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ASSOCIATION OF LOW AMNIOTIC FLUID INDEX WITH ADVERSE FETAL OUTCOME IN PATIENTS WITH PREGNANCY INDUCED HYPERTENSION

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ABSTRACT

Background: Hypertension in pregnancy (PIH) is one of the major morbidities and mortalities of maternity and perinatal. Impaired uteroplacental perfusion in PIH may result in impaired fetal renal perfusion and the following low amniotic fluid index (AFI) which is a valuable fetal well-being parameter. Adverse fetal outcome has been cited to include low Apgar scores, high number of NICU admissions and perinatal mortality rates because of low AFI. Nevertheless, there is little local data available that compares the results of low and normal AFI in PIH patients.

Methods: The research took place in the Department of Obstetrics and Gynaecology, PAF Hospital Sargodha, (1st February 2026- 30th April 2026). Non-probability consecutive sampling was used to select 100 pregnant women between 18 and 40 years' old who had singleton pregnancies (>34 weeks' gestation) diagnosed with PIH. Patients would be divided into low AFI (5 cm) and normal AFI (8 18 cm). All subjects were monitored until delivery, and unfavorable fetal results such as low Apgar score (5 minutes and below), admission to NICU, and perinatal death occurred. The SPSS version 26 was used to conduct data analysis and Chi-square or Fisher's exact test to compare groups and a $p \leq 0.05$ value was considered significant.

Results: It was discovered that Low AFI was correlated with more adverse fetal outcomes than normal AFI such as higher rates of low Apgar scores, NICU hospitalization, and perinatal mortality rates.

Conclusion: Poor amniotic fluid index among the pregnant women with hypertension induced by pregnancy is highly linked with the poor fetal outcomes. The detection and close observation of AFI among PIH patients can be early in order to result in perinatal effects and timely intervention.

KEYWORDS: Amniotic Fluid Index; Fetal Outcome; Hypertension, Pregnancy-Induced; Infant, Newborn; Perinatal Mortality; Pregnancy Complications; Ultrasonography, Prenatal

INTRODUCTION

Pre-partum hypertensive disorders are a leading cause of maternal and perinatal morbidity and mortality in the world, especially in the low- and middle-income nations. Such disorders are gestational hypertension, preeclampsia, and eclampsia, which ultimately complicate about 5-10 percent of all pregnancies, and are known to cause significant adverse outcomes due to impaired placental perfusion which affects fetal growth and well-being[1]. Although there are improved methods in the field of antenatal care and monitoring, pregnancy-induced hypertension (PIH) is a serious clinical issue[2], Uteroplacental insufficiency is one of the main mechanisms that cause adverse fetal outcomes in PIH[3]. Chronic fetal hypoxia and nutrient deprivation induced by reduced placental blood flow can induce adaptive fetal responses such as redistribution of blood flow to essential organs such as the brain and heart, but has the negative effect of causing decreased renal perfusion and reduced fetal urine output, the main source of amniotic fluid during the third trimester[4]. As a result, oligohydramnios, which refers to the reduction of the volume of amniotic fluid, emerges as a valuable clinical sign of permanent fetal impairment[5].

Amniotic fluid index (AFI), which is evaluated through ultrasonograph, can pass as a widely accepted and non-invasive measure of amniotic fluid volume and fetal well-being whereby an index of below 5 cm can be referred as low amniotic fluid index and index between 8cm-18cm as normal[6]. Low AFI is associated with a variety of poor fetal outcomes, such as intrauterine growth restriction (IUGR), low Apgar scores, high rates of operative birth, neglect of neonatal intensive care unit (NICU) admission, and perinatal mortality[7].

Recent researches have pointed out the prognostic importance of AFI in forecasting fetus results in hypertensive pregnancies. In the same spirit, prospective cohort study showed that women with PIH and oligohydramnios were found to have higher rates of adverse perinatal outcomes relative to women with normal AFI to enable timely clinical decision-making[8].

Moreover, developments in prenatal imaging and risk optimization have enhanced fetal identification of compromised fetuses; nevertheless, issues associated with resource strained environments are that the advanced monitoring mechanisms may be unavailable in these environments, and AFI is a parameter that is simple, cost-efficient, and valuable in detecting fetuses that are at risk[9]. Furthermore, AFI assessment along with other clinical variables like blood pressure measurements and fetus biometry may be effective in complementing the overall care of PIH[10].

Although the link between low AFI and poor fetal outcomes has been confirmed, local evidence of the frequency of adverse fetal outcomes in low-AFI and low-normal AFI in the specific patient subgroup (Patients with PIH) has not been studied in detail[11]. The majority of the research that is available is in other populations or not has direct comparative analysis. This illustrates the necessity of additional studies to test the correlation between AFI and fetal outcomes among local population and hence better evidence-based practice[12].

Hence, the current study will establish the percentage of adverse fetal outcomes in those patients who have fetal hypertension caused by pregnancy and will compare these outcomes with those of low and normal amniotic fluid indexes[13]. It is believed that the results of this research will offer important information on AFI as a predictive instrument in PIH and will allow clinicians to potentially optimize the use of antenatal care and increase neonatal outcomes.

METHODOLOGY

Descriptive research conducted within the Department of Obstetrics and Gynaecology, PAF Hospital Sargodha, and a written consent of the Institutional Ethical Review Committee (ERC approval No: CPSP/REU/OBG-2022-146-11716) was obtained prior to conducting the research. The experiment was conducted during six months (1st February 2026- 30th April 2026). The ethical best practice of the institutional research committee and practices formulated in the declaration of Helsinki were adhered to in all the procedures. Informed consent was signed by all participants after being explained about the purpose, risks and benefits of the study, kept confidential, and the right to withdraw at any point without having any consequences to their medical care.

Non-probability consecutive sampling was completely used to enroll 100 pregnant women who met the eligibility criteria. The sample size was computed by WHO sample size calculator with the expected frequency of perinatal mortality of 15% in the patients with pregnancy-induced hypertension, a 95% confidence level, and a 7% margin of error taken[14].

The exclusion criteria were patients that had a history of premature rupture of membranes, known congenital fetal anomalies on ultrasound, polyhydramnios, diabetes mellitus, or renal disease to remove confounding variables that independently determine amniotic fluid volume and fetal outcomes.

Upon enrollment, the baseline demographic information such as age, gestational age, parity, residential status and AFI were captured into a pre-designed proforma. Each participant was examined on a detailed clinical history and careful physical, systemic and obstetrical examination. Standard four-quadrant ultrasonographic was used to measure the index of amniotic fluid. All patients were followed up to birth and fetal outcomes were measured in terms of low Apgar score at 5 minutes (≤5), necessity to go to NICU because of fetal distress, and perinatal mortality as defined as death of the baby within 48 hours of birth.

Statistical Packages of Social Sciences (SPSS) version 26 were used to analyze these data. The mean standard deviation or median (interquartile range) of quantitative variables like age, gestational age, AFI, and parity were computed with reference to the data distribution measured by the Shapiro-Wilk test[15]. Categorical variables such as Apgar score of low quality, NICU admission, and perinatal mortality were indicated in frequencies and percentages. The impact of AFI (low and normal) in response to poor fetal outcomes was assessed using Chi-square test or Fisher-exact test where necessary, and p- 0.05 was taken as statistically significant. The controlling of the effect modifiers like age, gestational age, parity and residential status happened by using the stratification then post stratifying of the chi-square test.

RESULTS

The study involved 100 womenwho had hypertension during pregnancy. The average age of the participants was 28.4 ± 5.2 years with an average gestational age of presentation of 36.8 + 1.9 weeks. The multiparous (58%), and primiparous (42%)) were the predominant women. In terms of residential status, 60% were urban and 40% rural.

According to amniotic fluid index (AFI), 38% of the patients experienced low AFI (≤5 cm) whereas 62% had normal AFI (818 cm).

The poor fetal outcomes were significantly observed among low AFI patients as opposed to normal AFI patients. In general, the low Apgar score (5 years or less at 5 minutes) was observed among 26 per cent of neonates, NICU hospitalization among 34 per cent and perinatal mortality among 12 per cent of cases.

When stratified by AFI, low Apgar score was much more prevalent in the low AFI group (47.4%), than the normal AFI group (12.9%) ($p<0.001$). Equally, the NICU admittances were higher in patients that presented with low AFI

(55.3) as compared to those with normal AFI (21.0) (p=0.002). There was also a higher incidence of perinatal mortality in the low AFI group (23.7%) than normal AFI (4.8%) (p= 0.01).

Table 1: Baseline Characteristics of Study Population (n=100)

Variable	Mean ± SD / n (%)
Age (years)	28.4 ± 5.2
Gestational age (weeks)	36.8 ± 1.9
Parity (Primiparous)	42 (42%)
Parity (Multiparous)	58 (58%)
Residential status (Urban)	60 (60%)
Residential status (Rural)	40 (40%)

Table 2: Distribution of Amniotic Fluid Index (n=100)

AFI Category	Frequency n (%)
Low AFI	38 (38%)
Normal AFI	62 (62%)

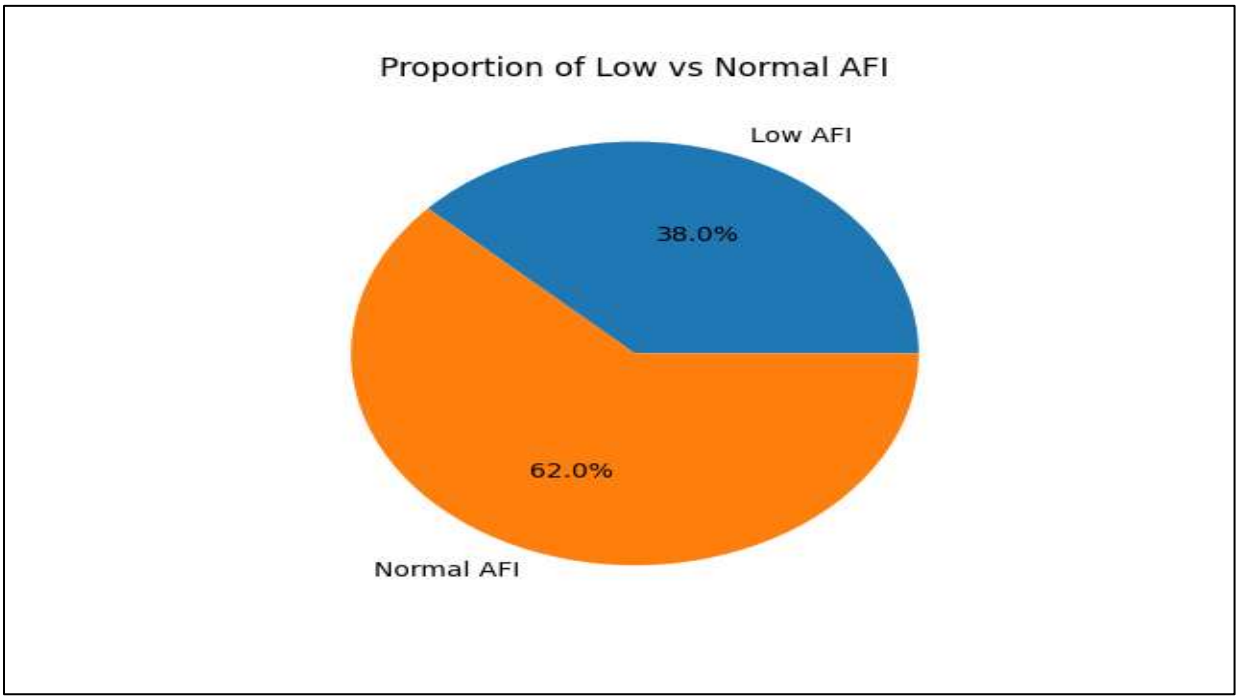

Figure 1: Pie chart showing proportion of low vs normal AFI

Table 3: Comparison of Adverse Fetal Outcomes between Low and Normal AFI

Outcome	Low AFI (n=38)	Normal AFI (n=62)	p-value
Low Apgar Score	18 (47.4%)	8 (12.9%)	<0.001
NICU Admission	21 (55.3%)	13 (21.0%)	0.002
Perinatal Mortality	9 (23.7%)	3 (4.8%)	0.01

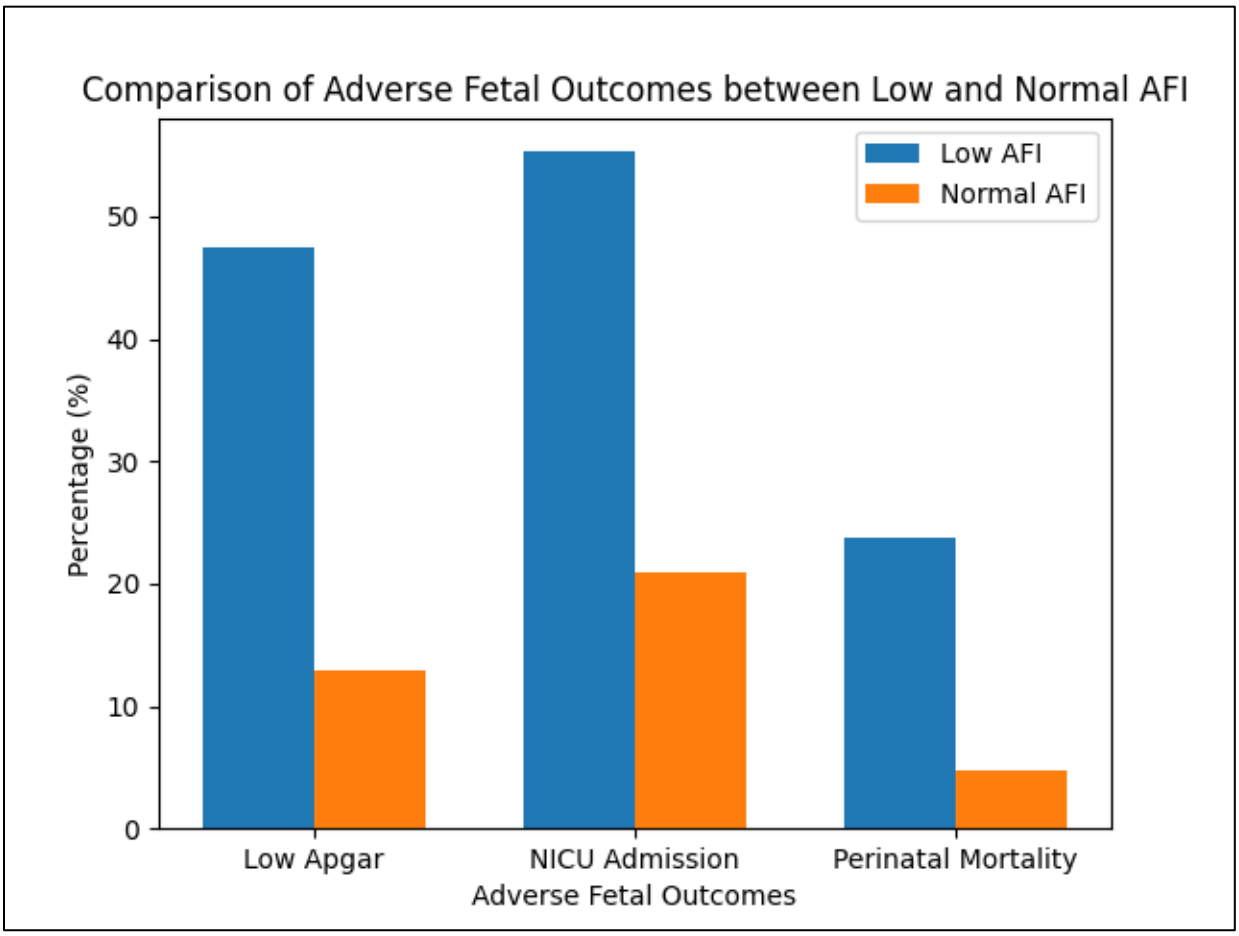

Figure 2: Bar chart showing comparison of adverse fetal outcomes (Low Apgar, NICU admission, Perinatal mortality) between low and normal AFI group

Lower AFI was strongly related to high frequency of unfavorable fetal outcomes such as low Apgar ratio, greater hospitalization in the NICU as well as perinatal mortality in comparison with normal AFI with pregnancy induced hypertension.

DISCUSSION

The current research has shown that there is a strong relationship existing between low amniotic fluid index (AFI) and negative fetal prognosis in women with pregnancy-induced hypertension (PIH). In particular, low AFI (<5 cm) was correlated with significantly high levels of low Apgar scores, NICU hospitalizations, and perinatal mortality rates relative to normal AFI (8 18 cm). These results demonstrate that AFI is a significant sonographic indicator of fetal compromise during hypertensive pregnancies and support its use in antepartum monitoring[16].

The reason as to why the low AFI group has increased adverse outcomes can be attributed to the pathophysiology of PIH. In PIH, the abnormal placentation causes an insufficient ambient of the uterus, which i.e., causes long-term fetal hypoxia and reallocation of fetal blood to critical bodily locations like the brain and heart[17]. This compensation mechanism decreases renal perfusion and production of fetal urine that is the main source of amniotic fluid during the third trimester. This phenomenon results in the development of oligohydramnios as an outcome of chronic stresses on the fetus and of placental insufficiency in its functioning, thus exposing the newborn to the risk of intrapartum distress and neonatal morbidities[18].

Our results coincide with other research that has already identified a close correlation between oligohydramnios and poor perinatal outcomes. A big prospective study reported a lot more of NICU admission, low birth weight and low Apgar scores occurred in pregnancies complicated with oligohydramnios compared to normal AFI[19], and comparative study showed fetal distress and perinatal morbidity were significantly overaroused in low birth weight pregnancies with low AFI.

The most common adverse outcome witnessed in the low AFI group in the present study was NICU admission. This observation is consistent with the literature that oligohydramnios is closely correlated with respiratory distress among

neonates and intensive neonatal care after birth due to chronic intrauterine hypoxia. Moreover, the escalating perinatal mortality in the low AFI category indicates severe placental insufficiency in PIH as it has been a continuingly reported phenomenon in the regional and international literature[20].

Recent research is also in favor of the usefulness of AFI as a component of the fetal comprehensive surveillance during hypertensive pregnancy. A 2023 study highlighted the fact that low AFI is a marker of fetal compromise and predictor of cesarean section because of fetal distress, and is consistent with our results and augments the clinical significance of continuous AFI monitoring in PIH women[21].

AFI despite its usefulness has some limitations. Certain researches indicate variability in measuring ultrasound between observers and over-diagnosis of oligohydramnios[22], which might unnecessarily arise and cause undue intervention to the baby, and thus such measurement should be evaluated with doppler-studies, fetal growth measurements and clinical examination so that the diagnostic efficiency may improve[23].

There are certain limitations of the current study. To begin with, the research was carried out in only one tertiary care hospital, which has a small sample, which can restrict the generalizability. Second, the consecutive sampling method is not probability sampling which can lead to selection bias. Third, the associations of long-term neonatal outcomes after the initial perinatal period were not evaluated. In spite of these shortcomings, the study retells some important local findings of the association between AFI and fetal outcomes in PIH and reports the necessity of early diagnosis and tight follow-up of high-risk pregnancies.

CONCLUSION

This research finds that low amniotic fluid index (AFI of 5cm or below) in pregnant patients with hypertension-induced pregnancy is strongly correlated with a higher number of adverse neonatal outcomes such as low Apgar scores, increased NICU admissions, and higher perinatal mortality rates than those with normal AFI.

The major revelation of this research is the clear comparative evidence that shows that lowered AFI is a significant clinical sign of fetal compromise in PIH patients alone, hence its importance in risk stratification. The research contributes to local information on proving that AFI is a powerful, non-invasive, and effective equipment to identify the high-risk pregnancies early.

These results are in accordance with the study aims and highlight that regularly measuring AFI and keeping a close eye on it in patients with pregnancy-induced hypertension will support the timely obstetric care and may lead to higher perinatal outcomes.

RECOMMENDATIONS

An amniotic fluid index should be a regular evaluation in the antenatal surveillance of patients with pregnancy-induced hypertension to allow early detection of high-risk cases. Low AFI patients should be on a higher alert, a timely decision-making scale on delivery, and facilities to be provided with neonatal care to minimize the harmful fetal outcomes. Additional multicentric research including more participants and incorporation of more sophisticated fetal monitoring (such as the Doppler investigations) is not only advisable but also necessary to enhance the evidence base and enhance clinical practices.

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