk of cesarean sections among women with borderline AFI was one of the study's noteworthy findings. Half of the study population required cesarean delivery, predominantly due to fetal distress and non-reassuring fetal heart rate patterns. Reduced AFI may predispose to umbilical cord compression during uterine contractions, leading to variable declarations and intrapartum fetal distress. Although borderline AFI is often managed expectantly, the increased operative delivery rate observed suggests that such pregnancies require vigilant intrapartum monitoring to allow timely intervention and prevent adverse neonatal outcomes [13,15].

In the current study, meconium-stained amniotic fluid was quite common. Meconium passage is commonly associated with fetal hypoxia and stress, particularly in term pregnancies. Reduced fluid volume may restrict meconium dilution in the context of borderline AFI, raising the risk of meconium aspiration syndrome. The association between borderline AFI and meconium-stained liquor observed in this study supports the hypothesis that even moderate reductions in amniotic fluid volume can have clinically relevant implications for fetal well-being during labor [16].

Neonatal outcomes in this study further emphasize the significance of borderline AFI. Many newborns had low Apgar scores at one minute, and many of them needed to be admitted to the neonatal critical care unit. Low Apgar scores may reflect transient or persistent neonatal compromise resulting from intrapartum hypoxia. The increased requirement for NICU admission indicates that neonates born to mothers with borderline AFI may require additional monitoring and supportive care in the immediate postnatal period. These findings suggest that borderline AFI may serve as a marker for compromised intrauterine conditions, even in the absence of overt oligohydramnios [17].

Low birth weight was another important neonatal outcome observed in the present study. Although the study population consisted of term pregnancies, a significant proportion of neonates weighed less than 2.5 kg. This finding may indicate underlying placental insufficiency, which can manifest as both reduced amniotic fluid volume and sub-optimal fetal growth. Borderline AFI may therefore represent an early or less severe manifestation of placental dysfunction, which becomes clinically evident through adverse perinatal outcomes rather than isolated abnormalities in fetal growth parameters [18].

The study's conclusions have significant clinical ramifications. Borderline AFI in term pregnancy should not be dismissed as a normal variant, and such cases warrant closer antenatal and intrapartum surveillance. Regular fetal monitoring, timely decision-making during labor, and preparedness for neonatal resuscitation are essential components of management. While routine early induction or operative delivery may not be justified in all cases, individualized management based on overall maternal and fetal assessment is crucial. Further large-scale prospective studies are required to establish standardized guidelines for the management of borderline AFI and to determine whether specific interventions can improve perinatal outcomes.

Conclusion

In this prospective observational study, a higher frequency of unfavorable perinatal outcomes was linked to a borderline AFI in term pregnancy. Pregnancies with borderline AFI demonstrated higher rates of operative delivery, meconium-stained amniotic fluid, intrapartum fetal distress, poor Apgar scores, and neonatal ICU admissions. Although borderline AFI does not fulfill the diagnostic criteria for oligohydramnios, the findings suggest that it may reflect underlying placental insufficiency and reduced fetal reserve. These observations highlight the clinical relevance of identifying borderline AFI during late pregnancy. Enhanced antenatal surveillance and vigilant

intrapartum monitoring may facilitate early detection of fetal compromise and timely intervention. To improve management techniques and ascertain whether specific therapies can enhance perinatal outcomes in pregnancies complicated by borderline AFI, more research with bigger sample sizes and comparison control groups is required.

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