The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 5, 2025

COMPARING NEONATAL OUTCOMES IN NORMAL VERSUS BORDERLINE AMNIOTIC FLUID INDEX (AFI) IN FULL TERM PREGNANCIES

Dr Saba Fazal Dad[*1], Dr Viqar Ashraf[2], Dr Ayesha Imran[3], Dr Samina Rehan[4], Fareeha Zaheer[5]

[*1,2,3,4,5]*Department of Obstetrics and Gynaecology, DHQ teaching Hospital, Gujranwala*

[*1]drsabafazaldad@gmail.com

DOI: https://doi.org/10.5281/zenodo.15395415

Keywords
Amniotic Fluid, Birthweight, Pregnancy, Term birth, Pregnancy Outcome, Term Birth.

Article History
Received on 05 April 2025
Accepted on 05 May 2025
Published on 13 May 2025

Corresponding Author: *
Dr Saba Fazal Dad

Abstract

Background: *The borderline amniotic fluid index (AFI) is one of the grey areas to ascertain its impact on fetomaternal outcomes.*

Objectives: *(I) To find the frequency of borderline AFI (5-24 cm) in full term pregnancies. (II) To compare birthweight (BW) and 5 min Apgar in normal versus borderline AFI groups.*

Study design: *Descriptive case series*

Place and duration of study: Department of Obstetrics and Gynaecology, DHQ teaching Hospital, Gujranwala.

Materials and Methods: *Following approval from the institutional ethical committee, we enrolled 120 patients with singleton term pregnancies from our hospital's labor room. Patients were grouped into normal and borderline AFI groups based on sonographic assessments. All patients were monitored until delivery, and fetal BW and 5 min Apgar score were measured. Data analysis was performed using SPSS version 25, with statistical significance defined as a p-value of ≤ 0.05.*

Results: *The patients had a mean age of 29.23 ± 6.39 years. The mean AFI was 13.18 ± 5.80 cm, and the mean birthweight was 3047.83 ± 474.76 grams. The mean Apgar score at 5 min was 8.14 ± 1.102. Patients with borderline AFI were 34 (28.33%). The distribution of mean BW in AFI groups showed that the mean BW in the normal AFI group was 3132.51 ± 425.331 grams, while in the borderline AFI group, it was 2833.62 ± 529.945 grams (P=0.002). The mean 5 min Apgar score was 8.28 ± 1.081 versus 7.79 ± 1.095 for normal versus borderline AFI groups respectively (P=0.029).*

Conclusion*: The borderline AFI is 28.33% of our population. The fetal BW and 5 min Apgar score are significantly higher in normal versus borderline AFI. The large multicentred trials would provide more insight before final verdict.*

INTRODUCTION

An adequate amount of amniotic fluid is necessary for the optimized gestational outcomes. Both polyhydramnios (increased amniotic fluid) or oligohydramnios (decreased amniotic fluid) are associated with adverse pregnancy outcomes.[1] Amniotic fluid index (AFI) was introduced decades ago to standardize the quantity of amniotic fluid. It is sonographic fluid depth measurement of all

quadrants of the abdomen. It has become now standard tool for the quantitative assessment of amniotic fluid.[2]

The normal range of AFI is between 8 to 24 cm. The cases in which the AFI <5 cm (oligohydramnios) must undergo early and prompt management to avoid adverse fetomaternal outcomes. The borderline AFI i.e., 5-8 cm is a grey zone with variable gestational prognosis. This is the area of interest among researchers to find out possible fetomaternal poor outcomes associated with borderline AFI.[3, 4] A study in 2018 found that frequency of borderline AFI was 24.88%.[5] A recent study found that pregnancies with borderline AFI had higher rates of low birth weight (47% versus 17%, p value <0.001) and <7 Apgar scores at 5 min time (35% versus 14%, p value 0.001).[6] Another study in the same year i.e. 2021 showed that there was no difference between borderline and normal AFI in terms of poor Apgar or fetal distress i.e., Apgar score <7 at 5 minutes (3.1% vs 1.5%, p = 0.06) and meconium staining of liquor (33% vs 38.3%, p = 0.3).[7]

Research data shows that oligohydramnios is associated with various adverse fetomaternal outcomes. The grey area of borderline AFI has been the area of controversy whether it is associated with adverse fetomaternal outcomes or not.[6, 7] Due to the limited research data regarding this topic in Pakistan, we are aiming our study to compare normal versus borderline AFI in terms of fetal outcomes. The international data regarding this subject has considerable controversy.[2, 6, 7] The results of our study would help us to improve fetal outcomes due to early and prompt management and anticipation if we would find an association of borderline AFI and adverse fetal outcomes. This would reduce the fetal morbidity and mortality among newborns.

METHODS AND MATERIALS

This study of descriptive case series was conducted from 1st of March 2023 to 30th of September 2023 at Obstetrics and Gynecology department of District Headquarter Teaching Hospital, Gujranwala. The Institutional Ethical approval was taken (Letter no) before conducting this research. The trial was registered on clinicaltrials.gov (NCT). The sample size of 120 cases was calculated by taking expected frequency of borderline AFI as 24.88%.[5] The confidence level was kept at 95% and absolute precision as 8%. The women with full term singleton pregnancy with age range of 18 to 40 years were included. Exclusion criteria included maternal comorbidities (e.g., diabetes, hypertension, renal/hepatic diseases, ischemic heart disease), sonographic evidence of fetal anomalies or molar pregnancy, and maternal drug or alcohol use during current gestation. After detailed clinical and laboratory assessment, radiological examination for AFI estimation was carried out by consultant sonologist in our hospital using a curvilinear sonar probe of 3.5 MHz. Based on AFI values, patients were categorized into two groups, normal (>8-24 cm) and borderline (5-8 cm). All patients received the same standard obstetrical care as per hospital protocols and were followed until parturition. Fetal BW and five-minute Apgar score were calculated, and the data were entered into a specially designed proforma. The collected data was analysed using SPSS version 25. Quantitative variables such as maternal age, gestational age, BW, and 5-minute Apgar scores were expressed as mean ± standard deviation (SD). Categorical variables like AFI categories (normal & borderline) and fetal gender were expressed by frequency and proportions. Both groups (normal versus borderline AFI) were compared in terms of neonatal BW and 5-minute Apgar score using an independent sample t-test. Effect modifiers such as maternal age, BMI, parity, and fetal gender were addressed by stratification. Post-stratification independent sample t-tests were applied. A p-value of <0.05 was considered statistically significant.

RESULTS

At the conclusion of the study period, data from 120 patients were analyzed. The patients had a mean age of 29.23 ± 6.39 years. The distribution of age groups is depicted in the bar graph (Figure VII). The mean gestational age and mean BMI were 39.13 ± 1.414 weeks and 25.11 ± 1.974 kg/m^2, respectively. The parity data showed that primigravida patients were 25.8%. The mean amniotic fluid index (AFI) was 13.18 ± 5.80 cm, and the mean birth weight was 3047.83 ± 474.76 grams. The mean Apgar score at 5 min was 8.14 ± 1.102. Female fetal gender predominated, with 63 (52.5%) female fetuses (Figure IX). Patients with borderline AFI were 34 (28.33%).

(Figure VIII). There was no difference between normal versus borderline AFI groups in terms of distribution of age, gestational age, BMI, and fetal gender (p values 0.866, 0.356, 0.375 and 0.453 respectively) (Table I and II).

The distribution of mean birth weight (BW) in AFI groups showed that the mean BW in the normal AFI group was 3132.51 ± 425.331 grams, while in the borderline AFI group, it was 2833.62 ± 529.945 grams (p-value 0.002). The mean 5 min Apgar score was 8.28 ± 1.081 versus 7.79 ± 1.095 for normal versus borderline AFI groups respectively (p value 0.029) (Table III).

The data were stratified according to age, gestational age, BMI, parity, and fetal gender (Table IV to XIII). The results indicated that all stratification groups exhibited a significant difference in mean BW among AFI groups for following subgroups; for age ≥30 years (p-value <0.0001) and gestational age <38 weeks (p value 0.007) gestational age ≥38 weeks (p-value 0.046), BMI ≥25 kg/m^2 (p value 0.001), parity ≥3 (p value 0.006), male fetal gender (p value 0.053), female fetal gender (p value 0.012). The results were significantly different in 5 min mean Apgar score among AFI groups for following subgroups; gestational age ≥38 weeks (p value 0.026), parity <3 (p value 0.024), male fetal gender (p value 0.022) only.

TABLES

Parameter	Group A (Control group) (n=61)	Group B (Experimental group) (n=61)	P value
Age (years)	34.98 ± 2.88	34.83 ± 2.30	0.755
Gestational age (weeks)	10.07 ± 1.23	9.83 ± 1.047	0.232 Error! Bookmark not defined.

Table I. Age and gestational age among groups

Outcomes	Group A (Control group) (n=61)	Group B (Experimental group) (n=61)	P value
SVD	26 (42.6%)	31 (50.8%)	0.591
CSD	25 (41%)	23 (37.7%)	
E&C	10 (16.4%)	7 (11.5%)	

Table II. Mode of delivery among groups

Outcomes	Group A (Control group) (n=61)	Group B (Experimental group) (n=61)	P value
Alive birth	46 (49.5%)	47 (50.5%)	0.832
IUD	5 (41.7%)	7 (58.3%)	0.543
NICU admission	22 (64.7%)	12 (35.3%)	0.043

Table IIII. Outcomes among groups

DISCUSSION

The amniotic fluid index (AFI) is a critical parameter during obstetrical evaluation. It is used to assess the volume of amniotic fluid surrounding the fetus during pregnancy. This index plays a pivotal role in evaluating fetal well-being and can offer crucial insights into both fetal health and the overall status of pregnancy.[1] AFI is determined using ultrasound, a non-invasive imaging technique that employs sound waves to generate images of the fetus and its surroundings. During a routine prenatal ultrasound examination, the AFI is calculated by dividing the uterus into four quadrants and measuring the deepest vertical pocket of amniotic fluid in each quadrant. These measurements are then summed to obtain the value which is expressed in centimeters.[1, 4]

AFI values are interpreted based on the foetus's gestational age. Normal AFI values can fluctuate throughout pregnancy, with higher volumes often observed in the second trimester and a gradual decline towards end of gestation. Generally, an AFI ranging from 5 to 25 centimeters is considered normal.

However, it is crucial to account for individual patient factors, such as maternal body habitus, fetal position, and amniotic fluid distribution, when interpreting AFI measurements.

Deviations from normal AFI values may suggest underlying fetal or maternal complications. For instance, oligohydramnios (AFI < 5 cm) may be linked to fetal growth restriction, placental insufficiency, or fetal renal abnormalities. Conversely, polyhydramnios (AFI > 25 cm) may indicate fetal anomalies, maternal diabetes, or fetal distress.[3, 8] The Apgar score is universally accepted for the immediate and quick neonatal assessment. The low score should be considered as alert for further evaluation and management to optimize the fetal outcomes.[9-11] Younger gestational age, lower BW, and abnormal amniotic fluid volumes increase the risk of low Apgar score in neonates.[12]

A study investigated the relationship between birth weight (BW) and amniotic fluid index (AFI) in term pregnancies with intact membranes, aiming to determine whether AFI could serve as a predictor for macrosomia and intrauterine growth restriction (IUGR). A total of 231 women with term gestations (37–42 weeks) and AFI values between 5.0 and 24.0 cm were included. The findings demonstrated a positive linear correlation between AFI and BW, with higher AFI values associated with increased BW. Specifically, an AFI greater than 15.0 cm was linked to more than double the incidence of macrosomia (defined as BW > 4,000 g), while an AFI above 18.0 cm was associated with a greater than sixfold increase in the risk of macrosomia. Furthermore, macrosomic infants were significantly more likely to be delivered via cesarean section. In contrast, no significant association was observed between low-normal AFI levels (5–8 cm) and the occurrence of IUGR (BW < 2,500 g). The study concluded that while elevated AFI is a potential predictor of macrosomia and increased cesarean delivery risk, low-normal AFI does not appear to be a reliable indicator of fetal growth restriction.[13]

In a cross-sectional study conducted at Obstetrics and Gynecology Unit I, Holy Family Hospital, and Railway Teaching Hospital Complex, Rawalpindi, from February 2003 to January 2004, researchers aimed to determine the accuracy of antepartum AFI ≤ 5 cm as a predictor of adverse outcomes at birth in 100 women with high-risk pregnancies. The sensitivity, specificity, positive predictive value, negative predictive value of AFI to predict poor 5 min Apgar score (<6) were 57.1%, 51.3%, 16%, 88%, and 52%, respectively. Thus, the study concluded that low AFI is a poor predictor of adverse outcomes in high-risk term pregnancies and that AFI is not a reliable screening test for predicting the birth of an infant with a low Apgar score in such cases.[14] The low Apgar score is also associated with the cases in which the instrumental delivery is conducted or emergency cesarean section is performed.[15, 16]

The term "borderline AFI" denotes a measurement that falls within the spectrum lying between normal and abnormal ranges, indicating a moderate amniotic fluid volume. Although the exact definition of borderline AFI may exhibit slight variations among healthcare practitioners, it typically encompasses AFI measurements ranging from 5-8 cm. Several studies have delved into this grey AFI area, and while findings may exhibit some variance, they generally suggest an elevated risk associated with borderline AFI compared to normal AFI.[17].[18].[19]

Another study evaluated the impact of borderline AFI on perinatal outcomes in uncomplicated late preterm pregnancies. A total of 430 women with singleton pregnancies between 34+0 and 36+6 weeks of gestation were enrolled. Participants were divided into two groups based on AFI values: 107 women with borderline AFI and 323 with normal AFI. No statistically significant differences were found between the groups regarding rates of delivery before 37 weeks, cesarean section due to non-reassuring fetal heart rate, meconium-stained amniotic fluid, low Apgar scores (<7 at 5 minutes), transient tachypnea of the newborn, respiratory distress syndrome, neonatal intensive care unit (NICU) admission, or neonatal hyperbilirubinemia. However, the induction of labor was significantly more frequent in the borderline AFI group (p = .040). Additionally, the fetal renal artery pulsatility index (PI) was significantly lower in the borderline group (p = .014), suggesting possible alterations in fetal circulation.[5] An Indian prospective observational study involved 200 pregnant women admitted to Pradyumna Bal Memorial Hospital, Bhubaneswar, from September 2019 to February 2021. Eligible participants were women in their third trimester with singleton pregnancies, out of which

100 women presented with borderline AFI and were classified as cases, while the remaining 100 had a normal AFI and served as controls. The results revealed significantly higher rates of adverse maternal outcomes, including preterm delivery, meconium-stained amniotic fluid, and lower segment cesarean section, in the borderline AFI group ($p \leq 0.001$). Additionally, the borderline AFI group exhibited a higher incidence of perinatal complications, such as Apgar score <7 ($p = 0.001$), respiratory distress syndrome ($p = 0.001$), neonatal intensive care unit admission ($p < 0.001$), intrauterine growth restriction ($p < 0.001$), and low birth weight ($p < 0.001$).[6] In our study mean BW was significantly higher in the normal AFI group (3132.51 ± 425.331 grams) compared to the borderline AFI group (2833.62 ± 529.945 grams). Similarly, the 5-minute Apgar score was higher in the normal AFI group (8.28 ± 1.081) compared to the borderline AFI group (7.79 ± 1.095).

Another prospective, hospital-based study conducted at Tribhuvan University Teaching Hospital over one year, from 2017 to 2018, aimed to compare obstetric interventions and neonatal outcomes between term pregnancies with borderline and normal AFI. The study included 128 women with uncomplicated term pregnancies admitted to the labor ward, with 64 women in each group. The rate of labor induction was higher in the borderline AFI group compared to the normal AFI group (73.4% vs. 35.9%, $p = 0.0001$, OR = 4.9), as was the rate of cesarean section (42.1% vs. 28.1%, $p = 0.04$, OR = 1.8). Neonates from the borderline AFI group exhibited a higher incidence of tachypnea compared to those from the normal AFI group (50% vs. 11.1%, $p = 0.01$), as well as a higher rate of low birth weight (9.1% vs. 4.5%, $p = 0.04$). However, no significant differences were found in the incidence of meconium staining of amniotic fluid (33% vs. 38.3%, $p = 0.3$) or APGAR score <7 at 5 minutes (3.1% vs. 1.5%, $p = 0.06$). Importantly, there were no NICU admissions or neonatal deaths in either group.[7]

The data regarding borderline versus normal AFI favors the normal AFI for optimized fetomaternal outcomes. Some studies found little or no difference between the various adverse fetomaternal outcomes between these two groups. In a retrospective study at Hubei Maternal and Child Health Hospital, perinatal outcomes of induced labor using dinoprostone were compared between pregnancies with borderline and normal AFI at term, along with factors affecting cesarean section outcomes. Results showed significantly lower time to delivery and use of oxytocin augmentation in the borderline AFI group. However, there were no significant differences between groups in delivery mode, time to onset of labor, fetal distress, Apgar scores, meconium-stained amniotic fluid, birth weight, or NICU admission rates. In the borderline AFI group, gestational hypertension and birth weight were major factors affecting cesarean section outcomes. In the normal AFI group, maternal age, parity, biparietal diameter, and meconium-stained amniotic fluid were related factors.[2]

Current evidence suggests that borderline AFI may be linked to higher risks of adverse neonatal outcomes compared to normal AFI. Practitioners should monitor these pregnancies closely for optimal maternal and neonatal outcomes. The AFI is the standard method to assess for the amniotic fluid estimation. Further research with inclusion of more fluid parameters can enhance its accuracy.

CONCLUSION

Borderline AFI accounts for 28.33% of our population. Both fetal BW and 5-min Apgar scores are higher in normal compared to borderline AFI. Larger multicentre trials are needed for further insight.

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