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Impact of Low Amniotic Fluid Index at Term Pregnancy on Perinatal Outcome

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Abstract
Introduction: The amniotic fluid volume is an indicator of fetal wellbeing. Low Amniotic fluid index (AFI) is associated with several adverse perinatal outcomes. Its assessment is an essential component of antenatal fetal surveillance.
Aim: The study is carried out to evaluate perinatal outcome in low AFI patients as oligohydramnios can reflect fetal jeopardy. It can also guide an obstetrician whether further evaluation needed or not as well as timing of delivery.
Methodology: A prospective cohort study was done on 200 pregnant patients admitted in Obstetrics & Gynaecology, Dhaka Medical College & Hospital meeting the inclusion & exclusion criteria included in this study. Among them 100 patients belong to group- A had low AFI (≤5) and group B comprises 100 patients with normal AFI (>5). Assessment of perinatal outcome done by APGAR score at 1 and 5 minutes, birth weight, admission into NICU, still birth & early neonatal death and mode of delivery.
Result: In this study, significance difference observed between two group in APGAR score at 1 min, low birth weight and mode of delivery. 36% from Group-A and 21% of Group-B neonates were found having low APGAR score (<7) at 1 minute which was improved after 5 min. Analyzing the birth weight data, 35% newborn from Group-A and 14% from Group-B were found low birth weight. Caesarean section higher (84%) in Group-A and vaginal delivery higher (64%) in Group-B. No significant difference observed between both group in APGAR score at 5 min, NICU admission & perinatal death.
Conclusion: It has been observed that low APGAR score at 1 min, low birth weight and mode of delivery have statistically significant relationship with low amniotic fluid index (AFI≤5).

Keywords: Low Amniotic Fluid, Term Pregnancy, Perinatal Outcome

Introduction

Amniotic fluid (AF) is the albuminous fluid contained in the amniotic sac, called liquor amnii and is a part of the baby's life support system which provides temperature stability & cushioning. It is an essential complex and dynamic environment that changes in nature and amount as pregnancy progresses. This fluid is produced soon after the amniotic sac is formed at about 12 days after conception. It is first made up of transudate of maternal plasma through the chorio-amnion or from fetal plasma through highly permeable fetal skin prior to keratinization. After that fetal urine becomes the primary substance around the 20th week's [1]. In the second trimester of pregnancy amniotic fluid volume is maintained by a balance of fetal fluid production in lung and urine, as well as fluid resorption by fetal swallowing. Amniotic fluid permits fetal swallowing essential for GIT development. It guards against umbilical cord compression and protects the growing fetus from mechanical and biochemical injury. It provides lubrication & surrounds the fetus during intrauterine growth. The presence of normal amniotic fluid throughout gestation allows for normal development of the fetal respiratory and musculoskeletal systems. Amniotic fluid may be regarded as the largest part of the fetal extracellular space and it provides a more accessible means than fetal blood for investigation of the fetus. So optimum level of amniotic fluid is essential for fetal well-being. This is also an integral part of the antenatal evaluation of pregnancies at risk for any adverse pregnancy outcome especially in the third trimester [2]. Quantity of the liquor volume changes throughout pregnancy, increasing linearly until the early third trimester and then remaining constant until term.

Along gestational age normal amniotic fluid volume (AFV) varies being 30 ml at 10 weeks and gradually peaking to 1 liter at 36-37 weeks gestation. The volume then starts decreasing with a mean AFV of 800 ml at 40 weeks. If the pregnancy is overdue by two weeks or more, the patient may be at risk for low amniotic fluid level since fluid decreases almost by half around 42 weeks of gestation. Oligohydramnios is associated with several adverse perinatal outcomes, including fetal intolerance of labor, caesarean delivery for fetal intolerance, neonatal intensive care unit (NICU) admission, intrauterine growth restriction (IUGR), 5-minutes APGAR score less than 7, and fetal or neonatal death [3, 4]. Low AFI is considered to be one of the indications for delivery as it may be associated with fetal asphyxia, fetal growth restriction, non- reassuring fetal heart rate (FHR) tracing and/or stillbirth [5]. As etiology, management and the outcome are different in late onset oligohydramnios compared to early onset oligohydramnios. Cause of oligohydramnios in term is mostly idiopathic, so term pregnancies are chosen. Most studies on oligohydramnios have been conducted on high-risk pregnancies [6]. Such pregnancies are at an increased risk of adverse perinatal outcome such as fetal distress in labor, induction of labor, cesarean delivery for fetal distress, meconium passage, low Apgar score and neonatal resuscitation or neonatal intensive care unit admission. Some researchers have not confirmed the association of adverse perinatal outcome with oligohydramnios [7]. So, the existence of an entity like low-risk term oligohydramnios has been questioned. Thus, this study is inspired to evaluate the association of isolated oligohydramnios at term with adverse perinatal outcomes. As it is quite common among the population & estimated prevalence can be up to 3~8% of pregnancies [8]. It is very important to predict the perinatal outcomes with oligohydramnios especially considering the socio- economic conditions in our country to reduce perinatal morbidity and mortality.

Methodology

Study Design: Prospective, cohort study.

Place of Study: Department of Obstetrics & Gynecology, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh.

Period of Study: This study has been carried out over a period of 02 (two) years from January 2019 to December 2020.

Study Population: A hospital based prospective cohort study has been carried out in the Dept. of Obstetrics & Gynaecology, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh. Women with term pregnancy admitted in this hospital with or without labour pain, both have been included in this study. These patients have been evaluated by details history, meticulous clinical examination and sonography & other investigations. Written and verbal consent have been taken from these patients who has participated in this study.

Sample Size

Group	Estimated Sample size	Actual Sample Size
Group-A Low (AFI≤5)	88	100
Group-B Normal (AFI>5)	88	100

Inclusion criteria

a) Singleton pregnancy.
b) Term pregnancy.
c) AFI ≤ 5 cm and AFI >5-24 cm.

Exclusion criteria

a) Multiple pregnancies.
b) Fetal congenital anomaly.
c) Pregnancy with medical disorders eg. Diabetes Mallitus, HTN, Thyroid disorder, Heart disease, SLE, Jaundice etc.
d) Pregnancy with obstetrical complications eg. CPD, APH, Obstructed labour etc.
e) PROM.

Data Collection

A structured data collection form was developed containing all the variables of interest. Data was collected by interview, observation, and clinical examination etc. Having approval from the Ethical Review Committee (ERC) the purpose and procedure of the study were discussed with the selected subjects. Written consent was taken from those who agreed to participate in the study.

Study Procedure

This is a prospective cohort study conducted at Dhaka Medical College Hospital (DMCH). Ethical clearance for this study was obtained from the Ethical Review Committee (ERC) of the DMCH. After fulfilment of inclusion and exclusion criteria total 200 patients were selected who admitted in DMCH with or without labour pain. Informed written consent has been taken from patients after full explanation regarding the risk and benefits of the study. Maternal and fetal condition has been evaluated by proper history, examination and investigation reports. Related investigations including ultrasonogram were repeated, if lacking adequate information. Depending upon the sonographic report patients were categorized into two groups. Among them 100 women with low AFI (≤5) classified as group-A and 100 women with normal AFI (>5) have been classified as Group-B. During labour process monitoring of maternal and fetal condition was done by partograph and close fetal monitoring. After delivery detail records of pregnancy outcome have been collected from direct observation, delivery note and neonatal chart and recorded in a data sheet. Patients were followed up to the hospital stay.

Statistical Analysis

All the collected data has been stored in a tabular and matrix format. The entire set of variables could be quantified or labeled as numerical value for robust statistical analysis. All statistical analysis will be performed using the statistical package for social science (SPSS-20). Continuous parameter has been expressed as mean ± SD and categorical parameters as frequency and percentage. For statistical analysis chi-square test has been used where applicable. A "P" value of <0.05 has been considered significant. Major findings and relational data have been presented in suitable table. A description of each table has mentioned to understand them clearly.

Results

Table 1: Age distribution of study population (N=200)

Age	Frequency	Group-A Low (AFI≤5)		Group-B Normal (AFI>5)		P Value
		N (100)	%	N (100)	%	
18-25	117	55	55%	62	62%	
26-30	49	24	24%	25	25%	0.195
>30	34	21	21%	13	13%	

Age of the sample for this study is distributed from 18 to 42 having average at 25.24±5.51years. Highest number of patients

falls into the age group 18-25. Among normal AFI group 62% patients were in the age group 18-25 and in low AFI group 55% patients were in the age group 18- 25. Mean age of normal AFI group is 24.9 with standard deviation 4.84. and mean age of low AFI group is 25.57 and standard deviation is 6.13. After performing t-test it is found (t score=0.195) that there is no significant difference between the mean age of patients with the AFI value. Table 1 shows that correlation between AFI value and age group was found statistically not significant.

Table 2: Gravidity and parity vs group cross-tabulation (N=200)

		Group A AFI (≤5)	Group B AFI (>5)	Total	P Value
	Primigravida	45	41	86 (43%)	
Gravida	Multigravida	55	59	114 (57%)	0.33
	Total	100	100	200 (100%)	
Parity	Primipara	52	46	98 (49%)	
	Multipara	48	54	102 (51%)	0.45
	Total	100	100	200	

In this study 43% of the total patients are primigravida. Among low AFI (≤5) group 41% and Normal AFI (>5) group 45% are primigravida. 57% sample are multigravida. P value is greater than 0.05 which renders a conclusion that relationship between gravida and AFI is statistically not significant. Out of 200 patients 49% are primipara and 51% of the patients are multipara. Comparison of parity among two groups are shown in Table 2.

Table 3: APGAR score at 1 & 5 minutes vs group cross-tabulation (N=200)

		Group		Total	P value
		Group-A AFI≤5)	Group-B (AFI>5)		
	<7	36	21	57	.019
APGAR Score 1 min	≥7	64	79	143	
APGAR	<7	9	8	17	
Score 5 min	≥7	91	92	183	0.80

P value has been obtained by Chi-square Test.

In this study APGAR score has been categorized as normal (≥7) and low (<7). Among 200 new born baby 36% from Group-A and 21% of Group-B found low APGAR score at 1 minute. At 5 minutes 9% from Group-A and 8% from Group B have found low APGAR score. For association between APGAR score at 1 minute and AFI value was statistically significant but at 5 minutes this is not significant.

Table 4: Birth weight vs group cross-tabulation (N=200)

Birth Weight	Group		Total	P Value
	Group-A AFI≤5)	Group-B (AFI>5)		
Low Birth Weight	35	14	49	.001
Normal Birth Weight	65	86	151	
Total	100	100	200	

P value has been obtained by Chi-square Test.

Table 4 shows that 35% among Group A and 14% from Group B newborn were found having low birth weight. On the other hand, 65% of Group-A and 86%of Group-B newborn had normal birth weight. Result indicates that birth weight difference among two based on AFI is statistically significant.

Table 5: Admission in NICU vs group cross-tabulation (N=200)

Admission in NICU	Group		Total	P Value
	Group A (AFI≤5)	Group B (AFI>5)		
No	87	94	181	
Yes	13	6	19	.091
Total	100	100	200	

P value has been obtained by Chi-square Test.

Out of 100 new born in Group A 13% were admitted in NICU whereas 6% of newborn from Group B were admitted in NICU. Association between AFI and NICU admission was found statistically insignificant (p>0.05).

Table 6: Still birth and early neonatal death vs group cross-tabulation (N=200)

	Group		Total	P Value
	Group A (AFI≤5)	Group B (AFI>5)		
Alive Baby	96	98	194	
Still Birth	1	0	1	
Early neonatal death	3	2	5	0.543
	100	100	200	

P value has been obtained by Chi-square Test.

In this study, 3% of Group-A (AFI≤5) and 2% from Group-B (AFI>5) baby were detected as early neonatal death. 01 (one) out of 100 patients from Group-A (AFI≤5) was stillbirth resulting 04% total death from Group-A. Statistical association from chi- square test between AFI and Neonatal Death is statistically insignificant for this study.

Table 7: Mode of delivery vs group cross-tabulation (N=200)

Mode of Delivery	Group		Total	P Value
	Group A (AFI≤5)	Group B (AFI>5)		
NVD	15	64	79	
Assisted	1	0	1	
LSCS	84	36	120	0.02
Total	100	100	200	

P value has been obtained by Chi-square Test.

15% of Group-A and 64% of Group-B patients had normal vaginal delivery (NVD), whereas 84% from Group-A and 36% from Group-B have gone through LSCS procedure. Only 1% from group-A had assisted vaginal delivery. Difference in mode of delivery among two group is statistically significant (P=0.02).

Discussion

A prospective cohort study has been performed to see the relationship of low amniotic fluid with fetal outcomes. Association of fetal outcomes with normal amniotic fluid index and low amniotic fluid index has been observed. APGAR score at 1 minute and 5 minutes, birth weight, NICU admission, still birth and early neonatal death have been used to evaluate the fetal outcomes. Subjects were recruited after fulfilling the inclusion and exclusion criteria. A total 200 patients, out of which 100 patients had greater than 5 amniotic fluid index and 100 had less than or equal to 5 amniotic fluid index is the sample for this study. This study has been carried out in obstetrics and gynecology department of Dhaka medical college from January 2019 to December 2020. The mean age group of women in this study is 25.24 with Standard deviation of 5.51 years. Most of the women (58.5%) in this study fell into the age group of 18 to 25 years. This is comparable to the study conducted by Shrestha *et*

al. [9] where age were 21 to 25 years and mean was 24.36±3.98 years. Another study conducted by Jagatia *et al*. [10] where 67% patients fell in the range of 20 to 25 years. Ülker & Özdemir [11] included women with mean age 24.91±4.66. Women with 23 to 26 years with mean 25.48±4.12 years had been inlcuded by [12]. The present study has been conducted on gestational age of 37 to 40 completed weeks with mean gestational age 38.28 ± 1.009. Similar criteria had been maintained by Shah *et al*. [12], where age was distributed from 37 to 42 with mean gestational age of study population was 39.24. Another study conducted by Sharif & Qasim [13] where total 90 women having 37-40 weeks of gestation & mean gestational age was 39.31 ± 1.20. Majority (57%) of the patients in this study are multigravida whereas 43% of patients are primigravida. Similarly, Madaan *et al* [2] considered patients with 52% multi and 48% primigravida. Another study conducted by Bakhsh *et al*. [14] where 75.1% were mutigravida and 24.9% were primigravida. In this study, it is found that low AFI group had 35% low birth weight neonates and normal AFI group had 14% low birth weight neonates. Correlation between two groups is statistically significant (P value 0.001). Similar finding was observed in Chauhan *et al*, [15] where 8.33% low birth weight in low AFI group and 1.8% in normal AFI group were found and their p value was statistically significant. Another study conducted by Casey *et al* [16] where the proportion of low-birth-weight infants (<2500g) was significantly increased with oligohydramnios. They observed 35% low birth weight for low AFI group vs 9% low birth weight for normal AFI group (p value < 0.01). A prospective study from January 2009 to December 2009 in Dhaka city among 78 oligohydramnios patient where 65.38% low birth weight & 34.61% normal birth weight [17]. In this study, after birth 1 minute APGAR score was <7 for 21% case of normal AFI group and 36% cases in low AFI group. Some of them improved at 5 minutes after immediate resuscitation. APGAR at 1 minutes for both groups has been found statistically significant (P value=0.019). Ülker & Özdemir [11] analyzed distressed fetus cases and observed 60% neonates had 1 minute Apgar Scores below 7 in the low AFI group. Bachhav & Waikar [18] found statistically significant difference (p=0.003) for APGAR score at 1 min between two group (normal AFI group 50% vs low AFI group 24%). This result coincides with the present study. In this study, APGAR score < 7 at 5 minutes was 9% in low AFI group and 8% in normal AFI group. So, association of APGAR score at 5 minutes with low AFI is not statistically significant (P value > 0.05). Reported that there is no significant statistical difference between low amniotic fluid index and APGAR score at birth [7]. They found APGAR score < 7 at 5 minutes in 9 (6%) cases of low AFI group and 2 (0.56%) cases in normal AFI group. In the study of Rainford *et al*. [19] found no difference between the two groups of 5 minutes APGAR score which support the present study. However, another study done by Chauhan, *et al* [15] had shown that the neonates born to women with low AFI group having APGAR score less than 7 at 5 minutes (33.33%) and with normal AFI group (8.33%). The result was statistically significant (P-value <0.05). Zhanga *et al*. [20] conducted a study where APGAR score <7 at 1 minute in low AFI group was 19% and in normal AFI group was 11.5%. APGAR score < 7 at 5 minutes was 3.1%. in normal AFI group and 7.75% in low AFI group. Both results at 1 minute and 5 minutes were statistically not significant for their study. In the present study, it is found that 6% of new born from normal AFI group was admitted in the NICU whereas 13% of new born from low AFI group was admitted in NICU. Relationship regarding NICU admission and amniotic fluid volume is statistically not significant (P=0.091) for this study. However, Shrestha *et al* [9] found that NICU admission for low AFI group was 38.88% and 16.66% for normal AFI group with significant statistical difference (P= 0.003). Similarly, Chauhan *et al*. [15] observed significant difference regarding need for admission to neonatal intensive care unit 8.33% for low AFI group and 1.67% for normal AFI group. In this study, 3% of Group-A (AFI≤5) and 2% from Group-B (AFI>5) baby were detected as early neonatal death. 01 (one) out of 100 patients from Group-A (AFI≤5) was stillbirth resulting 04% total death from low AFI group, which is not statistically significant. Shrestha *et al*. [9] reported that 8.33% perinatal death in low AFI and 1.38% death in normal AFI patient where P value was non-significant (P value 0.053). Found that short term perinatal morbidities (p= 0.59) were shown no statistical difference between both group that align with the findings of this study [21]. However, Casey *et al*. [16] reported that both still birth (1.4% vs 0.3%) and neonatal deaths (5% vs 0.3%) difference among normal and low AFI group were statistically significant. In this study, caesarean section rate was higher (84%) in low AFI group whereas vaginal delivery was higher (64%) in normal AFI group. Majority of caesarean section was attributed to fetal distress, fetal growth restriction, cord prolapse, prolong labor etc. Vidya A. Thobbi [22] concluded that majority of the deliveries of their study with 200 oligohydramnios were found to be caesarean to the extent of 74.0% and remaining 26.0% of them were normal deliveries. They noticed that fetal distress (62%) was the major indication for caesarean section. Study done by Hou *et al*. [23] observed that the caesarean delivery (CD) rate was significantly higher (84.4 versus 54.7%; p<0.001) in pregnancies with oligohydramnios compared to those without oligohydramnios. Both study support result obtained in his study. Found that among low AFI group caesarean section rate was 48% and among normal AFI group 22%. They also concluded that most (44%) of the caesarean delivery was attributed to fetal distress [24].

Conclusion

In the present study, it is observed that oligohydramnios is associated with greater number of distressed babies with low APGAR score (<7) at 1-minute, low birth weight and caesarean delivery. Hence, it is concluded that there is a statistically significant relationship of oligohydramnios with poor APGAR score at 1-minute, low birth weight neonates and mode of delivery.

Study Limitations

Sampling was performed in single center (Government hospital). Due to time constraints small sample size was taken in this study. In study sampling patients have performed their ultrasound at different diagnostic center located remotely in different parts of the country. Perinatal outcomes have been observed till their hospital stay.

Recommendations

1. Multicenter sampling should be considered.
2. A comparatively larger sample size could be considered.
3. For better quality control of the data and uniformity it would be better to take ultrasound data from single source.
4. Convenient supplemental diagnostic modalities in association with AFI should be considered to enhance the accuracy of the results.
5. Long term follows up is required for better quality control.

Conflict of Interest
Not available

Financial Support
Not available

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