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Association Of Prelabour Amniotic Fluid Index (AFI) And Feto-Maternal Outcome: A Prospective Cohort Study

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ABSTRACT:-

Background:

Assessment of AFI is used to study fetal well being at admission into labour which predicts the fetuses at risk of developing fetal distress.

Aim: To evaluate the role of AFI in the prediction of feto maternal outcome.

Methods: A prospective cohort study of term pregnant women (37 – 42 weeks) admitted at Tertiary care hospital at Puducherry for 2 years. AFI was measured by four quadrant method with ultrasound. Fetomaternal outcomes were monitored.

Results:

Among 405 patients studied, 30 (7.4%) oligohydramnios, 121 (29.9%) Borderline AFI, 251 (62%) normal AFI and 3 (0.7%) Polyhydramnios. AFI was statistically significant related to type of labour, CTG changes and neonatal birth weight. All other parameters like gestational age, nature of liquor, mode of delivery, APGAR, NICU admission and neonatal hospital stay were not significant. **Conclusion:** AFI in singleton pregnancies could not predict all fetomaternal outcome. But can still help in selecting high risk patients who need continuous monitoring.

Key words: AFI, Fetomaternal outcome, Oligohydramnios, Polyhydramnios.

INTRODUCTION:

The primary aim of antenatal care is to deliver a healthy neonate at an appropriate gestational age without maternal and fetal morbidity and mortality. Antepartum fetal surveillance plays a vital role in modern obstetrics in reducing perinatal mortality and to ensure good neonatal outcome (1). Fetus with uteroplacental insufficiency is prone to develop hypoxia in labour leading to hypoxic damage, neurological injury and cerebral palsy (2). Various methods of fetal monitoring have been

suggested to identify these fetuses at risk in labour. These methods include biophysical profile, modified biophysical profile, Labour Admission Test (LAT) and continuous electronic cardiotocogram (3). Intrapartum cardiotocography is presently the established method of fetal monitoring which has reduced the overall perinatal mortality. One time labour admission test (LAT) was described to identify the women whose fetuses were compromised or likely to become compromised in labour (2). The level of amniotic fluid can also affect the obstetric outcome. It provides a favourable intrauterine milieu for the fetus by providing nutrition and protection from mechanical and biological injury (4). With economic constraints and in busy wards with few cardiotocogram monitors triaging of patients becomes important. Hence the assessment of AFI as a study is used for fetal wellbeing at admission into labour room which could be a simple and useful tool to predict the fetuses who require continuous fetal heart rate monitoring and who are at risk of developing fetal distress (1).

Materials and method:

The present study was undertaken to determine the value of prelabour Amniotic Fluid Index (AFI) in predicting fetomaternal outcomes in pregnant women at term. After obtaining clearance from the Institute Ethics Committee, the study was performed in the Department of Obstetrics and Gynaecology at Pondicherry Institute of Medical Sciences from September 2016 to May 2018.

This is a Prospective cohort study which included sample size of 400 from study population of term pregnant women (37–42 weeks gestation) admitted at Pondicherry Institute of Medical Sciences before they went into active labour.

INCLUSION CRITERIA:

- a) Term pregnant women (37–42 weeks)
- b) Singleton pregnancy

EXCLUSION CRITERIA:

- a) Prelabour rupture of membranes.
- b) Preterm
- c) Patients for elective Caesarean section.
- d) Known or detected fetal abnormality.
- e) Fetal malpresentation.
- f) Antepartum hemorrhage.

METHODOLOGY:

Women with singleton pregnancy between 37–42 weeks gestation were enrolled in the study after taking a written informed consent. Baseline demographic characteristics, detailed history and clinical examination was done on all patients and the details entered in the proforma.

Amniotic fluid index (AFI) was measured by four quadrant method with ultrasound. Maternal abdomen was divided into four quadrants using umbilicus and the line nigra as reference markers. Vertical measurement of the largest cord free pool in each quadrant was measured and the values of all the four quadrants were summated. Ultrasound was performed in all patients using Sonosite MicroMax ultrasound machine with SonoRes and SonoMB technology– Manufactured by Sonosite, Inc. Bothell, WA 98021, USA.

AFI ≤ 5 was taken as oligohydramnios, AFI 5.1 – 8 was taken as borderline AFI, AFI 8.1 – 24 was considered normal AFI and AFI ≥ 24 was taken as polyhydramnios as per Williams textbook of Obstetrics(3).

The various fetomaternal outcomes were studied. Maternal outcomes studied were the type of labour onset – spontaneous or induced, nature of liquor, mode of delivery, various CTG patterns and mode of delivery. Fetal outcomes such as APGAR score, birth weight, neonatal intensive care unit admission, neonatal morbidity and neonatal hospital stay were studied.

STATISTICAL ANALYSIS

Data was entered in MS EXCEL and analysed using SPSS version 20 and Epi info 3.5.3. Descriptive statistics such as mean and standard deviation for continuous variables, frequency and percentage for categorical variables were calculated. Chi square test was done to find the association between categorical values. ROC (Receiver Operating Characteristic) curve analysis was done. p value < 0.05 was considered as significant.

RESULTS:

A total of 405 pregnant women in pre labour were recruited and their demographic characteristics noted before clinical and ultrasound examination. The maternal and fetal outcomes obtained were analysed.

Table 1: Demographic feature and type of liquor

1. Age group (years)	Total n(%)	Mean
<20	50(12.3)	25.3years
20–30	315(77.8)	
30–40	40(9.9)	
Total	405(100.0)	
2. Booking status	Frequency	Percent
Booked at other hospitals	50	12.3
Booked at PIMS	355	87.7
3. Parity	Frequency	Percent
Primigravida	204	50.4
Multi gravida	201	49.6
4. Liquor	Frequency	Percent
Oligohydramnios (AFI ≤ 5)	30	7.4
Borderline (AFI 5.1–7.9)	121	29.9
Normal (AFI 8–24)	251	62
Polyhydramnios (AFI ≥ 25)	3	0.7

The age of the women ranged from 18 to 39 years with the mean age being 25.3 years. Most of the patients (315) belonged to age group of 20-30 years being the reproductive age group. Among the 405 women recruited, 355 (88%) women were booked at P.I.M.S and 50 (12%) were booked at other hospital or clinic. Out of the total 405 pregnant women, 204(50.4%) were primigravida and multigravida were 201(49.6). Among the 405 pregnant women, AFI was found to be normal in

251(62%) patients, oligohydramnios were 30(7.4%) ,borderline AFI were 121(29.9%) and polyhydramnios were only 3(0.7%).

Table 2: Maternal Outcomes

1) Age group (years)	AFI category				Total
	Oligohydramnios (AFI≤5)	BorderlineAFI (5.1–7.9)	Normal AFI (8–24)	Polyhydramnios (≥25)	
	n(%)	n(%)	n(%)	n(%)	
<20	6(20.0)	11(9.1)	33(13.1)	0(0.0)	50(12.3)
20–30	22(73.3)	99(81.8)	192(76.5)	2(66.7)	315(77.8)
30–40	2(6.7)	11(9.1)	26(10.4)	1(33.3)	40(9.9)
Total	30(100.0)	121(100.0)	251(100.0)	3(100.0)	405(100.0)
2) Distribution of gestational age group					
Early term (37 –38weeks+6days)	27(90.0)	109(90.1)	234(93.2)	2(66.7)	372(91.9)
Fullterm(39–40weeks+6days)	3(10.0)	11(9.1)	17(6.8)	1(33.3)	32(7.9)
Lateterm(41–41weeks+6days)	0(0.0)	1(0.8)	0(0.0)	1(0.0)	1(0.2)
Total	30(100.0)	121(100.0)	251(100.0)	3(100.0)	405(100.0)
3) Type of labour					
Spontaneous	7(23.3)	66(54.5)	139 (55.4)	1(33.3)	213(52.6)
Induced	23(76.7)	55(45.5)	112 (44.6)	2(66.7)	192(47.4)
Total	30(100.0)	121(100.0)	251(100.0)	3(100.0)	405(100.)
4) Distribution of nature of liquor					
Clear	24(80.0)	110(90.9)	214(85.6)	3(100.0)	351(86.9)
Thin MSL	3(10.0)	9(7.4)	27(10.8)	0(0.0)	39(9.7)
Thick MSL	3(10.0)	2(1.7)	9(3.6)	0(0.0)	15(3.5)
Total	30(100.0)	121(100.0)	250(100.0)	3(100.0)	405(100.0)
5) Mode of delivery and AFI					
Normal	17(56.7)	86(71.1)	172(68.5)	2(66.7)	277(68.4)
LSCS	9(30.0)	20(16.5)	46(18.3)	0(0.0)	75(18.5)
Instrumental	4(13.3)	15(12.4)	33(13.1)	1(33.3)	53(13.1)
Vacuum	4(13.3)	15(12.4)	32(12.7)	1(33.3)	52(12.8)
Forceps	0(0.0)	0(0.0)	1(0.4)	0(0.0)	1(0.2)
Total	30(100.0)	121(100.0)	251(100.0)	3(100.0)	405(100.0)

In the 20-30 years age group which had the largest number of patients 192 had normal AFI and 22 patients had oligohydramnios, 2 had polyhydramnios and 99 had borderline AFI. The average gestational age was 38 weeks and 6 days. Oligohydramnios was seen in 27 of 372 patients of early term group whereas 109 had borderline AFI and most patients (234) had normal AFI. Among late term one patient each had borderline AFI and polyhydramnios. Of the total 405 patients 213 (52.6%) went into spontaneous labour and 192 (47.4%) patients were induced. The induced cases in the oligohydramnios group were 23 (76.7%). Thick MSL was seen in 3 (10%) of oligohydramnios, 2 (1.7%) of borderline group and 9 (3.6%) of normal AFI. In oligohydramnios group out of 30 (7.4%), 17 (56.7%) had normal and 4 (13.3%) had instrumental delivery. LSCS in the oligohydramnios group was 9 (30%).

There is no statistically significant association between age group, gestational age, nature of liquor, mode of delivery with AFI. Chi-square test; p value = 0.6080, 0.0038, 0.3921, and 0.3146 respectively. There is statistically significant association between type of labour with AFI (p value = 0.0038).

Table 3: CTG abnormalities

CTG abnormalities		AFI category				Total
		Oligohydramnios (AFI ≤ 5)	Borderline AFI (5.1 – 7.9)	Normal AFI (8 – 24)	Polyhydramnios (≥ 25)	
		n(%)	n(%)	n(%)	n(%)	
Reassuring	Normal	17 (56.7)	99 (81.8)	209 (83.3)	3 (100.0)	328 (81.0)
	Early deceleration	1 (3.3)	2 (1.7)	6 (2.4)	0 (0.0)	9 (2.2)
Non Reassuring	Reduced baseline variability	3 (10.0)	2 (1.7)	6 (2.4)	0 (0.0)	11 (2.52)
Abnormal	Bradycardia	0 (0.0)	0 (0.0)	1 (0.4)	0 (0.0)	1 (0.2)
	Tachycardia	0 (0.0)	1 (0.8)	2 (0.8)	0 (0.0)	3 (0.7)
	Spontaneous deceleration	1 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.2)
	Variable deceleration	1 (3.3)	3 (2.5)	3 (1.2)	0 (0.0)	7 (1.7)
	Late deceleration	7 (23.3)	14 (11.6)	24 (9.6)	0 (0.0)	45 (11.1)
Total		30 (100.0)	121 (100.0)	251 (100)	3 (100.0)	405 (100)

Chi-square test; p value = 0.0018;

There is a statistically significant association between CTG abnormalities and AFI. Most CTG abnormalities were found in oligohydramnios group (43.3%) followed by borderline AFI (18.2%). CTG was normal in all the 3 polyhydramnios patients.

TABLE 4: Fetal Outcomes

1) Age group 2 (years)	AFI category				Total
	Oligohydramnios (AFI ≤ 5)	Borderline AFI (5.1 – 7.9)	Normal AFI (8 – 24)	Polyhydramnios (≥ 25)	

		n(%)	n(%)	n(%)	n(%)	n(%)
APGAR 1 MIN	≤7	3(10)	6(5)	23(9)	0(0)	32(8)
	>7	27(90)	115(95)	228(91)	3(100)	373(92)
Total		30(100)	121(100)	251(100)	3(100)	405(100)
APGAR 5 MIN	≤7	1(3)	0(0)	5(2)	0(0)	6(1)
	>7	29(97)	121(100)	246(98)	3(100)	399(99)
Total		30(100)	121(100)	251(100)	3(100)	405(100)
2) Birth weight and AFI						
AGA		26(86.7)	109(90.1)	238(94.8)	3(100.0)	376(92.9)
SGA		4(13.3)	11(9.1)	9(3.6)	0(0.0)	24(5.9)
LGA		0(0.0)	1(0.8)	4(1.6)	0(0.0)	5(1.2)
Total		30(100.0)	121(100.0)	251(100.0)	3(100.0)	405(100.0)
3) NICU admission and AFI						
YES		8(26.7)	15(12.4)	24(9.6)	0(0.0)	47(11.6)
NO		22(73.3)	106(87.6)	227(90.4)	3(100.0)	358(88.4)
Total		30(100.0)	121(100.0)	251(100.0)	3(100.0)	405(100.0)
4) Neonatal hospital stay						
<3 days		9(30.0)	44(36.4)	96(38.2)	1(33.3)	150(37.0)
3–7 days		21(70.0)	76(62.8)	152(60.6)	2(66.7)	251(62.0)
>7 days		0(0.0)	1(0.8)	3(1.2)	0(0.0)	4(1.0)
Total		30(100.0)	121(100.0)	251(100.0)	3(100.0)	405(100.0)
5) Distribution of complications in neonates						
HIE		0(0)	0(0)	2(0.8)	0(0)	2(0.5)
Hyperbilirubinemia		0(0)	2(1.5)	1(0.4)	1(33)	4(1)
APGAR ≤ 7 in 5min		1(3)	0(0)	5(2)	0(0)	6(1)
TTN		1(3)	0(0)	5(2)	0(0)	6(1.48)
Tachypnea		2(6)	2(1.5)	8(3)	0(0)	12(2.96)
No complications		26(88)	117(97)	230(91.6)	2(67)	375(92.59)
Total		30(100)	121(100)	251(100)	3(100)	405(100)

Among the neonates born to 30 oligohydramnios pregnant women, APGAR≤ 7 at 1min and 5min were 3(10%) and 1(3%) respectively, whereas in borderline AFI APGAR≤ 7 at 1min and 5min were 6(5%) and 0. Appropriate for gestational age was 238(94.8%) in normal AFI group, 109(90.1%) in borderline AFI and 26(86.7%) in oligohydramnios. Total SGA neonates were 24(5.9%) in the study and in oligohydramnios group small for gestation age was seen in 4(0.96%). Among the neonates born to 405 pregnant women, 47(11.6%) neonates got admitted to NICU. Among them 8(26.7%) belonged to oligohydramnios, 15(12.4%) to borderline AFI, and 24(9.6%) belonged to polyhydramnios group. There is statistically significant association between birthweight and AFI. Chi-square test; p value=0.0386. There is no statistically significant association between AFI and APGAR 1min, 5min, NICU admission, neonatal hospital stay with p value of 0.488, 0.389, 0.0789, 0.0789 respectively.

Maximum hospital stay was 14 days due to birth asphyxia in the normal AFI group.

Most common complication was tachypnea 2.96% followed by TTN in 1.48%. Tachypnea and TTN were mostly in normal AFI patients. There was no perinatal mortality or meconium aspiration syndrome.

Table 5: Sensitivity and specificity of significant outcomes

Outcomes	Sensitivity(%)	Specificity(%)	Positive Predictive Value(%)	Negative PredictiveValue(%)
Mode of delivery	56.9	46.2	33.3	69.4
NICU Admission	34.1	73.4	13.5	90.1
Birthweight	66.1	63	96.1	11.7

Area under the curve for other outcomes like type of labour, CTG abnormalities, APGAR score was below 0.5. Hence sensitivity and specificity was not calculated.

DISCUSSION:

The mean age in the present study was 25.3 years. The mean age in the study by Megha et.al (4) was 27.5 years which correlates with our study whereas the mean age in the study by Morris et.al was 31.9 years(5). The gestational age group included in our study were between 37–42 weeks, which were categorized into early term(37–38weeks +6 days) , full term (39–40 weeks +6 days), late term (41–41 weeks+6 days) . Majority of patients in all the categories of AFI were under the early term group 372(91.9%), 27(90%), 109(90.1%), 234(93.2%), 2(66.7%) in oligohydramnios, borderline AFI, normal AFI and polyhydramnios respectively. There was no statistically significant association between AFI and gestational age group which was similar to some studies (5) (6).

In the present study, most of the labours were spontaneous in onset 213(52.6%) whereas induced were 192(47.4%). Most of the oligohydramnios group had labour induction 23(76.7%). There is statistically significant association between the type of labour and AFI in present study which was consistent with other studies (8) (9).

Meconium stained liquor was seen in 54(13.2%) of 405 patients. In the oligohydramnios group of 30(10%), 3(10%) had thin MSL and 3(10%) had thick MSL. There was no statistically significant association between nature of liquor and AFI. The results were in accordance with Tasneem et al and Chaudary et al. (5) (10)

In the present study various CTG abnormalities were seen in 43.3% of oligohydramnios group. Non reassuring CTG in 3(10%) and abnormal CTG like spontaneous decelerations variable deceleration and late deceleration in oligohydramnios were 1 (3.3%), 1(3.3%) and 7(23.3%) respectively. There is a statistically significant association between CTG abnormality and AFI which is similar to Chaudryetal whereas contrary to Megha et al (10) (4)

There were total of 277(68.4%) normal deliveries, LSCS were 75(18.5%), instrumental deliveries were 53(13%) in our study. 30%of oligohydramnios group had LSCS and 13.3% had instrumental delivery. There was no statistically significant difference between the mode of delivery and AFI which is consistent with Patel et al whereas contradictory to Thobbi et al. (11) (12).

APGAR Score at 1 min ≤ 7 was found in 3(10%) in oligohydramnios and at 5 min ≤ 7 is found in 1(30%) of oligohydramnios. In normal AFI group APGAR at 1 min and 5 min was 23(9%) and 5(2%) respectively. There was no statistically significant between APGAR score and AFI but in study by Megha et al and Sharma et al it is statistically significant differs from our study (4) (13)

Birthweight was classified in the current study as AGA, SGA and LGA. AGA was mostly in normal AFI group 238(94.8%). Out of the total SGA 24(5.9%), oligohydramnios group had 4 SGA. LGA was 4(1.6%) in normal AFI group. There is statistically significant association between birthweight and AFI whereas in Sharma et al it was found that birth weight $> 2.5\text{kg}$ was found in 27% of oligohydramnios, 2.5–1.5kg was seen in (40%) and $< 1.5\text{ kg}$ in 33% (13)

In the oligohydramnios group NICU admission was found in 8(26.7%), whereas in borderline and normal it was 15(12.4%), 24(9.6%) respectively. No NICU admission was seen in the polyhydramnios group. NICU admission did not show any statistical significance. But it was statistically significant in Asgharnia et al and Megha et al (8) (4)

Most of the newborns 251(62%) stayed for 3 – 7 days. Maximum hospital stay was for 14 days in a baby with birth asphyxia. Most of the neonates 380(93.8%) did not have any complications. Tachypnea was the commonest complication seen in 12(2.96%) of the neonates followed by TTN in 1.48%.

LIMITATIONS:

Majority of patients fell into the category of normal AFI and only 30 women (7.4%) had oligohydramnios. This could have resulted in the lack of significant association between AFI & the adverse outcomes. Larger number of patients in all the categories of AFI would have helped in better comparison of outcome among the different categories of AFI & may have been reflective of the true usefulness of prelabour AFI in predicting fetomaternal outcomes. A comparison of cases & controls i.e. a case control study would have been a better design for this study.

CONCLUSION:

Pre labour amniotic fluid index in singleton term pregnancies could not predict all the fetomaternal outcomes. Out of the fetomaternal outcomes, the type of labour onset, CTG abnormalities, duration of first stage of labour and neonatal birth weight showed statistically significant association with amniotic fluid index. Further case control studies are needed to study AFI as a labour admission test and its use as a predictor of fetomaternal outcomes, probably taking a larger sample size. Until its role as labour admission test is established, CTG will remain the primary screening tool of fetal well being assessment in labour and in prediction of other fetomaternal outcomes.

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