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Original Research Article

Study of low amniotic fluid index and its effect on perinatal outcome

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ABSTRACT

Introduction: AFI may be an important predictor for deciding timing of delivery and adverse maternal and fetal outcome. Hence, we aimed at determining whether an antepartum low amniotic fluid index (AFI) is a predictor of adverse perinatal outcome in normal pregnancy and to determine a threshold level of AFI that could predict an adverse outcome.

Materials and Methods: This study was conducted as an observational study on a total of 100 antenatal females presenting with term pregnancy at Department of Obstetrics and Gynecology, Lord Mahavir Civil Hospital, Ludhiana during study period. Detailed history and clinical examination was done. AFI was assessed with help of USG.

Results: The study was conducted on a total of 100 antenatal females. AFI was <5 in 38%. Low AFI was associated with LSCS and negative fern test was statistically significant ($p<0.05$). We observed a significant association of low AFI with low birth weight, poor APGAR score at 1 as well as 5 minutes and higher risk of NICU admission ($p<0.05$). The area under the curve and sensitivity as well as specificity at cutoff (4.5) was maximum for NICU admission followed by LSCS ($p<0.05$).

Conclusion: AFI is an important determinant of adverse maternal and fetal outcome. AFI <5 is associated with adverse maternal outcome in the form of higher operative delivery and adverse fetal outcome i.e. low birth weight, meconium stained liquor, low APGAR score and higher NICU admission. Intensive intrapartum care along with fetal surveillance may help in minimizing adverse perinatal outcomes.

1. Introduction

Amniotic fluid assessment is an important component of antepartum evaluation especially during third trimester of pregnancy.[1,2] The average amount of amniotic fluid at third trimester is 700 to 800 ml. Reduced amount of amniotic fluid is termed oligohydramnios, which is defined as "abnormally low level of amniotic fluid volume for the gestational age". Oligohydramnios has been reported to complicate approximately 3-5% of the pregnancies.[3] For the assessment of oligohydramnios and determining the sufficiency of amniotic fluid quantity, "amniotic fluid index" is used.[4,5] Amniotic fluid index can be determined with the help of ultrasonography; which can assess amniotic fluid levels both qualitatively (e.g. reduced amniotic fluid volume) or quantitatively (e.g. amniotic fluid index ≤5 cm, single deepest pocket <2 cm).[6]

Multiple methods are used for assessment of AFI. These include four quadrant, single deep pocket and two diameter pocket. Phelan et al in 1987 first described four quadrant method for assessment of AFI with the aid of transabdominal USG.[7] Based upon this assessment, AFI in the range of 8 to 20 cm is considered normal whereas AFI in the range of 5 to 8 cm and less than 5 cm is considered borderline and low AFI respectively.[3]

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A decreased AFI has been considered as an important clue for underlying fetus abnormality or maternal disease state. Oligohydramnios may be secondary to congenital fetal anomalies, maternal hypertension, diabetes, PROM and IUGR. Low AFI (<5) has been associated with adverse maternal and neonatal outcome and increased rates of operative interference.[8] Increased risk of perinatal morbidity as well as mortality could be attributed to loss of cushioning effect of amniotic fluid, leading to cord compression and utero-placental insufficiency. AFI may be an important predictor for deciding timing of delivery and adverse maternal and fetal outcome[9] but the association is not yet confirmed.[10] Therefore, we aimed at determining whether an antepartum low amniotic fluid index (AFI) is a predictor of adverse perinatal outcome in normal pregnancy and to determine a threshold level of AFI that could predict an adverse outcome.

2. Materials and Methods

This study was conducted as an observational study on a total of 100 antenatal females presenting with term pregnancy at Department of Obstetrics and Gynecology, Lord Mahavir Civil Hospital, Ludhiana during the study period of two years i.e. from March 2019 to March 2021. Antenatal Females with term pregnancy (37 to 40 weeks of gestation) with singleton gestation, cephalic presentation, AFI in the range of 0-20 cm and intact membranes were included whereas patients with ruptured membranes, fetal malpresentations and polyhydramnios were excluded from the study.

After obtaining ethical clearance from Institute's ethical committee, all the participants fulfilling inclusion criteria were enrolled and written consent was obtained. Detailed history was obtained using the proforma. Any associated complications in present pregnancy were noted. Females were subjected to detailed clinical examination. All the females were subjected to an ultrasound examination to monitor fetal wellbeing. Amniotic fluid index was also assessed using Phelan's technique.[7] Apart from this, some suspected patients were further evaluated for fetal wellbeing by NST and fetal Doppler studies.

Based upon AFI, all the patients were divided into three groups - AFI<5 cm, AFI≥5-8 cm and AFI>8 cm. The groups were compared in terms of maternal outcome and Neonatal outcome.

2.1. Statistical analysis

Data was compiled using MsExcel and analysed using IBM SPSS software version 20 (IBM Corp. Illinois Chicago). Categorical data was expressed as frequency and proportions and chi square test was used to assess the difference between proportions of two group. ROC curve was plotted to determine the cut off value of AFI for predicting adverse outcome. P value less than 0.05 was considered statistically significant.

3. Results

The study was conducted on a total of 100 antenatal females with mean age of 24.6±3.9 years and 64% females were primiparous.

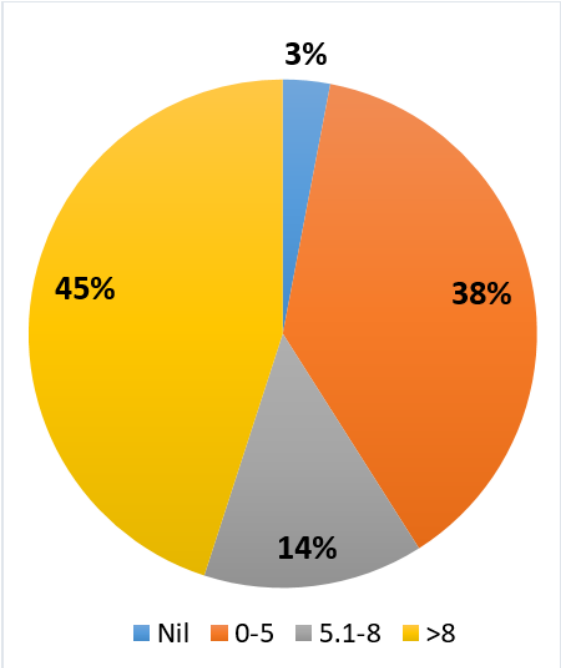

Fig. 1: Distribution of patient on the basis of AFI

About 38% and 14% females had low AFI (1-5) and borderline AFI (5.1-8) respectively whereas 3% patients had anhydramnios.

We observed no difference in age, parity and gestational age between females of three groups (p>0.05). Obstetric doppler was done only in four cases with low AFI and it was abnormal in 2 cases. Decreased AFI was the most common indication of admission in cases with AFI less than 5 and 5-8 whereas spontaneous labour was the indication in 84.4% cases with AFI 8 to 20(p<0.05).

The reason for termination of pregnancy in majority of cases with low and borderline AFI was decreased AFI (95.1% and 78.6% respectively). Majority of females with low AFI (73.2%) delivered via LSCS whereas 50% females with borderline AFI delivered required induction. The observed association of AFI with reason and mode of termination and negative fern test was statistically significant (p<0.05).

We observed a significant association of low AFI with low birth weight, poor APGAR score at 1 as well as 5 minutes and higher risk of NICU admission (p<0.05).

Table 1: Association between AFI and baseline variables

Baseline variables		AFI ≤5(n=41)		5-8(n=14)		8-20(n=45)		P value
		N	%	n	%	n	%	
Age(years)	≤20	3	7.3	1	7.1	9	20	0.27
	21-25	25	61	6	42.9	20	44.4	
	26-30	12	29.3	5	35.7	11	24.4	
	31-35	0	0	2	14.3	4	8.9	
	>35	1	2.4	0	0	1	2.2	
	Mean	24±3.39		25.7±3.8		24.4±4.5		
Parity	Primipara	27	65.9	7	50	30	66.7	0.49
	Multipara	14	34.1	7	50	15	33.3	
Gestational age(weeks)	37-38	22	53.7	4	28.6	23	51.1	0.25
	39-40	19	46.3	10	71.4	22	48.9	
Reason for admission	Decreased AFI	37	90.2	13	92.9	1	2.2	0.001
	Safe confinement	3	7.3	1	7.1	6	13.3	
	Spontaneous onset of labour	1	2.4	0	0	38	84.4	

Table 2: Association between AFI and maternal outcome

Maternal outcome		AFI ≤5(n=41)		5-8(n=14)		8-20(n=45)		P value
		n	%	n	%	n	%	
Reason for termination	Liquor nil	1	2.4	0	0.0	0	0.0	0.001
	Decreased AFI	39	95.1	11	78.6	3	6.7	
	Spontaneous labour	1	2.4	3	21.4	42	93.3	
Mode of delivery	**FTVD** Spontaneous Induced	**11** 3 8	**2.8** 7.3 19.3	**8** 1 7	**57.1** 7.1 50	**40** 35 5	**88.9** 77.8 11.1	0.001
Indications of LSCS	LSCS	30	73.2	6	42.9	5	11.1	0.25
	Deceleration in CTG	20	66.7	4	66.7	1	20	
	Thick MSL	3	10.0	0	0.0	0	0.0	
	NPOL	2	6.7	1	16.7	3	60	
	Previous LSCS	5	16.7	1	16.7	1	20	
Fern test	Negative	22	53.7	9	64.3	45	100	0.001
	Positive	19	46.3	5	35.7	0	0.0	

Using ROC curve analysis, cut off value of 4.50 was observed to be a better predictor of adverse perinatal outcome. The area under the curve and sensitivity as well as specificity at this cutoff was maximum for NICU admission followed by LSCS ($p<0.05$).

4. Discussions

Amniotic fluid act as protective fluid which provides cushion like effect on fetus as well as provide the space for physical growth and musculoskeletal growth of the growing fetus, promote development of fetal lung, and also helps in aversion of umbilical cord compression.[11,12] Low AFI has been associated with adverse fetal and maternal outcome. This study was conducted on 100 antenatal females with mean age of 24.6±3.9 years. The prevalence of Oligohydramnios has been estimated in approximately 1 to 5% pregnancies at term but its prevalence may be as high as 37% in presence of fetal anomaly or other pregnancy associated complications.[13,14] In present study, anhydramnios was observed in 3% cases and oligohydramnios was observed in 38% cases. However, 14% cases had borderline AFI. Naik et al documented much lower prevalence of oligohydramnios i.e. 3.39%.[15] Locatelli et al. documented 11% prevalence of oligohydramnios.[16]

As all the cases presented with term pregnancy, they were advised to terminate the pregnancy based upon their condition. The reason for termination in significantly higher

Table 3: Association between AFI and fetal outcome

Fetal outcome		AFI ≤5(n=41)		5-8(n=14)		8-20(n=45)		P value
		n	%	n	%	n	%	
Color of liquor	Clear	32	78.0	12	85.7	40	88.9	0.39
	Meconium stained	09	22.0	2	14.3	5	11.1	
Birth weight(kg)	≤2	13	31.7	1	7.1	4	8.9	0.03
	2-2.5	14	34.1	4	28.6	20	44.4	
	>2.5	14	34.1	9	64.3	21	46.7	
APGAR @1 minute	Good	30	73.2	12	85.7	42	93.3	0.038
	Poor	11	26.8	2	14.3	3	6.7	
APGAR @5 minute	Good	31	75.6	12	85.7	43	95.6	0.035
	Poor	10	24.4	2	14.3	1	2.2	
NICU admission	No	11	26.8	12	85.7	40	88.9	0.001
	Yes	30	73.2	2	14.3	5	11.1	
Reason for NICU admission	Poor APGAR	7	23.3	0	0	2	40	0.87
	Grunting	3	10	0	0	1	20	
	Tachypnea	6	20	1	50	0	0	
	LBW	1	3.3	0	0	0	0	
	RD	13	43.3	1	50	2	40	
Neonatal outcome	Uneventful	40	97.6	14	100	45	100	0.48
	Death	1	2.4	0	0.0	0	0.0	
Long term neonatal problem	Nil	38	92.7	14	100	45	100	0.11
	Surfactant requirement	3	7.3	0	0.0	0	0.0	
Medical complications	No	40	97.6	14	100	45	100	0.48
	Yes	1	2.4	0	0.0	0	0.0	

Table 4: Area under the curve for poor maternal and neonatal outcome

Outcome	Area	P value	95% CI		Sensitivity (%)	Specificity (%)
			Lower	Upper		
LSCS	0.833	0.001	0.750	0.916	83.1	68.3
APGAR 1min	0.702	0.011	0.567	0.838	66.7	62.5
APGAR 5min	0.706	0.014	0.568	0.843	66.3	64.3
NICU admission	0.852	0.001	0.770	0.934	84.1	75.7

proportions of females in low and borderline AFI group was decreased AFI. LSCS was conducted in significantly higher proportions of females with low AFI as compared to normal AFI. Induction was required in majority of females with borderline AFI. Most common indication of LSCS in low as well as borderline AFI group was deceleration in CTG (66.7% each) (p>0.05). Similar to present study, Gandotra et al. observed increased risk of LSCS in pregnancy with oligohydramnios.[17] Sharma et al. documented rate of caesarean section in 23.33% patients with oligohydramnios. Most common indication for LSCS was fetal distress (60.72%).[18] Similarly, Radhamani et al. documented higher rate of LSCS in oligohydramnios cases (elective and emergency LSCS in 13.8% and 30.8% cases respectively).[19] Das et al. documented significantly higher rate of LSCS (60%) in study group as compared to control group (20%), supporting the findings of present study. Most common indication of LSCS was fetal distress (31%).[20]

Fern test is used to confirm premature rupture of membrane.[21] The sensitivity and specificity of fern test for diagnosis of premature rupture of membranes was 77.8% and 79.3% respectively.[21] In present study, fern test was positive in significantly higher proportions of females with low AFI. Premature rupture of membrane is an important cause of oligohydramnios and adverse perinatal outcome.[22]

Colour of liquor helps in determining the underlying fetal distress. As oligohydramnios is associated with increased uteroplacental insufficiency, leading to increased incidence of meconium stained amniotic fluid.[23] We reported Meconium stained liquor in higher proportions of females with low and borderline AFI as compared to normal AFI (p>0.05). Our study findings were concordant with the findings of Radhamani et al, in which 18.5% neonates born to mother with low amniotic

fluid had meconium stained liquor.[19] Similarly, Das et al. documented significantly higher cases of Meconium stained liquor in oligohydramnios as compared to control.[20] Bhat et al. concluded AFI to be an important predictor of fetal tolerance during labour and decrease in amniotic fluid volume is associated with increased fetal stress and meconium stained liquor.[24]

AFI has been shown to have significant association on birth weight of the neonate.[13] In line with the above finding, majority of neonate with low AFI had low and very low birth weight as compared to neonates of borderline and normal AFI group ($p<0.05$). Gandotra et al. also documented statistically significant association of LBW with oligohydramnios.[17] Naik et al also documented Oligohydramnios to be associated with higher incidence of low birth weight babies.[15]

Literature suggest that oligohydramnios is associated with adverse perinatal outcome. Oligohydramnios was significantly associated with low APGAR score at 1 and 5minutes and higher rate of NICU admission ($p<0.05$). Though the proportions of neonates requiring NICU admission was significantly higher in low AFI group, indication of NICU admission were statistically similar among neonates of three groups ($p>0.05$).

Similar findings were documented by Gandotra et al, where oligohydramnios was significantly associated with low Apgar score at 5 minutes and NICU admission.[17] Sharma et al also documented that majority of neonates born to mother with oligohydramnios required resuscitation and were admitted in NICU for more than 5 days.[18] Our study findings were similar to Naik et al in which oligohydramnios was associated with low Apgar score at 1 and 5 min, higher admission to NICU & Perinatal mortality.[15]

We also aimed to determine the threshold level of AFI that could predict an adverse outcome. ROC curve analysis was done to determine the cutoff value of AFI to predict adverse outcome. Based upon the area under the curve, the cut off value of AFI was determined as 4.5 which was predictor of adverse maternal and fetal outcome. The area under the curve and sensitivity as well as specificity at this cutoff was maximum for NICU admission followed by LSCS ($p<0.05$). Previous literature have reported AFI of less than 5 as predictor of adverse fetal outcome.[25,26]

5. Conclusion

Amniotic fluid index is an important determinant of adverse maternal and fetal outcome. AFI <5 is associated with adverse maternal outcome in the form of higher operative delivery and adverse fetal outcome i.e. low birth weight, meconium stained liquor, low APGAR score and higher NICU admission. ROC analysis revealed that AFI cut off of 4.5 could be the better predictor of adverse fetomaternal outcome. Intensive intrapartum care along with fetal surveillance may help in minimizing adverse perinatal outcomes.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Magann EF, Chauhan SP, Bofill JA, Martin JN. Comparability of the amniotic fluid index and single deepest pocket measurements in clinical practice. *Aust N Z J Obstet Gynaecol*. 2003;43(1):75–7.
2. Kofinas A, Kofinas G. Differences in amniotic fluid pattern and fetal biometric parameters in third trimester pregnancies with and without diabetes. *J Matern Fetal Neonatal Med*. 2006;19(10):633–8.
3. James DK, Steer PJ, Weiner CP, Gonik B. High risk pregnancy: management options. 4th ed.; 2007. p. 197–207.
4. Madendag Y, Madendag IC, Sahin E, Aydin E, Sahin ME, Acmaz G. How Well Do the Popular Ultrasonic Techniques Estimate Amniotic Fluid Volume and Diagnose Oligohydramnios, in Fact? *Ultrasound Q*. 2019;35(1):35–8.
5. Cheung CY, Roberts VH, Frias AE, Brace RA. Effects of maternal western-style diet on amniotic fluid volume and amnion VEGF profiles in a nonhuman primate model. *Physiol Rep*. 2018;6(20):e13894.
6. Beloosesky R, Ross MG, Levine D. Oligohydramnios: Etiology, diagnosis, and management. Last accessed on 27th June 2020. Available from: https://www.uptodate.com/contents/oligohydramnios-etiology-diagnosis-and-management-in-singleton-gestations.
7. Phelan JP, Smith CV, Broussard P, Small M. Amniotic fluid volume assessment using the fourquadrant technique in the pregnancy at 36-42 weeks gestation. *J Reprod Med*. 1987;32(7):540–2.
8. Yadav S, Shah P, Patel RV, Chavda A, Shah MK. Oligohydramnios:- a common problem with increasing incidence in term pregnancy and its fetomaternal outcome. *World J Pharma Med Res*. 2019;5(8):181–3.
9. Casey BM, Mcintire DD, Bloom SL, Lucas MJ, Santos R, Twickler DM, et al. Pregnancy outcomes after antepartum diagnosis of oligohydramnios at or beyond 34 weeks' gestation. *Am J Obstet Gynecol*. 2000;182(4):909–12.
10. Chauhan SP, Hendrix NW, Morrison JC, Magann EF, Devoe LD. Intrapartum oligohydramnios does not predict adverse peripartum outcome among high-risk parturients. *Am J Obstet Gynecol*. 1997;176(6):1130–6.
11. Madaan S, Mendiratta SL, Jain PK, Mittal M. Aminotic Fluid Index and its Correlation with Fetal Growth and Perinatal Outcome. *J Fetal Med*. 2015;2(2):61–7.
12. Umber A. Perinatal Outcome in Pregnancies Complicated by Isolated Oligohydramnios at Term. *Annals*. 2009;15(1):35–7.
13. Sherer DM, Langer O. Oligohydramnios: use and misuse in clinical management. *Ultrasound Obstet Gynecol*. 2001;18(5):411–9.
14. Coady AM. Amniotic Fluid. In: Twining's Textbook of Fetal Abnormalities. Churchill Livingstone; 2015. p. 81–99.
15. Naik AS, Chadha MT. A Study of Effect of Oligohydramnios on the Obstetric and Perinatal Outcome. *Sch J App Med Sci*. 2018;6(11):4562–7.
16. Locatelli A, Vergani P, Toso L, Verderio M, Pezzullo JC, Ghidini A. Perinatal outcome associated with oligohydramnios in uncomplicated term pregnancies. *Arch Gynecol Obstet*. 2004;269(2):130–3.
17. Gandotra N, Mahajan N, Manhas A. Perinatal outcome associated with oligohydramnios at term. *Int J Reprod Contrac Obstet Gynecol*. 2020;9(9):3576–9.
18. Sharma ST. Clinical study of maternal and fetal outcome in pregnancies with oligohydramnios. *Int J Gynaecol*. 2019;7(11):60–4.

19. Radhamani S, Babitha. A clinical study of feto-maternal outcome in pregnancies with oligohydramnios. *Int J Reprod*. 2017;6(3):869.
20. Das S, Haldar R, Sinhababu PP, Sharma M, Mahapatra B. Pregnancy Outcome in Oligohydramnios At Term: A Study of 100 Cases. *IOSR J Dent Med Sci*. 2017;16(6):53–5.
21. Rogers LC, Scott L, Block JE. Accurate Point-of-Care Detection of Ruptured Fetal Membranes: Improved Diagnostic Performance Characteristics with a Monoclonal/Polyclonal Immunoassay. *Clin Med Insights Reprod Health*. 2016;9:15–8.
22. Palacio M, Kühnert M, Berger R, Larios CL, Marcellin L. Meta-analysis of studies on biochemical marker tests for diagnosis of premature rupture of membranes: comparison of performance indexes. *BMC Pregnancy Childbirth*. 2014;14(1):1–2.
23. Moore TR. Superiority of the four-quadrant sum over the single-deepest-pocket technique in ultrasonographic identification of abnormal amniotic fluid volumes. *Am J Obstet Gynecol*. 1990;163(3):762–7.
24. Bhat S, Kulkarni V. Study of effect of oligohydramnios on maternal and fetal outcome. *Int J Med and Dent Sci*. 2015;4(1):582–8.
25. Nageotte MP, Towers CV, Asrat T, Freeman RK. Perinatal outcome with the modified biophysical profile. *Am J Obstet Gynecol*. 1994;170(5):1672–6.
26. Rosati P, Guariglia L, Cavaliere AF, Ciliberti P, Buongiorno S, Ciardulli A, et al. A comparison between amniotic fluid index and the single deepest vertical pocket technique in predicting adverse outcome in prolonged pregnancy. *J Prenat Med*. 2015;9(1-2):12–5.

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