Journal of Population Therapeutics & Clinical Pharmacology

DIAGNOSTIC ACCURACY OF AMNIOTIC FLUID INDEX IN DETERMINATION OF POOR APGAR SCORE AMONG FEMALES WITH POST-TERM PREGNANCY

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ABSTRACT

This study aimed to evaluate the diagnostic accuracy of amniotic fluid index to predict the poor Apgar score in females with postdate pregnancy in a tertiary care hospital taking poor Apgar score at birth as the gold standard. A cross-sectional study was conducted in the Obstetrics and Gynecology Department of Jinnah Hospital, Lahore from December 2023 to December 2024. A total of 300 pregnant women aged 20-40 years with <5 parity and gestation age 40-42 weeks according to ultrasound were included in the study. Ultrasound was performed in all subjects by a senior radiologist to assess the amniotic fluid index. Females were labeled as positive if AFI<5cm and negative if AFI>5cm. After 5 minutes of delivery, the Apgar score was measured and was labeled as poor if the Apgar score was <7 and was labeled as good if the Apgar score was >7. The results revealed the sensitivity of AFI as 89.62%, specificity 8.76%, PPV 34.92%, NPV 60.71% and overall diagnostic accuracy was 37.33%. With respect to gestational age, the sensitivity was 86.84%, specificity was 10.97%, PPV was 31.11%, NPV was 64.29% and diagnostic accuracy was 35% in women who were 42 weeks pregnant. In women with gestational age 41 weeks, sensitivity was 91.17%, specificity was 7.14%, PPV was 53.45%, NPV was 57.14% and diagnostic accuracy was 38.89%. In conclusion, the amniotic fluid index is a highly sensitive tool for the prediction of poor Apgar score; however, its overall diagnostic accuracy is not reliable individually without additional screening tools.

Keywords: Amniotic Fluid, Pregnancy, Ultrasound

INTRODUCTION

A full-term pregnancy is defined as one between 39 weeks to 40 weeks while a gestation age of 42 weeks or more is termed a post-term pregnancy. It is essential to track the gestation age in early pregnancy with ultrasound examination instead of the menstrual cycle to reduce the risk of post-

term pregnancies. Although a greater gestation ageof>41 weeks increases the likelihood of maternal, fetal, and neonatal complications, most neonates are born healthy without any major risk to maternal health.[1]

Examination of amniotic fluid through ultrasound has become an essential element of prenatal care and is followed during regular visits to the obstetrician.[2] The abnormal volume of the fluid can indicate maternal and fetal conditions such that polyhydramnios increases the likelihood of aneuploidy and fetal abnormalities and oligohydramnios increases the risk of intrauterine growth restriction and renal dysfunction in 2nd trimester.[3]

Post-term pregnancies have also a higher risk of cesarean section with the incidence of emergency surgery increased by 1.5 folds.[4] During the ultrasonographic examination, it is recommended to examine the largest fluid pocket as it allows the determination of amniotic fluid index through which oligohydramnios can be diagnosed and labor induction and fetal distress can be predicted.[5]

The reported frequency of poor Apgar score (i.e. < 7 after 5 minutes of birth) is 32.5% among cases of postdate pregnancy.[6]A local study reported the sensitivity of AFI was only 57.1% while specificity was 51.3% for the assessment mode of delivery.[7]However, in another local study, a 6.12% sensitivity and 99.43% specificity of AFI were reported for lower-segment cesarean section.[8]

The rationale of this study was to assess amniotic fluid index as a predictorof poor Apgar score in postdate pregnancies as in postdate pregnancies obstetricians often do not take risks and induce an early delivery to prevent hazards to the health of neonates. The literature review reports that amniotic fluid index (AFI) assessment on USG is not a useful and reliable method to predict fetal surveillance, but controversies are present in the literature. This study is intended to assess the diagnostic reliability of AFI on USG which will be helpful in the future as it will be helpful in the prediction of poor fetal outcomes andbetter management and preventive measures to have better neonatal outcomes. It will help to improve our practice, and local guidelines for the management of these cases and will help to achieve more patients' satisfaction.

This study aimed to evaluate the diagnostic accuracy of amniotic fluid index to predict the poor Apgar score in females with postdate pregnancy in a tertiary care hospital taking poor Apgar score at birth as the gold standard.

METHODOLOGY

A cross-sectional study was conducted in the Obstetrics and Gynecology Department of Jinnah Hospital, Lahore from December 2023 to December 2024. A total of 300 pregnant women aged 20-40 years with <5 parity and gestation age 40-42 weeks according to ultrasound were included in the study. The sample size was calculated by taking a 10% margin of error, 95% confidence interval, 32.5% predicted incidence of poor Apgar score, 57.1% predicted sensitivity, and 51.3% specificity of AFI. Women with a history of cesarean section, multifetal pregnancy, premature rupture of membranes, intrauterine growth restriction, cephalopelvic disproportion, macrosomic fetus, congenital abnormalities, pre-eclampsia, eclampsia, gestation hypertension, or diabetes were excluded. All participants provided their informed consent to become a part of the study. The ethical committee of the hospital approved the study.

Participants' demographic and obstetric details were recorded. Ultrasound was performed in all subjects by a senior radiologist to assess the amniotic fluid index. Females were labeled as positive if AFI<5cm and negative if AFI>5cm. Then females were followed in the ward till delivery. All females underwent normal delivery. After 5 minutes of delivery, the Apgar score was measured and was labeled as poor if the Apgar score was <7 and was labeled as good if the Apgar score was >7.

True positive meant when AFI<5cm and Apgar was also <7 after 5 minutes while true negativewas when AFI>5cm and Apgar was also >7 after 5 minutes.False positivewas labeled when AFI<5cm but Apgar was >7 after 5 minutes and false negativewas labeled when AFI>5cm but Apgar was <7 after 5 minutes.

All data was analyzed by SPSS version 20. Quantitative variables like maternal age, gestational age, amniotic fluid index, and Apgar score were presented as mean ±SD, and qualitative variables like

parity were presented by percentage. Sensitivity, specificity, positive predictive value negative predictive value, and overall diagnostic accuracy of AFI were calculated by a 2x2 table.

RESULTS

A total of 300 patients were included for analysis with a mean age of 27.68 ± 3.90 among which 204 patients (68%) were younger than 30 years and 96 patients (32%) were 30 years or older. 180 patients (60%) had a gestational age of 41 weeks whereas the remaining120 patients (40%) were 42 weeks pregnant. The amniotic fluid index was <5 in 28 patients (9.3%) and ≥5 in 272 (90.7%). APGAR score was <7 in 148 patients (46.7%) neonates and ≥ 7 in 160 (53.3%). Baseline maternal and neonatal information is shown in Table I.

The diagnostic yield of the AFI index taking APGAR score at birth as the gold standard is shown in Table II. The sensitivity was 89.62%, specificity 8.76%, PPV 34.92%, NPV 60.71%, and overall diagnostic accuracy was 37.33%. For women older than 30 years, sensitivity was 84%, specificity was 8.45%, PPVwas 26.25%, NPV was 60% and overall diagnostic accuracy was 28.13%. While for women younger than 30 years, the values were 91.35%, 8.94%, 41.11%,61.11%, and41.66%, respectively.

With respect to gestational age, the sensitivity was 86.84%, specificity was 10.97%, PPV was 31.11%, NPV was 64.29% and diagnostic accuracy was 35% in women who were 42 weeks pregnant. In women with gestational age 41 weeks, sensitivity was 91.17%, specificity was 7.14%, PPV was 53.45%, NPV was 57.14% and diagnostic accuracy was 38.89%.

Stratification of Apgar score was done according to maternal and gestational age as shown in Table III. The difference in AFI and Apgar scores was not significant between both age groups and gestational age groups.

Table I: Maternal, Fetal, and Neonatal Data of Participants

Variables	N (%)
Mean age	27.6 ± 3.90
Age groups	
<30 years	204 (68%)
>30 years	96 (32%)
Gestation age	
41 weeks	180 (60%)
42 weeks	120 (40%)
Amniotic fluid index	
<5	28 (9.3%)
≥5	272 (90.7%)
Apgar score	
<7	140 (46.7%)
≥7	160 (53.3%)

Table II: Diagnostic Yield of AFI Index Taking APGAR Score at Birth as Gold Standard

Parameters	Percentage
Sensitivity	89.62%
Specificity	8.76%
Positive predictive value	34.92%
Negative predictive value	60.71%
Diagnostic accuracy	37.33%

Table III: Maternal Age and Gestational Age Stratification Regarding APGAR Score Among Patients with Amniotic Fluid Index

Variables			APGAR score	
			Less than 7	7 or more
Gestational age				
42 weeks	Amniotic fluid index	5 or more	33	73
		Less than 5	5	9
41 weeks	Amniotic fluid index	5 or more	62	104
		Less than 5	6	8
Maternal age				
Above 30 Years	Amniotic fluid index	5 or more	21	65
		Less than 5	4	6
Below 30 years	Amniotic fluid index	5 or more	74	112
		Less than 5	7	11

DISCUSSION

This study was conducted to evaluate the diagnostic accuracy of the amniotic fluid index for the prediction of poor Apgar score in women with post-date pregnancy.The findings indicated that AFI is a satisfactory screening tool but its results are not reliable enough to predict poor Apgar score alone. Awan et al and RajaKaruna et al also reported similar results.[9, 10]

The results of the present study showed an unsatisfactory accuracy of 37.3% with a high sensitivity of 89.62% which is helpful in detecting newborns at risk and a low specificity of 8.76% which shows failure to identify true negative. A low PPV of 34.92% indicates a high chance of false positives and NPV of 60.71% shows moderate reliability on negative results. These results are similar to those of Sultana et al which reported a 57.1% sensitivity, 51.3% specificity, 16% positive predictive value, 88% negative predictive value, and 52% overall efficiency of AFI for the prediction of poor Apgar score.[11]

In contrast to this, Sekhon et al compared the efficacy of maximum vertical pocket vs amniotic fluid index for predicting adverse neonatal outcomes.[12] It reported that the former better predicted fetal distress, cesarean birth, induction of labor, and abnormal fetal heart rate which helped with smooth birth without interventions.

Sharma et al reported a 50% sensitivity, 79.66% specificity, 29.41% PPV, and 90.38% NPV of amniotic fluid index for the prediction of a 5-minute Apgar score.[13] However, this study concluded a better predictive accuracy of umbilical artery systolic/diastolic ratio with respective values as 60%, 91.52%, 54.54%, and 93.10% (p<0.001). The results of the present study are significantly different from Egagifo et al where the sensitivity and specificity of AFI for adverse neonatal outcomes were 39.7% and 82.3%, respectively.[14] In comparison to this, the 2-diameter pocket had a 69.8% sensitivity and 58.2% sensitivity which accurately predicted intrauterine growth restriction, fetal distress, NICU and hospitalstay, early mortality, and abnormal amniotic fluid volume. In Taha et al, AF had a 91.4% sensitivity and 93.3% specificity for the prediction of poor Apgar score and NICU admissions.[15]

CONCLUSION

The amniotic fluid index is a highly sensitive tool for the prediction of poor Apgar score; however, its overall diagnostic accuracy is not reliable individually without additional screening tools.

REFERENCES

1. Green A, Chiu S, Manor E, Smith L, Oyelese Y. The association of gestational age at delivery with neonatal outcomes in prenatally diagnosed vasa previa. The Journal of Maternal-Fetal & Neonatal Medicine. 2022;35(25):10162-10167.

2. Huri M, Di Tommaso M, Seravalli V. Amniotic fluid disorders: from prenatal management to neonatal outcomes. Children. 2023;10(3):561.
3. Bakhsh H, Alenizy H, Alenazi S, Alnasser S, Alanazi N, Alsowinea M, et al. Amniotic fluid disorders and the effects on prenatal outcome: a retrospective cohort study. BMC pregnancy and childbirth. 2021;21:1-7.
4. Dias BAS, Leal MdC, Esteves-Pereira AP, Nakamura-Pereira M. Variations in cesarean and repeated cesarean section rates in Brazil according to gestational age at birth and type of hospital. Cadernos de Saúde Pública. 2022;38:e00073621.
5. Gunnarsdóttir J, Swift EM, Jakobsdóttir J, Smárason A, Thorkelsson T, Einarsdóttir K. Cesarean birth, obstetric emergencies, and adverse neonatal outcomes in Iceland during a period of increasing labor induction. Birth. 2021;48(4):493-500.
6. Marwat SH, Naz MK, Riaz M, Sardar N, Hassan S, Naseem H. Amniotic Fluid Index and its relationship with Poor Apgar Score in Term Pregnancy. Journal of Health and Rehabilitation Research. 2023;3(2):650-654.
7. Talpur S, Kahn S, Abbas A, Asad S, Kousar T. To Analyse the Significance of Reduced Amniotic Fluid Index in Pregnancy and its Correlation with Perinatal Outcome. Journal of The Society of Obstetricians and Gynaecologists of Pakistan. 2021;11(3):217-219.
8. Sharif N, Qasim A. Perinatal outcome in pregnant females at term having low amniotic fluid index. The Professional Medical Journal. 2021;28(09):1358-1364.
9. Awan S, Tabasum S, Parveen T, Bhutto A, Mandvia A, Kaleem R, et al. Amniotic Fluid Index and Its Relationship with Poor Apgar Score in Term Pregnancy: Amniotic Fluid Index in Term Pregnancy. Pakistan Journal of Health Sciences. 2023:29-32.
10. Rajakaruna RMU, Karunaratne SMG, Thennakoon BNS. Predictive Value of Amniotic Fluid Index in Term Small for Gestational Age with Normal Doppler Studies for Perinatal Outcomes. Open Journal of Obstetrics and Gynecology. 2023;13(8):1339-1349.
11. Sultana S, Akbar Khan M, Khanum Akhtar K, Aslam M. Low amniotic fluid index in high-risk pregnancy and poor apgar score at birth. J Coll Physicians Surg Pak. 2008;18(10):630-634.
12. Sekhon S, Rosenbloom JI, Doering M, Conner SN, Macones GA, Colditz GA, et al. Diagnostic utility of maximum vertical pocket versus amniotic fluid index in assessing amniotic fluid volume for the prediction of adverse maternal and fetal outcomes: a systematic review and meta-analysis. The Journal of Maternal-Fetal & Neonatal Medicine. 2021;34(22):3730-3739.
13. Sharma M, Sharma G, Verma A. Umbilical artery systolic/diastolic ratio and amniotic fluid index in prediction of adverse perinatal outcome in term pregnancies. International Journal of Applied and Basic Medical Research. 2022;12(2):76-81.
14. Egagifo O, Omo-Aghoja LO, Adeyinka AT. Correlation of perinatal outcomes with amniotic fluid assessment techniques in high-risk pregnancies in a Tertiary Hospital in Southern Nigeria. African Health Sciences. 2021;21(3):1310-1320.
15. Taha WS, Galal SK, Moghazy SMA. Amniotic Fluid Turbidity via Ultrasound before 34 Weeks of Pregnancy and Neonatal Outcomes. Al-Azhar International Medical Journal. 2024;5(4):14.