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Association of Low Amniotic Fluid Index and Adverse Fetal Outcome at Term

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ABSTRACT

Background: Amniotic fluid plays a major role in the fetal growth and development by providing a suitable, protective low resistance environment for growth and development. The abnormalities of the fluid volume can thus interfere directly with the fetal development. **Objective:** To determine the association of low amniotic fluid index and adverse fetal outcome at term. **Study Design:** Prospective cohort study. **Settings:** Department of Obstetrics and Gynecology, DHQ hospital, Faisalabad Pakistan. **Duration:** Six months from 6th October 2016 to 5th April 2017. **Methods:** A total of 108 pregnant subjects, 54 each in group A (with amniotic fluid index ≤5 cm) and in group B (with amniotic fluid index >5), aged 18 to 40 years were included. Patients with h/o chronic hypertension, diabetes mellitus, multiple pregnancy, polyhydramnios and premature rupture of membranes were excluded. All cases were followed till delivery and outcome variables were noted. **Results:** The mean age of women in group A was 29.94 ± 5.52 years and in group B was 29.98 ± 6.09 years. The adverse fetal outcomes like IUGR was recorded in 19 (35.19%) in group A while 5 (9.26%) in group B, low birth weight was recorded in 15 (27.78%) versus 8 (14.81%) of the newborns whereas APGAR score <7 at 5 minutes in 15 (27.78%) versus 6 (11.11%) of the neonates respectively. NICU admission was required in 14 (25.93%) of babies in group A compared to 7 (12.96%) in group B. Meconium-stained liquor was seen in 19 (35.19%) versus 6 (11.11%) of patients in group A and B respectively. P value was <0.05 and relative risk <1 which was statistically significant. **Conclusion:** This study concluded that low amniotic fluid index (≤5 cm) is associated with adverse fetal outcome at term.

Keywords: *Low amniotic fluid index, Apgar score, Birth weight.*

INTRODUCTION

Amniotic fluid (AF) provides mechanical protection to the developing fetus and has important nutritional and immunologic roles. The amniotic fluid that surrounds the developing fetus plays a crucial role in the normal development.[1] Given that AF is in direct contact with the placenta and fetal membranes, surrounding the fetus, while passing through several fetal cavities (e.g., gastrointestinal and respiratory tracts), it is expected that its molecular composition is both reflective of and contributes to fetal wellbeing.[2] Apart from fetal wellbeing, amniotic fluid plays a major role in fetal growth and development as well.[3] It provides the fetus with a protective low resistance environment suitable for growth and development.[4] It prevents umbilical cord compression and thus protects the fetus from vascular and nutritional compromise. The abnormalities of the fluid volume can thus interfere directly with the fetal development.[5] The amount of amniotic fluid varies with gestation, averaging 50ml at 12 weeks of pregnancy to 400 ml at 20 weeks of pregnancy. The average amount of AFI in 3rd trimester is 700-800ml.[6]

The gold standard for measuring amniotic fluid volume is the invasive dye dilution technique. Validated non-invasive methods include the four-quadrant amniotic fluid index (AFI), single deepest pocket (SDP) and two-diameter pocket. Oligohydramnios can be defined as amniotic fluid volume < 5% for gestational age, AFI < 5 cm (as originally described by Phelan *et al*,[7] or maximal deepest pocket < 2 cm. Regardless of the method used,

the finding of oligohydramnios is not normal.[8] The semi quantitative method of calculating an Amniotic Fluid Index (AFI) by using ultrasound to measure the sum of the deepest pockets of amniotic fluid in the four quadrants is the most common method of quantifying amniotic fluid volume.[9] In pregnancy, idiopathic oligohydramnios is an obstetrical complication that results in poor perinatal outcome.[10]

As oligohydramnios is a dangerous obstetrical condition and associated with adverse fetal outcome, so we planned to conduct this study to determine the association of low AFI and adverse fetal outcome at term in local population. The results of this study will provide us data regarding fetal complications associated with low amniotic fluid index. The latter will help us refine protocols for antenatal monitoring and management in this high-risk group in order to reduce morbidity and mortality of the fetus.

METHODS

This Prospective cohort study was conducted at Department of Obstetrics and Gynecology, DHQ Hospital, Faisalabad Pakistan. The duration of the study was Six months from 6th October 2016 to 5th April 2017. A total of 108 patients, 54 each in group A and B were recruited by using non probability consecutive sampling technique.

All pregnant females 18 to 40 years of age with amniotic fluid index ≤5 cm and >5cm, parity from one to four and gestational age between 37 and 41+6 weeks (assessed by dating scan) were included in the study.

Patients with h/o chronic hypertension, diabetes mellitus, antenatal heart disease (assessed on ultrasonography), Polyhydramnios (assessed on ultrasonography), premature rupture of membranes, multiple pregnancy (assessed on ultrasonography) and women with h/o antepartum hemorrhage were excluded.

After permission from the ethical review committee, a total number of 108 pregnant ladies presenting to the department of obstetrics and gynecology of DHQ hospital, Faisalabad, fulfilling the inclusion/exclusion criteria were selected. After taking informed written consent, height, weight and BMI were noted. The patients were recruited and assigned to group A & B using non probability consecutive sampling technique. Group A (exposed group) included all pregnant females with amniotic fluid index ≤5 cm while Group B (unexposed group) included all those with amniotic fluid index >5 cm. Our objective was to determine the association of low amniotic fluid index and adverse fetal outcome at term. All cases were followed till delivery and adverse fetal outcome (as per-operational definition) was noted by the researcher. Adverse fetal outcome was measured in terms of low birth weight (weight of babies <2500 grams at birth). The color of liquor was noted during labour by doing vaginal examination or by seeing the pad used by patient and if green was taken as meconium stained. Fetus below 10th percentile for growth was taken as being IUGR. All this data was recorded as Yes/No, on a specially designed proforma (Annexure-I).

Statistical analysis was performed using SPSS version 16. Results were presented as mean ± standard deviation for quantitative variables i.e., maternal age, parity, BMI and gestational age. Frequency and percentage were calculated for qualitative variables like socioeconomic status (poor/middle/upper), IUGR, low birth weight babies, APGAR score <7 at 5 minutes, meconium-stained liquor and NICU admission (yes/no) in each group. The outcome variables were compared for difference by Chi Square test and p-value ≤0.05 was considered as significant. Effect modifiers like age, gestational age, parity, BMI and socioeconomic status were controlled through stratification and post-stratification chi square was applied to see their effect on outcome. P value ≤ 0.05 was considered as significant. Relative risk was calculated with 95% confidence level.

RESULTS

The age range of the subjects included in the study varied from 18 to 40 years with mean age of 29.96 ± 5.78 years. The mean age of women in group A was 29.94 ± 5.52 years and in group B was 29.98 ± 6.09 years. Majority of the patients 52.78% were between 18 to 30 years of age as shown in Table 1.

Table 1: Age distribution for both groups

Age (years)	Group A (n=54)	Group B (n=54)	Total (n=108)
	Patients (%)	Patients (%)	Patients (%)
18-30	30 (55.56 %)	27 (50.0 %)	57 (52.78 %)
31-40	24 (44.44 %)	27 (50.0 %)	51 (47.22 %)
Mean ± SD	29.94 ± 5.52	29.98 ± 6.09	29.96 ± 5.78

The mean gestational age in group A was 39.48 ± 1.30 weeks and in group B was 39.39 ± 1.30 weeks as shown in Table 2. The mean parity was 2.65 ± 1.01. The mean parity in group A and B was 2.56 ± 1 and 2.74 ± 1.0 respectively. Mean BMI was 26.38 ± 4.99 kg/m2. The mean BMI was 26.40 ± 4.98 and 26.37 ± 5.01 in group A and B respectively. Percentage of patients according to socioeconomic status.

The adverse fetal outcomes i.e. IUGR was recorded in 19 (35.19%) in group A patients while in 5 (9.26%) of patients in group B, low birth weight was recorded in 15 (27.78%) versus 8 (14.81%) of the patients respectively and APGAR score <7 at 5 minutes in 15 (27.78%) versus 6 (11.11%) respectively, meconium stained liquor in 19 (35.19%)

versus 6 (11.11%) and NICU admission in 14 (25.93%) versus 7 (12.96%) respectively with p-value of <0.05 and relative risk <1 which was statistically significant. Table 3

Table 2: Distribution of patients according to Gestational age in both groups

Gestational Age (weeks)	Group A (n=54)	Group B (n=54)	Total (n=108)
	Patients (%)	Patients (%)	Patients (%)
37-39 weeks	25 (46.30%)	26 (48.15%)	51 (47.22 %)
40-41+6 weeks	29 (53.70%)	28 (51.85%)	57 (52.78%)
Mean ± SD	39.48 ± 1.30	39.39 ± 1.30	39.43 ± 1.30

Table 3: Adverse fetal outcome in both Groups (n=108)

Perinatal Outcome		Group A (n=54)		Group B (n=54)		P value	RR
		No.	%	No.	%		
IUGR	Yes	19	35.19%	05	9.26%	0.001	0.853
	No	35	64.81%	49	90.74%		
Low Birth Weight	Yes	15	27.78%	08	14.81%	0.100	0.845
	No	39	72.22%	46	85.19%		
Apgar score <7 at 5 minutes	Yes	15	27.78%	06	11.11%	0.029	0.813
	No	39	72.22%	48	88.89%		
Meconium-Stained Liquor	Yes	19	35.19%	06	11.11%	0.003	0.729
	No	35	64.81%	48	88.89%		
NICU admission	Yes	14	25.93%	07	12.96%	0.089	0.851
	No	40	74.07%	47	87.04%		

DISCUSSION

Oligohydramnios is one of the major causes of maternal and perinatal morbidity and mortality.[11] The pregnancies with oligohydramnios has increased incidence of meconium stained liquor, abnormal FHR tracing, low Apgar score, low birth weight, admission to NICU, birth asphyxia and cesarean section for fetal distress.[12] In a study enrolling 12940 patients from low and middle income countries (LMIC), prevalence of oligohydramnios was 0.7% being lowest (0.2%) in Zambia and the Democratic Republic of Congo (DRC) and highest (1.5%) in Pakistan.[13]

A meta-analysis of isolated oligohydramnios came up with the same conclusion as our study that it was associated with higher rates of an Apgar score <7 at 1 and 5 min (OR 1.53, CI 1.03-2.26, and OR 2.01, CI 1.3-3.09, respectively) and admission to the neonatal intensive care unit (OR 1.47, CI 1.17-1.84).[8] It is well established that oligohydramnios is associated with an increased incidence of adverse perinatal outcome, possibly as a result of umbilical cord compression with associated utero-placental insufficiency, and/or meconium-stained liquor.[14]

Saxena R *et al* in a prospective study of oligohydramnios found that the latter was associated with IUGR in 15 (42.86%) and 7 (10.76%) in exposed and unexposed groups respectively, thus IUGR being four times higher in the former group a finding similar to our study. NICU admission was required for 28.57% of cases almost similar to our study.[15] In another study by Patil SV *et al* conducted in Hyderabad, India concluded that an AFI of <5 cm was associated with IUGR, low birth weight, APGAR score <7 at 5 minutes. However, the frequency of low birth weight was much higher (62%) compared to our study (27.7%). This could be due to inclusion of patients from 34 weeks of gestation, with policy of routinely inducing pregnancies with persistent oligohydramnios and non-reactive CTG. Whereas our study was conducted on term gravidae. Moreover, population under study might be more prone to low birth weight due to its genetic makeup and dietary habits as we can see that more babies with low birth weight were born in the control group (24%) as well compared to (14%) in our study.[16] Chauhan R *et al* in their study found that 26.4% babies exposed to AFI <5 had low APGAR score i.e., < 7 in 1-5 minutes similar to our study (27.78%) and 24% were admitted to NICU comparable to 25.93% in our study.[17]

Another study showed significantly higher rate (65.5%) of low birth weight resulting from low AFI. The APGAR score less than 7 at 5 minute was significantly higher in severe oligohydramnios group and majority of the neonate experienced complications like RDS (13%), meconium aspiration (21%) with admission in neonatal ward (54%). Low AFI was also responsible for a significantly higher rate of caesarean section.[18]

In a meta-analysis,[19] forty-three studies (244 493 fetuses) were included demonstrating a strong association between oligohydramnios (varying definitions) and birthweight <10th centile (summary odds ratio [OR] 6.31, 95% confidence interval [95% CI] 4.15–9.58; In a case control prospective comparative study performed on 200 randomly selected low risk pregnant patients at term, the results showed that there was significantly low APGAR score of less than 7 at 5 minute in cases (32%) comparable to our study. In this study almost double the number of babies in cases had IUGR whereas 28%of babies needed admission in NICU comparable to 25.93% in our study.[20]

In a study conducted in Ethiopia, there were higher rates of neonatal morbidities in terms of low birthweight (19.8%) and admission to NICU (15.4%).[21] In a systematic review and meta-analysis conducted in USA, the patients with isolated oligohydramnios were more likely to be admitted to the NICU (RR, 1.71; 95% CI, 1.20–2.42) in accord with our study. In this study there was no difference in the rate of meconium-stained amniotic fluid between the two groups though.[8]

In a prospective comparative study of 100 women with singleton term pregnancy with cephalic presentation, an AFI <5 cm was associated with significantly higher rate of induction of labor (p<0.001), caesarean section (p=0.04)

and fetal distress (p<0.05). However, meconium-stained liquor (p=0.76), Apgar score less than seven at 5 minutes (p=0.307), low birth weight (p=0.130) or NICU admission (p=1) were comparable in the two groups.[22] This is in contrast to our study where fetal and neonatal complications were increased. The difference may be due to policy of inducing oligohydramnios and early recourse to operative delivery in the former study.

In another study conducted in Jaipur, India, meconium-stained liquor (MSL) was seen in 50.91% of cases and 18.18% of controls, a statistically significant difference (p<0.05). It shows three times higher cases of MSL in exposed group which is similar to our study. The absolute value of 50.91% is, however, much higher than 35% of MSL in our study. Nevertheless, there was no statistically significant difference between the mean birth weight and birth weight distribution in cases and controls.[23] The contrasting results within the same county and the countries sharing the same geography prompt for larger, well controlled trials.

CONCLUSION

The incidence of oligohydramnios is on increase due to increasing maternal age and routinely performed obstetric ultrasonography. While the vast majority of cases of oligohydramnios are associated with minimal or no morbidity, a clinically important increase in perinatal mortality, meconium staining, low APGAR score and requirement for NICU care exists.

LIMITATIONS

Sample size was small. The multiple site study with larger sample size will be more helpful to confirm the relation.

SUGGESTIONS / RECOMMENDATIONS

Antepartum diagnosis of oligohydramnios warrants close fetal surveillance in order to reduce perinatal morbidity and mortality.

CONFLICT OF INTEREST / DISCLOSURE

Conflict of interest declared none.

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