

Evaluation of Perinatal Outcomes in Pregnant Women With Low Amniotic Fluid Index

Forozan Milani; M.D.¹, Leila Khosousi; M.D.¹, Seyedeh Hajar Sharami; M.D.¹,
Maryam Shakiba; Ph.D.², Javid Rasoulia; M.D.³, Seyedeh Maryam Attari; M.Sc.¹,
Yalda Donyaiei-Mobarrez; M.Sc.⁴

1 Reproductive Health Research Center, Department of Obstetrics & Gynecology, Al-zahra Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran

2 Cardiovascular Diseases Research Center, Department of Epidemiology and Biostatistics, Guilan University of Medical Sciences, Rasht, Iran

3 Department of Neurosurgery, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran

4 Department of Midwifery, School of Nursing and Midwifery, Guilan University of Medical Sciences, Rasht, Iran

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Abstract

Objective: The outcomes and management of low amniotic fluid index (AFI) in pregnancy are controversial. The purpose of this study was to determine the relationship between low AFI and perinatal outcomes.

Materials and methods: This prospective study was conducted on 420 uncomplicated singleton pregnant women with a gestational age of over 28 weeks who referred to Al-Zahra Hospital in Rasht (Iran) for routine perinatal care. Pregnant women were divided into 3 groups of 140 patients based on the AFI and were followed up until delivery. Three groups included normal ($8 < \text{AFI} \leq 25$ cm), borderline ($5 < \text{AFI} \leq 8$ cm) and oligohydramnios ($\text{AFI} \leq 5$ cm) AFI.

Results: The three adverse outcomes of respiratory distress, hospitalization in NICU, and length of hospitalization were statistically significantly different between the two groups with normal and borderline AFI and in the borderline group was more than the normal group. Adverse outcomes including; low birth weight (LBW), small for gestational age (SGA), respiratory distress, 1- min APGAR scores < 7 , hospitalization in NICU and its duration were statistically significantly different between the two groups with normal AFI and oligohydramnios, and it was more in the oligohydramnios group than the normal group. The three adverse outcomes of LBW, SGA and 1- min APGAR scores < 7 in the two borderline and oligohydramnios groups had statistically significant differences and were more in the oligohydramnios group than the borderline group.

Conclusion: Consideration to the AFI in perinatal care to predict adverse perinatal outcomes and perform necessary interventions to improve these outcomes is necessary.

Keywords: Amniotic Fluid; Oligohydramnios; Pregnancy

Introduction

The normal volume of amniotic fluid plays an

important role in the proper growth and development of the fetus (1, 2) and it is an accurate measure to evaluate the proper placental function (3, 4). Early diagnosis and interventions is one of the most important goals of perinatal care (5). Ultrasound

Correspondence:

Yalda Donyaiei-Mobarrez

Email: donyaeimobarrez1396@gmail.com



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assessment of amniotic fluid volume plays an important role in perinatal care and is an integral part of it (6).

The common method used to measure amniotic fluid volume is the use of the amniotic fluid index (AFI) in ultrasound, based on which the largest vertical amniotic fluid pocket in each of the four quadrants of the uterus is selected and then added together (7, 8). AFI is one of the parameters used to evaluate fetal well-being, predict adverse perinatal outcomes and perform necessary interventions to improve these outcomes (3, 9). The normal range of AFI is 8-24 cm. AFI in the range of 5.1-8 cm is borderline oligohydramnios, and AFI of 5 cm or less are defined as oligohydramnios (3, 7).

Oligohydramnios may indicate uteroplacental insufficiency, which can be associated with increased adverse perinatal outcomes and fetal and neonatal mortality and morbidity (10, 11). The incidence rate of oligohydramnios varies from 0.5 to 5% depending on the studied population and its definition (12). The average incidence of borderline oligohydramnios in term pregnancy is about 12% (13).

According to studies, oligohydramnios can be associated with adverse pregnancy outcomes such as fetal distress, meconium aspiration, preterm labor, cesarean section, low birth weight, low APGAR score, NICU admission, fetal and neonatal death (3, 7, 14, 15). However, the results of studies are conflicting for both oligohydramnios and borderline oligohydramnios due to differences in inclusion criteria, gestational age, and definition of oligohydramnios (3, 7, 16, 17). Therefore, the purpose of this study was to determine the relationship between low amniotic fluid level and perinatal outcomes.

Materials and methods

This prospective study was conducted to evaluate perinatal outcomes in pregnancies with low AFI in 420 singleton pregnant women of 28 to 42 weeks referred to Al-Zahra Hospital in Rasht (Iran).

This research was based on a research project approved by the Research and Technology and Ethics Committee of Guilan University of Medical Sciences with the code: IR.GUMS.REC.1397.100, which was conducted after obtaining the necessary permits and obtaining written consent from the participants.

In this study, 420 uncomplicated singleton pregnant women, with a gestational age of over 28

weeks, who had referred to this center for routine perinatal care, were selected and divided into 3 groups of 140 patients based on the AFI reported in ultrasound.

Normal AFI group (control group): $8 < \text{AFI} \leq 25$ cm

Borderline oligohydramnios group: $5 < \text{AFI} \leq 8$ cm

Oligohydramnios group: $\text{AFI} \leq 5$ cm

Pregnancy with assisted reproductive technologies, multiple pregnancies, presence of fetal or placental abnormalities in ultrasound, rupture membrane, Rh iso-immunization, gestational diabetes, chronic hypertension or preeclampsia and severe systemic maternal disease, evidence of intrauterine infection with TORCH were excluded.

Routine pregnancy care and standard ultrasound to evaluate pregnancy status and AFI were performed for all pregnant women, and follow-up of patients continued until delivery. Then the perinatal outcomes in each of the three groups were examined and compared. Perinatal outcome variables were as follows: gestational age at birth, C-section rates, birth weight, low birth weight (< 2500 g), small for gestational age (SGA) (defined as birth weight below the 10th percentile for gestational age), meconium-stained amniotic fluid, 1- and 5-min APGAR scores < 7 , neonatal respiratory distress, admission to neonatal intensive care unit (NICU) after delivery, hospitalization period in NICU, fetus death and neonatal death within the first 7 days.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 24 (IBM, Armonk, NY, USA). Means \pm standard deviations were utilized as appropriate to describe the findings. The differences in categorical variables were tested with Pearson Chi-square and Fisher's exact tests and differences between continuous variables were tested using Mann-Whitney U-test. One way ANOVA test was used to analyze the differences among groups' means. $P < 0.05$ was considered significant.

Results

In this study, a total of 420 singleton pregnancies were evaluated in 3 groups of 140 patients with normal AFI, borderline oligohydramnios and oligohydramnios. The mean maternal age was 29.56 ± 5.6 for the normal group, 28.36 ± 6.2 for the borderline group and 29.52 ± 5.5 for the oligohydramnios group. There was no significant difference in maternal age between groups.

Gestational age at delivery and birth weight in the group with normal AFI were higher than the borderline and oligohydramnios groups. The previous cesarean section was the most common cause of cesarean delivery in the normal group whereas fetal distress was the most cause in borderline and oligohydramnios cases.

Adverse perinatal outcomes including; the rate of cesarean delivery (p=0.07), the incidence of meconium-stained amniotic fluid (p=0.09), the frequency of a 5-min APGAR score of less than 7 (p=0.172), Fetal death (p= 0.369) and Neonatal death (p=0.369) were not significantly differ between groups. However, mean gestational age at delivery (p= 0.001), neonatal weight at birth (p<0.001), LBW (p<0.001), SGA (p<0.001), 1- min APGAR scores<7(p<0.001), neonatal respiratory distress (p<0.001), admission to neonatal intensive care unit (NICU) after delivery (p<0.001), hospitalization period in NICU (p=0.001) were significantly differ between groups (Table 1).

The comparison of perinatal outcomes among the three groups is reported in Table 2. The three adverse outcomes of respiratory distress, hospitalization in NICU, and length of hospitalization were statistically significantly different between the two groups with normal and borderline AFI (p<0.001) and in the borderline group was more than the normal group. Adverse outcomes including; LBW, SGA, respiratory distress, 1- min APGAR scores<7, hospitalization in NICU and its duration were statistically significantly different between the two groups with normal AFI and oligohydramnios, and it was more in the oligohydramnios group than the normal group. The

three adverse outcomes of LBW, SGA and 1- min APGAR scores<7 in the two borderline and oligohydramnios groups had statistically significant differences (p<0.001) and were more in the oligohydramnios group than the borderline group.

Discussion

The present study was conducted to determine the relationship between low AFI and perinatal outcomes. According to the results of this research, gestational age at delivery and birth weight in the group with normal AFI were higher than the borderline and oligohydramnios groups. The previous cesarean section was the most common cause of cesarean delivery in the normal group whereas fetal distress was the most cause in borderline and oligohydramnios cases.

Oligohydramnios may indicate uteroplacental insufficiency, which can be associated with increased adverse perinatal outcomes and fetal and neonatal mortality and morbidity (10, 11). According to the results of our study, the three adverse outcomes of respiratory distress, hospitalization in NICU, and length of hospitalization were statistically significantly different between the two groups with normal and borderline AFI (p<0.001) and in the borderline group was more than the normal group. Similar to the results of the present study, according to a study that was conducted with the aim of comparing perinatal outcomes in two groups with borderline and normal AFI, fetal distress in the group with borderline AFI was higher than in the group with normal AFI (3).

Table 1: Neonatal characteristics at the time of birth in three groups

	Normal 8<AFI<25	Borderline 5<AFI<8	Oligohydramnios AFI<5	P value
Cesarean delivery	110(78.5%)	98(70%)	96(68.5)	0.07
Gestational age(weeks)	38.4±1.4	37.7±2	37.7±2.2	0.001
Birth weight, Mean (SD)	3220±537	2888±527	2741±657	<0.001
LBW (<2500g)	10(7.1%)	20(14.3%)	42(30%)	<0.001
SGA	3(2.1%)	6(4.3%)	12(8.6%)	<0.001
APGAR 1 min<7	4(2.9%)	6(4.3%)	20(14.3%)	<0.001
APGAR 5 min<7	3(2.1%)	1(0.7%)	3(2.1%)	0.172
Meconium staining	24(17.1%)	21(15%)	34(24.3%)	0.09
Respiratory distress	16(11.4%)	50(35.7%)	44(31.4%)	<0.001
Fetal death	-	-	1(0.7%)	0.369
Neonatal death	-	-	1(0.7%)	0.369
NICU admission	18(12.9%)	50(35.7%)	42(30%)	<0.001
The average length of stay in NICU (Mean)	0.46	2.12	1.94	0.001

SD; standard deviation, LBW; low birth weight, LGA; large for gestational age, SGA; small for gestational age, value is significant at p< 0.05.

Table 2: Comparison of perinatal outcomes among the three groups

Perinatal Outcome	Normal vs. borderline	Normal vs. oligohydramnios	Borderline vs. oligohydramnios
Gestational age	<0.001	<0.001	0.862
Birth weight	<0.001	<0.001	0.033
LBW (<2500g)	0.103	<0.001	<0.001
SGA	0.335	0.002	<0.001
APGAR 1 min<7	0.637	<0.001	0.001
Respiratory distress	<0.001	<0.001	0.403
NICU admission	<0.001	<0.001	0.443
the average length of stay in NICU	<0.001	0.003	0.71

LBW; low birth weight, SGA; small for gestational age, value is significant at $p < 0.05$.

In contrast to the findings of the present study, based on another study that was conducted with the aim of comparing perinatal outcomes in two groups with borderline and normal AFI, adverse pregnancy outcomes, including fetal distress and hospitalization in the NICU, were not statistically significantly different between the two groups (7). However, increased NICU admission rates can be associated with fetal distress and low APGAR score (18).

According to the results of our study, adverse outcomes including; LBW, SGA, respiratory distress, 1- min APGAR scores<7, hospitalization in NICU and its duration were statistically significantly different between the two groups with normal AFI and oligohydramnios, and it was more in the oligohydramnios group than the normal group. The three adverse outcomes of LBW, SGA and 1- min APGAR scores<7 in the two borderline and oligohydramnios groups had statistically significant differences ($p < 0.001$) and were more in the oligohydramnios group than the borderline group. Similar to the results of the present study, based on a retrospective cohort study, there was an association between oligohydramnios and LBW (19), which could be caused by preterm labor or chronic uteroplacental insufficiency (18). According to a study that was conducted with the aim of evaluating the impact of oligohydramnios on perinatal outcomes, LBW, respiratory distress, and 1- min APGAR scores<7 in the group with oligohydramnios were more than in the normal group (20). Also, based on another study that was conducted with the aim of comparing perinatal outcomes in two groups with normal AFI and oligohydramnios, the 1- min APGAR scores<7 had statistically significant differences between the two groups, and fetal distress was the most common reason for cesarean in the oligohydramnios group (21). Similar to the results of

the present study, Lajber et al. (2020) conducted a study with the aim of comparing perinatal outcomes in two groups with normal AFI and oligohydramnios, based on which the rate of LBW, respiratory distress and hospitalization in the NICU was higher in the oligohydramnios group compared to the normal group (22). In contrast to the findings of the present study, according to a study by Dwivedi et al. (2019) which was conducted with the aim of comparing perinatal outcomes in two groups with normal AFI and oligohydramnios, hospitalization in NICU did not have a statistically significant difference between the two groups (23).

In the interpretation of the above findings, decreased amniotic fluid volume may indicate placental insufficiency (21, 24). In other words, poor placental perfusion can lead to oligohydramnios and its adverse outcomes (25). However, the results of studies are conflicting due to differences in inclusion criteria, gestational age, and definition of oligohydramnios.

Strengths: Considering that studies have mainly compared perinatal outcomes between two groups with normal AFI and oligohydramnios, one of the strengths of this study was the comparison of perinatal outcomes between three groups with normal, borderline and oligohydramnios AFI.

Limitations: As fewer studies have been conducted on borderline oligohydramnios and perinatal outcomes, it was not possible to compare the results.

Conclusion

According to the results of this research, gestational age at delivery and birth weight in the group with normal AFI were higher than the borderline and oligohydramnios groups. The previous cesarean section was the most common cause of cesarean delivery in the normal group whereas fetal distress was the most cause in borderline and

oligohydramnios cases. The three adverse outcomes of respiratory distress, hospitalization in NICU, and length of hospitalization were statistically significantly different between the two groups with normal and borderline AFI and in the borderline group was more than the normal group. Adverse outcomes including; LBW, SGA, respiratory distress, 1- min APGAR scores<7, hospitalization in NICU and its duration were statistically significantly different between the two groups with normal AFI and oligohydramnios, and it was more in the oligohydramnios group than the normal group. The three adverse outcomes of LBW, SGA and 1- min APGAR scores<7 in the two borderline and oligohydramnios groups had statistically significant differences and were more in the oligohydramnios group than the borderline group. Therefore, consideration to the AFI in perinatal care to evaluate fetal well-being, predict adverse perinatal outcomes and perform necessary interventions to improve these outcomes is necessary.

Conflict of Interests

Authors declare no conflict of interests.

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