Amniotic Fluid Disorders, Maternal Complications, and Neonatal Outcome

Mersal Rahman Hussein[1], Faiz Abdulwahad Alwaeely[2]
[1, 2]College of medicine, University of Basrah, Iraq.

Abstract

Introduction: Amniotic fluid is a protective liquid consisting of water and substances such proteins, carbohydrates, lipids, hormones, and chemical compounds. Amniotic fluid anomalies are twofold. Polyhydramnios is characterized as an AFI of 24 cm or higher. Oligohydramnios is a decreased AFI of less than 5 cm. Aims of the study to identify the maternal risk factors associated with amniotic fluid disorders and to assess the effect of amniotic fluid disorders on maternal and fetal outcome. **Method:** A prospective case-control study was conducted at Basrah maternity and children's hospital between the 1st of January 2022 and the 30th of June 2022. A total of 75 pregnant women who were admitted to labor room with intact membranes and with anticipation of spontaneous vaginal delivery were evaluated. They will be divided into three groups according to ultrasound examination of AFI and the deepest amniotic fluid sac into normal liquid, polyhydramnios, and oligohydramnios. The comparison of the three groups in terms of complications, mode of delivery, and NICU admission was studied. **Results:** 33% of the patients studied had polyhydramnios and 33% had oligohydramnios. Normal amniotic fluid index was 28 3.08, whereas polyhydramnios was 29.88 6.01 and oligohydramnios was 3.22 1.09. Amniotic fluid anomalies were linked to BMI and maternal diabetes. Age, education, parity, and gravidity were not associated with amniotic fluid anomalies. There was a relationship between the mother's gestational age, how she delivered delivery, and amniotic fluid abnormalities. Amniotic fluid abnormalities weren't connected to any fetal outcomes. **Conclusion:** Amniotic fluid problems are widespread in Basrah, and maternal hyperglycemia is a risk factor for polyhydramnios. Amniotic fluid abnormalities impact delivery and gestational age. Future research on amniotic fluid abnormalities will use a bigger sample size and cohort approach.

Keywords: AFI, Polyhydramnios, oligohydramnios, Basrah, Pregnancy.

1. Introduction

Amniotic fluid is a protective liquid comprised of water and solids including proteins, carbohydrates, lipids and phospholipids, enzymes, hormones, and chemical compounds like urea, uric acid, creatinine, and electrolytes. It's generated from foetal plasma and serves as a protective cushion [(1)]. Amniotic fluid helps mom and baby exchange nutrients, water, and biochemicals. Skin, respiratory, digestive, urinary tract, stem cells, hair, and blood cells contribute to foetal development [(1)]. The amniotic fluid amount does not fluctuate considerably from day to day, but it rises with the foetus's growth, peaking around 34 weeks of pregnancy (approximately 800 mL) [(2)]. The amnion originally secretes amniotic fluid, but from the 10th week of pregnancy it comes from foetal serum through the skin and umbilical cord. From the 16th week on, the foetal skin becomes impervious to water, and amniotic fluid is generated by the foetal kidney as urine and lung fluid, and evacuated by foetal swelling. By the 12th to 14th week, amniotic fluid includes proteins, carbohydrates, lipids, phospholipids, and urea, which contribute in foetal development [(1)]. There are two different forms of amniotic fluid abnormalities. Polyhydramnios is defined as an excessive amount of amniotic fluid with an Amniotic Fluid Index (AFI) of more than 24 cm. The second condition is oligohydramnios, which is defined as a reduced AFI of less than 5 cm [(1)]. Amniotic fluid problems should be considered whenever fundal height and gestational age vary. Discrepancies need an ultrasonography of amniotic fluid [(3)]. Transabdominal ultrasonography examination of AFV uses either MVP or AFI, depending on the institution. Sonographer examines belly to get image of maximal vertical pocket, deepest amniotic fluid pocket without foetal umbilical cord or body components [(4)]. From 12 to 6, measure. MVP is 2–8 cm; a 2cm pocket is abnormal single and multifetal oligohydramnios. MVP>8 is polyhydramnios [(4)]. AFI measures amniotic fluid volume (AFV). After 20 weeks of gestation, divide the uterus into four quadrants through the umbilicus to calculate the AFI. Four maximum vertical pockets equal the AFI. AFI5cm indicates oligohydramnios [(5)]. Maximum vertical pocket over diagnoses polyhydramnios, whereas AFI underdiagnoses oligohydramnios. Some institutions employ the MVP in low-AFV pregnancies and the AFI in high-AFV pregnancies. MVP should be used to evaluate oligohydramnios in multifetal pregnancies, as all four quadrants cannot be measured for each foetus [(6)]. Other procedures to determine polyhydramnios causes include a 75 g oral glucose tolerance test (OGTT) to rule out gestational diabetes and maternal infection testing (ToRCH serology). If foetal anaemia or hydrops are suspected, immunological (maternal blood group, Rhesus factor, antibody screening) and hematological problems must be ruled out [(6)]. The aim of study is to Identify and

doi.org/10.31838/hiv23.02.60 Received: 15.10.22, Revised: 12.11.22, Accepted: 14.12.22

mitigate the maternal risk factors associated with amniotic fluid disorders. Assess the effect of amniotic fluid disorders on maternal and foetal outcome. Determine the mode of delivery in pregnancy complicated with amniotic fluid disorders.

2. Method

A prospective case-control study was conducted at Basrah maternity and childhood Hospital, Between the 1st of January 2022 to the 30th of June 2022. A total of 75 pregnant women who were admitted to labor Word with intact membranes and with anticipation of spontaneous vaginal delivery were evaluated for inclusion in this study. Patients were included if they had at least one scan conducted by an expert's radiologist, if not Ultrasound examination was done for each patient to measure the AFI & SDP, and according to the ultrasound examination, those pregnant women were divided into three groups: First group Of Polyhydramnios who hard AFI >24 cm or SDP>8 cm, the second group of Oligohydramnios had AFI<5 cm or SDP<2 cm, and the third group is normal pregnant women who had AFI 5-24 cm or SDP 2-8cm which is regarded as a control group. Excluded from the study, the woman was multiple Pregnancies, Pre labor rupture of membrane, and those admitted with anticipation of cesarean delivery, had no hypertension, DM, or a renal disorder. Once meeting, the inclusion criteria, a formulated data collection sheet was filled from each patient. which include the following demographic factors age, level of education, working state, gravidity, and past medical history. After completing history taking each patient was examined for the following, Obstetric examination, BMI Was estimated according to the pre- pregnancy measures. Every participant was referred to the radiology department where an ultrasound was done looking for the whole thing needed and specifically to measure AFI and SDP and accordingly the women were classified into three groups: The Polyhydramnios group includes the AFI >24 cm or SDP >8 cm. Oligohydramnios group in which AFI <5 cm or SDP <2 cm. Normal group when the AFI 5-24 cm or SDP 2-8 cm. All women had included were followed till their deliveries, the gestational age of pregnancy at the time of delivery according to LMP and ultrasound measurement, and the mode of delivery. The neonatal outcome included: Living status, gender, APGAR score, Birth weight, Admission to a NICU, and congenital abnormalities. Statistical Analysis: The data set was checked for any missing data, then it was entered into the Statistical Package for the Social Sciences (SPSS) program version 20 which was used to code and analyzed data. X2-test and Fisher's Exact tests were used to measure the association between groups and a P-value ≤ 0.05 was considered significant.

3. Results

A total of 75 women were included in the study. Their mean age was equal to 27.29 years, ranging from a minimum of 16 years to a maximum of 44 years, as well as the majority of them (86.7%) were younger than 35 years. Most of them (65.3%) have a school diploma, and 94.7% of them are housewives. In term of body mass index, their mean BMI was equal to 25.05, and about half of them had a normal BMI. Regarding the parity, roughly 70% of them were multiparous women. Only 6.7% of the cases had a history of chronic illness in form of diabetes mellitus (Table 1).

Table (1): Demographic Distribution of the Mothers.

Variables		No.	%
Age	Mean ±Sd	27.29 ± 6.45	
	Range	16-44 years	
	≤35	65	86.7
	>35	10	13.3
Education	Illiterate	16	21.3
	School education	49	65.3
	College Education	10	13.3
Occupation	Employee	1	1.3
	Housewife	71	94.7
	Student	3	4.0
BMI	Mean ± SD	25.05 ± 3.62	
	<25 (normal and underweight)	37	49.3
	25-29.9 (Overweigh)	26	34.7
	≥ 30 (Obese)	12	16.0
Gravity	Prim gravida	23	30.7
	Multigravida	52	69.3
History of chronic diseases	Positive	5	6.7
	Negative	70	93.3

Concerning the amniotic fluid index, the results showed that it was normal in about one third of the cases, but amniotic fluid abnormalities were diagnosed in two thirds of the cases, with an equal percentage for oligohydramnios and polyhydramnios (Table 2).

Table (2): The Amniotic Fluid Index Among the Mothers.			
Amniotic fluid index	Diagnosis	Mean ± SD	Frequency (%)
	Overall	17.46 ± 10.72	75 (100%)
	Normal	19.28 ± 3.08	25 (33.33%)
	Polyhydramnios	29.88 ± 6.01	25 (33.33%)
	Oligohydramnios	3.22 ± 1.09	25 (33.33%)

Regarding the baby's outcome, most of the women delivered by normal vaginal delivery (84%), and 96% of the babies were alive, and more than half of them were girls (56%). Regarding the time of delivery, 66.7% of them were delivered at term and only 20% of the babies required NICU admission. The congenital anomalies were reported in only one patient (Table 3).

Table (3): Frequency of Maternal and Baby Outcome			
Variables		No.	%
Mode of delivery	Normal vaginal delivery	63	84.0
	Elective Caesarean section	3	4.0
	Emergency caesarean section	9	12.0
Baby living status	Dead	3	4.0
	Alive	72	96.0
Baby gender	Girl	42	56.0
	boy	33	44.0
Gestational age	Preterm <37 weeks	23	30.7
	Term ≥37-40	50	66.7
	>40	2	2.6
Admission to NICU	Yes	15	20.0
	No	60	80.0
Congenital anomalies	Yes	1	1.3
	No	74	98.7
APGAR score	<7 in 1 min	19	25.3
	<7 in 5 min	6	8.0

The association between certain maternal risk factors and amniotic fluid disorders demonstrates that there were no significant differences between maternal age, whether below or higher than 35 years, and the types of amniotic fluid disorders, although the percentage of polyhydramnios was higher among those older than 35 years in comparison with oligohydramnios (P value = 0.582). Also, no significant difference was detected between the level of education and the development of amniotic fluid disorders (P-value = 0.268) (Table 4)

Table (4): Association Between the Type of Amniotic Fluid Disordersand Maternal Demographics								
Variables		Normal AFI		Polyhydramnios		Oligohydramnios		P-value
		No.	%	No.	%	No.	%	
Materna age	≤35	23	92.0	20	80.0	22	88.0	0.582*
	>35	2	8.0	5	20.0	3	12.0	
Education	Illiterate	8	32.0	4	16.0	4	16.0	0.268*
	School education	15	60.0	19	76.0	15	60.0	
	College Education	2	8.0	2	8.0	6	24.0	
	Positive (DM)	0	0.0	5	20.0	0	0.0	
*Fishers-exact test								

Additionally, most of the poly and oligohydramnios cases were multigravida, but this difference was again not statistically significant (P-value= 0.217). Furthermore, increasing weight was found to significantly increase the risk of amniotic fluid abnormalities (P value = 0.002). Finally, maternal diabetes was found to significantly increase polyhydramnios risk (P value = 0.011) (Table 5).

Table (5): Association Between the Type of Amniotic Fluid Disorders and Certain Maternal Factors								
Variables		Normal AFI		Polyhydramnios		Oligohydramnios		p-value
		No	%	No.	%	No.	%	
Maternal parity	primigravida	5	20.0	7	28.0	11	44.0	0.217
	Multigravida	20	80.0	18	72.0	14	56.0	
BMI	Normal	19	76.0	11	44.0	7	28.0	0.002*
	Overweight	2	8.0	10	40.0	14	56.0	
	Obese	4	16.0	4	16.0	4	16.0	
History of chronic diseases	Negative	25	100.0	20	80.0	25	100.0	0.011*
	Positive (DM)	0	0.0	5	20.0	0	0.0	
*Fishers-exact test								

Regarding the association between the amniotic fluid disorder and gestational age, the results showed that oligohydramnios significantly increased with the increase in gestational age (0.024). It was also demonstrated that both types of amniotic fluid significantly increase the risk of emergency caesarean section, with the oligohydramnios having a higher risk (P-value = 0.036) (Table 6).

Table (6): Association Between the Type of Amniotic Fluid and Gestational Age / Mode of Delivery

Variables		Normal AFI		Polyhydramnios		Oligohydramnios		P-value
		No.	%	No.	%	No.	%	
Gestational age at delivery	Preterm <37 weeks	3	12.0	12	48.0	8	32.0	0.024*
	Term ≥37- 40	22	88.0	12	48.0	16	64.0	
	>40	0	0.0	1	4.0	1	4.0	
Mode of delivery	Normal vaginal delivery	25	100.0	20	80.0	18	72.0	0.036*
	Elective Caesarean section	0	0.0	1	4.0	2	8.0	
	Emergency caesarean section	0	0.0	4	16.0	5	20.0	

*Fishers-exact test

Although both oligo and polyhydramnios led to an increased risk of dead babies, this was statistically not significant if compared with normal (P-Value = 0.312). Both these two disorders increase the risk of NICU admission if compared with normal AFI, but again this had no statistical significance (P- value = 0.425). The only reported case of congenital anomalies was among the oligohydramnios maternal group, but this was statistically not significant (P-value = 0.182). The APGAR Scores at 1 and 5 minutes were more affected among the oligohydramnios compared with polyhydramnios, but this is also not significant statistically (P-value = 0.232) (Table 7).

Table (7): Association Between the Type of Amniotic Fluid and Foetal Outcome

Variables		Normal AFI		Polyhydramnios		Oligohydramnios		P-value
		No.	%	No.	%	No.	%	
Baby livingstatus	Dead	0	0.0	2	8.0	1	4.0	0.312*
	Alive	25	100.0	23	92.0	24	96.0	
Admissionto NCU	Yes	3	12.0	7	28.0	5	20.0	0.425*
	No	22	88.0	18	72.0	20	80.0	
Congenitalanomalies	Yes	0	0.0	0	0.0	1	4.0	0.990*
	No	25	100.0	25	100.0	24	96.0	
APGAR score at 1min	<7	3	12.0	9	36.0	7	28.0	0.182*
	>7	22	88.0	16	64.0	18	72.0	
APGAR score at5min	<7	0	0.0	3	12.0	3	12.0	0.232*
	>7	25	100.0	22	88.0	22	88.0	

*Fishers-exact test

4. Discussion

Amniotic fluid protects the amniotic sac. Two amniotic fluid abnormalities exist. First, polyhydramnios is an amniotic fluid volume larger than 24 cm. Second, it comprises oligohydramnios, or less than 5 cm AFI, 33% of polyhydramnios patients had a mean amniotic fluid index of 30 and a standard deviation of 6 [1]. Similar percentages (33%) were diagnosed with oligohydramnios, and the mean amniotic fluid index was 3. This is greater than the proportion reported by Baksh et al. [1], who found 2.8% of the sample had polyhydramnios and 11.7% had oligohydramnios. This is likely due to their study's randomization and sample size.

Regarding the connection between maternal age and amniotic fluid anomalies, the maternal age was separated into two age groups: below and above 35 years. Most participants (86.7%) were under 35. 8 percent of patients above 35 years old had amniotic fluid abnormalities (P = 0.582). Maternal age and amniotic fluid abnormalities were not linked. According to a research at Turkey's Ondokuz Mayis University, maternal age had no influence on prenatal and neonatal outcomes [7].

Concerning the connection between gravidity and amniotic fluid abnormalities, 70% of the women were multigravida, which is comparable to the above-mentioned study, where 75.1% were multigravida. No connection was detected between pregnancy and amniotic fluid abnormalities (P=0.217) [1]. High BMI (above 25) is associated with amniotic fluid problems. Half the group was fat (16%) and overweight (34.7%). Another research found higher poly and oligohydramnios and congenital abnormalities. This might be because most are fat or overweight, which is connected to pregnancy problems and newborn outcomes [8]. Only 6.7% of the sample had different chronic medical illnesses,

which is about half of the percentage reported in a study by Baksh et al., 2021 which showed the most significant maternal risk factors associated with amniotic fluid disorders include diabetes mellitus and gestational diabetes [1]. Diabetes mellitus is a risk factor for polyhydramnios and oligohydramnios, according to one report. According to the research, maternal diabetes is the greatest risk factor for amniotic fluid problems. Various maternal chronic conditions did not affect the amniotic fluid index, although they may pose other foetal hazards. No link was discovered between hypertensive disorders of pregnancy and oligohydramnios, possibly due to minor instances or therapy. Gestational age at delivery and amniotic fluid problems were significantly linked. Polyhydramnios and oligohydramnios instances occurred post term [9]. Normal AFI had the highest term delivery rate, followed by oligohydramnios and polyhydramnios.

Both poly and oligohydramnios increase premature delivery risk compared to women with normal AFI, but polyhydramnios has the largest proportion. These results are comparable to research performed in Spain, which found that oligohydramnios and polyhydramnios cases were related with shorter gestational age. However, a study from KSA found a higher risk of late-term birth than preterm delivery [1, 9]. Polyhydramnios (20%) required caesarean section (4% elective, 17% emergency), but oligohydramnios (28%) required caesarean section (20% emergency, 8% elective). In this study, abnormal amniotic fluid was related with an increased risk of c-section (P=0.036) compared to those with normal amniotic index. In a KSA research, the rate of caesarean births was greater in polyhydramnios patients compared to normal instances, according to Yefet & Daniel-Spiegel [11]. Among oligohydramnios patients, vaginal births were decreased. These results are comparable with those from India, where vaginal births were second only to caesareans (Madhavi et al. and Bhagat et al. found that oligohydramnios patients had a higher caesarean section rate [12, 13]. The majority of women had live-born neonates, while 3 cases (4%) of stillbirth were reported, with 2 of them having polyhydramnios and one with oligohydramnios, however this difference is not statistically significant (P-value = 0.312). In a research at King Abdul-Aziz University Hospital in Jeddah, 5356 of 5432 patients had liveborn babies, or 98.6% [14]. It's consistent with a recent KSA research that reported 98% of live births [1]. This little percentage discrepancy may be attributable to their larger sample size than ours. There was no link between congenital defects and amniotic fluid problems (P-value = 0.990), and the proportion is lower than the previous research, in which 2.9% of newborns had congenital deformities [14]. No significant relationship was discovered between poor APGAR score and amniotic fluid abnormalities, but a larger proportion was reported among individuals with polyhydramnios compared with oligohydramnios and a normal amniotic fluid index (P-value = 0.182). At 5 minutes, oligo and polyhydramnios are equal. It's still greater than average, but not statistically significant (P=0.232) [14].

5. Conclusion

1/3 of the study's patients had polyhydramnios and 1/3 had oligohydramnios. Normal amniotic fluid index was 28± 3.08, whereas polyhydramnios was 29.88 ±6.01 and oligohydramnios was 3.22 ±1.09. Amniotic fluid anomalies were linked to BMI and maternal diabetes. Age, education, parity, and gravidity were not associated with amniotic fluid anomalies. There was a relationship between the mother's gestational age, how she delivered delivery, and amniotic fluid abnormalities. Amniotic fluid anomalies did not affect foetal outcomes.

6. References

Bakhsh H, Alenizy H, Alenazi S, Alnasser S, Alanazi N, Alsowinea M, Alharbi L, Alfaifi B. Amniotic fluid disorders and the effects on prenatal outcome: a retrospective cohort study. BMC Pregnancy Childbirth. 2021;21(1):75. doi: 10.1186/s12884-021-03549-3.

Brace RA. Physiology of amniotic fluid volume regulation. Clin Obstet Gynecol. 1997 Jun;40(2):280-9.

Keilman C, Shanks AL. Oligohydramnios. [Updated 2022 Sep 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK562326/

Chen M, Chen C P. Invasive fetal therapy, global status and local development. Taiwanese J Obstet Gynecol. 2004;439:185–192

Bakhsh, H., Alenizy, H., Alenazi, S. *et al.* Amniotic fluid disorders and the effects on prenatal outcome: a retrospective cohort study. *BMC Pregnancy Childbirth*. 2021, **21**, 75.

Hamza A, Herr D, Solomayer EF, Meyberg-Solomayer G. Polyhydramnios: Causes, Diagnosis and Therapy. Geburtshilfe Frauenheilkd. 2013;73(12):1241-1246.

Cakmak Celik F, Aygun C, Kucukoduk S, Bek Y. Maternal and neonatal outcomes in advanced maternal age: a retrospective cohort study. J Matern-Fetal Neo M. 2017;30(20):2452–6.

Timur BB, Timur H, Tokmak A, Isik H, Eyi EG. The influence of maternal obesity on pregnancy complications and neonatal outcomes in diabetic and nondiabetic women. Geburtshilfe Frauenheilkd. 2018;78(4):400.

Amniotic Fluid Problems/Hydramnios/Oligohydramnios. Children's Hospital of Philadelphia. https://www.chop.edu/conditions-diseases/amniotic-fluidproblemshydramniosoligohydramnios. Accessed 22. September 2022.

Martínez-Frías ML, Bermejo E, Rodríguez-Pinilla E,

Frías JL. Maternal and fetal factors related to abnormal amniotic fluid. J Perinatol. 2009;19(7):514–20.

Yefet E, Daniel-Spiegel E. Outcomes from polyhydramnios with normal ultrasound. Pediatrics. 2016;137(2):e20151948. https://doi.org/10.1542/peds.2015-1948.

Madhavi K, Rao PC. Clinical study of oligohydramnios, mode of delivery and perinatal outcome. IOSR J Dent Med Sci. 2015;14(4):6–11.

Bhagat M, Chawla I. Correlation of amniotic fluid index with perinatal outcome. J Obstet Gynaecol India. 2014;64(1):32-5. doi: 10.1007/s13224- 013-0467-2.

Fida NM, Al-Aama J, Nichols W, Alqahtani M. A prospective study of congenital malformations among live born neonates at a university hospital in western Saudi Arabia. Saudi Med J. 2007;28(9):1367.