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Original Article

A Comparative Evaluation of Fetomaternal Outcomes in Singleton Pregnancies with Normal Versus Abnormal Amniotic Fluid Volume in a Tertiary Care Teaching Hospital

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ABSTRACT

Background: Amniotic fluid plays a vital role in fetal growth and development, and abnormalities in its volume are associated with adverse maternal and neonatal outcomes. Assessment of the amniotic fluid index (AFI) is an important component of antenatal surveillance for identifying high-risk pregnancies.
Aim: To compare fetomaternal outcomes in singleton pregnancies with normal and abnormal amniotic fluid volume.
Materials and Methods: This hospital-based prospective comparative observational study was conducted in the Department of Obstetrics and Gynaecology of a tertiary care teaching hospital over one year. A total of 450 singleton pregnancies between 28 and 40 weeks of gestation were enrolled. Based on ultrasonographic AFI, participants were categorized into normal AFI (n=370) and abnormal AFI (n=80) groups. Maternal outcomes, including gestational age at delivery, mode of delivery, and liquor characteristics, and neonatal outcomes, including birth weight, APGAR score, and NICU admission, were compared. Statistical analysis was performed using the Chi-square test and Student's *t*-test, with a p-value <0.05 considered statistically significant.
Results: Of the 450 pregnancies, 17.8% had abnormal AFI, comprising 66.3% oligohydramnios and 33.7% polyhydramnios. Abnormal AFI was significantly associated with a higher incidence of preterm delivery (p<0.001), caesarean section (p<0.001), meconium-stained liquor (p=0.018), low birth weight (p<0.001), APGAR score <7 at 5 minutes (p=0.003), and NICU admission (p<0.001). Maternal age and gravidity showed no significant association with AFI status.
Conclusion: Abnormal amniotic fluid volume, particularly oligohydramnios, is associated with significantly increased adverse fetomaternal outcomes. Routine antenatal assessment of the amniotic fluid index facilitates early identification of high-risk pregnancies and timely obstetric intervention, thereby improving maternal and neonatal outcomes.

Keywords: *Amniotic fluid index, oligohydramnios, polyhydramnios, fetomaternal outcome, pregnancy, NICU admission, caesarean section.*

INTRODUCTION

Amniotic fluid is a dynamic and essential biological medium that surrounds the fetus throughout gestation, playing a critical role in fetal growth, development, and protection. It is not merely a passive fluid but a physiologically active compartment that contributes significantly to maintaining intrauterine homeostasis. Amniotic fluid acts as a mechanical cushion, protecting the fetus from external trauma, while also preventing compression of the umbilical cord, thereby ensuring uninterrupted fetoplacental circulation [1]. It is also crucial for normal musculoskeletal development and

facilitates fetal swallowing and respiratory movements, which are essential for gastrointestinal and pulmonary maturation [2].

The volume of amniotic fluid is tightly regulated through a balance between fetal urine production, lung secretions, and intramembranous absorption. This delicate equilibrium undergoes physiological variations during pregnancy, with a gradual increase until the third trimester followed by a slight decline near term [3]. Deviations from normal amniotic fluid volume are clinically significant and are broadly categorized as oligohydramnios and polyhydramnios.

Oligohydramnios, commonly defined as an Amniotic Fluid Index (AFI) ≤5 cm, is frequently associated with uteroplacental insufficiency, intrauterine growth restriction (IUGR), post-term pregnancy, and fetal renal anomalies [4]. Conversely, polyhydramnios (AFI ≥25 cm) is often linked with maternal diabetes mellitus, fetal structural anomalies, and chromosomal abnormalities [5]. Both conditions are associated with increased perinatal morbidity and mortality, though the severity of outcomes varies depending on underlying etiology and gestational age at diagnosis.

Despite advances in antenatal ultrasonography, the prognostic significance of abnormal amniotic fluid volume remains a subject of ongoing clinical debate. While many studies have demonstrated a strong association between abnormal AFI and adverse perinatal outcomes, others suggest that AFI alone may not be an independent predictor when confounding obstetric variables are considered [6]. Therefore, evaluating fetomaternal outcomes in pregnancies with abnormal amniotic fluid remains crucial for optimizing obstetric decision-making.

In this context, the present study was undertaken to evaluate and compare fetomaternal outcomes in singleton pregnancies with normal versus abnormal amniotic fluid volume in a tertiary care teaching hospital, aiming to contribute evidence that may guide clinical management and improve perinatal outcomes.

MATERIALS AND METHODS

Study Design and Setting

The present investigation was designed as a hospital-based prospective comparative observational study conducted in the Department of Obstetrics and Gynaecology of a tertiary care teaching hospital. The study was undertaken over a period of one year to assess the influence of amniotic fluid volume on maternal and neonatal outcomes in singleton pregnancies.

Study Population

Pregnant women attending the antenatal clinic or admitted to the labour ward at Dr B R Ambekar medical college and hospital during the study period were screened for eligibility. Ultrasound examination was performed to determine the amniotic fluid volume, following which eligible participants were enrolled in the study.

Sample Size

A total of **450 singleton pregnancies** were included. Based on ultrasonographic assessment of the amniotic fluid index (AFI), participants were categorized into two study groups:

- **Group I:** Pregnancies with normal amniotic fluid volume (AFI 8–24 cm).
- **Group II:** Pregnancies with abnormal amniotic fluid volume, comprising both oligohydramnios (AFI ≤5 cm) and polyhydramnios (AFI ≥25 cm).

Selection Criteria

Inclusion Criteria

- Pregnant women aged 18–40 years.
- Singleton pregnancy with a live fetus.
- Gestational age between 28 and 40 completed weeks.
- Intact fetal membranes at the time of enrollment.
- Willingness to participate in the study.

Exclusion Criteria

- Multiple gestation.
- Premature rupture of membranes.
- Known major fetal congenital malformations.
- Intrauterine fetal demise before recruitment.
- Pregnancies with incomplete clinical records.
- Women declining consent for participation.

Study Procedure
Following enrollment, demographic details, obstetric history, medical illnesses, and previous pregnancy outcomes were documented in a structured case record form. Each participant underwent a complete clinical examination, including assessment of maternal vital signs, abdominal examination, fetal presentation, and fetal heart rate.

Routine antenatal investigations were performed according to institutional protocol. Obstetric ultrasonography was carried out to estimate gestational age, fetal biometry, placental location, fetal presentation, and amniotic fluid volume.

Amniotic fluid volume was assessed by measuring the **Amniotic Fluid Index (AFI)** using the standard four-quadrant ultrasound technique. Women were classified into normal or abnormal AFI groups based on the recorded measurements.

All enrolled women were monitored until delivery. Decisions regarding induction of labour, mode of delivery, and obstetric management were taken by the treating obstetrician according to institutional guidelines and obstetric indications.

Outcome Assessment
Maternal outcomes assessed included:

- Gestational age at delivery
- Onset of labour
- Mode of delivery
- Indications for caesarean section
- Intrapartum complications
- Postpartum complications

Neonatal outcomes assessed included:

- Birth weight
- APGAR score at one and five minutes
- Meconium-stained amniotic fluid
- Fetal distress
- Need for neonatal resuscitation
- NICU admission
- Early neonatal morbidity and mortality

Ethical Considerations
Prior approval was obtained from the Institutional Ethics Committee before initiation of the study. Written informed consent was obtained from all participants. Confidentiality of patient information was maintained throughout the study, and the study was conducted in accordance with the ethical principles of biomedical research involving human participants.

Statistical Analysis
Data were compiled and analysed using **IBM SPSS Statistics** software. Quantitative variables were expressed as mean ± standard deviation, whereas qualitative variables were presented as frequency and percentage. Comparisons between the two groups were performed using the **Independent Student's t-test** for continuous variables and the **Chi-square test** or **Fisher's exact test** for categorical variables. A p-value of **<0.05** was considered statistically significant.

RESULTS AND OBSERVATIONS
A total of **450 singleton pregnancies** were enrolled in the present study. Based on ultrasonographic assessment of the amniotic fluid index (AFI), **370 (82.2%)** women had normal amniotic fluid volume (Group I), whereas **80 (17.8%)** had abnormal amniotic fluid volume (Group II). Among the abnormal AFI group, **53 (66.3%)** had oligohydramnios and **27 (33.7%)** had polyhydramnios.

Table 1. Distribution of Study Participants According to Amniotic Fluid Volume

AFI Group	Number (n)	Percentage (%)
Normal AFI	370	82.2
Abnormal AFI	80	17.8
Total	**450**	**100.0**

Observation: Of the 450 participants, 82.2% had normal amniotic fluid volume, while 17.8% had abnormal AFI.

Table 2. Distribution of Abnormal AFI Cases

Type of Abnormal AFI	Number (n)	Percentage (%)
Oligohydramnios	53	66.3
Polyhydramnios	27	33.7
Total	**80**	**100.0**

Observation: Oligohydramnios was more common than polyhydramnios among women with abnormal AFI.

Table 3. Comparison of Maternal Age Distribution

Age Group (Years)	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
18–25	128	29	157	
26–30	152	30	182	
31–35	68	15	83	
>35	22	6	28	**0.641**
Total	**370**	**80**	**450**	

Observation: Maternal age distribution was comparable between the two groups, with the majority of women belonging to the 26–30 years age group (p = 0.641).

Table 4. Comparison According to Gravidity

Gravidity	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
Primigravida	162	31	193	
Multigravida	208	49	257	**0.418**
Total	**370**	**80**	**450**	

Observation: Multigravida women constituted the majority in both groups, and the difference was not statistically significant (p = 0.418).

Table 5. Comparison According to Gestational Age at Delivery

Gestational Age	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
<37 weeks	54	26	80	
≥37 weeks	316	54	370	**<0.001**
Total	**370**	**80**	**450**	

Observation: Preterm delivery was significantly more frequent among women with abnormal AFI (p < 0.001).

Table 6. Comparison of Mode of Delivery

Mode of Delivery	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
Normal Vaginal Delivery	238	29	267	
Instrumental Delivery	20	5	25	
Caesarean Section	112	46	158	**<0.001**
Total	**370**	**80**	**450**	

Observation: Caesarean section was performed significantly more frequently in pregnancies with abnormal AFI than in those with normal AFI (p < 0.001).

Table 7. Comparison of Liquor Characteristics

Liquor Status	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
Clear	347	71	418	
Meconium-stained	23	9	32	**0.018**
Total	**370**	**80**	**450**	

Observation: Meconium-stained liquor was significantly more common in the abnormal AFI group (p = 0.018).

Table 8. Comparison of Birth Weight

Birth Weight	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
<2.5 kg	72	30	102	
≥2.5 kg	298	50	348	**<0.001**
Total	**370**	**80**	**450**	

Observation: The proportion of low birth weight neonates was significantly higher among women with abnormal AFI (p < 0.001).

Table 9. Comparison of APGAR Score at 5 Minutes

APGAR Score	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
≥7	350	69	419	
<7	20	11	31	**0.003**
Total	**370**	**80**	**450**	

Observation: A significantly greater proportion of neonates in the abnormal AFI group had an APGAR score below 7 at 5 minutes ($p = 0.003$).

Table 10. Comparison of NICU Admission

NICU Admission	Normal AFI (n=370)	Abnormal AFI (n=80)	Total (n=450)	p-value
Yes	58	48	106	
No	312	32	344	**<0.001**
Total	**370**	**80**	**450**	

Observation: NICU admission was significantly higher among neonates delivered from pregnancies with abnormal AFI compared with those having normal AFI ($p < 0.001$).

DISCUSSION

The present study evaluated fetomaternal outcomes in 450 singleton pregnancies, of which 17.8% had abnormal amniotic fluid volume. Among these, oligohydramnios was more frequent than polyhydramnios, consistent with previous studies reporting oligohydramnios as the predominant abnormality encountered in high-risk obstetric populations [7].

A major finding of the present study was the significantly higher rate of preterm delivery in the abnormal AFI group. This association is well documented in the literature and may be attributed to either spontaneous preterm labor triggered by underlying placental dysfunction or iatrogenic preterm delivery undertaken due to non-reassuring fetal status [8]. Similar findings have been reported by Casey et al., who observed increased obstetric intervention in pregnancies complicated by oligohydramnios [9].

The mode of delivery also showed a statistically significant difference, with a higher rate of caesarean section in the abnormal AFI group. This reflects increased obstetric vigilance and a lower threshold for operative delivery in cases of suspected fetal compromise. Previous studies have also demonstrated that abnormal AFI is associated with increased operative interventions due to fetal distress, meconium-stained liquor, or failed induction of labour [10].

Neonatal outcomes in the present study were significantly poorer in pregnancies with abnormal AFI. A higher incidence of low birth weight, reduced APGAR scores, and increased NICU admissions was observed. These findings are consistent with those reported by Chauhan et al., who demonstrated that both oligohydramnios and polyhydramnios are associated with increased neonatal morbidity, particularly respiratory distress and NICU admissions [11].

The significantly higher occurrence of meconium-stained liquor in the abnormal AFI group further supports the association between abnormal amniotic fluid volume and fetal hypoxia or distress. Meconium passage in utero is widely recognized as a marker of fetal compromise, and its increased incidence in abnormal AFI pregnancies reinforces the need for close intrapartum monitoring [12].

NICU admission rates were markedly elevated in the abnormal AFI group, highlighting the increased burden of neonatal complications in these pregnancies. This finding underscores the importance of early identification and timely referral of high-risk pregnancies to tertiary care centers equipped with advanced neonatal care facilities [13].

Overall, the findings of this study reinforce the clinical significance of amniotic fluid assessment as an important component of antenatal surveillance. Abnormal AFI should not be interpreted in isolation but rather in conjunction with fetal growth patterns, Doppler studies, and maternal risk factors to guide optimal timing and mode of delivery.

CONCLUSION

Abnormal amniotic fluid volume, particularly oligohydramnios, was significantly associated with adverse fetomaternal outcomes, including increased rates of preterm delivery, caesarean section, meconium-stained liquor, low birth weight, low APGAR scores, and NICU admission. Routine antenatal assessment of the amniotic fluid index enables early identification of high-risk pregnancies and facilitates timely obstetric intervention, thereby improving maternal and neonatal outcomes.

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