

Original Article

ULTRASOUND EVALUATION OF AMNIOTIC FLUID INDEX IN WOMEN WITH NORMAL PREGNANCIES IN UMUAHIA, ABIA STATE, NIGERIA

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Abstract

Background: With the increasing incidence of polyhydramnios and oligohydramnios in pregnancy, there is a need to determine normal levels for amniotic fluid in pregnant women populations.

Objective: To determine the amniotic fluid index (AFI) and relationship with some fetal biometrics in women during their routine antenatal visits in Umuahia Abia state.

Materials and Methods: A cross-sectional study of pregnant women who were on their routine antenatal ultrasound visit in Alpha Clinics and Diagnostic centre, Umuahia, Abia state, Nigeria. AFI was determined using a digital real time ultrasound scan with a 3.5 MHz convex transducer. Data was analysed using IBM Statistical Package for Social Science (IBM SPSS Inc., USA) Version 16.0. Qualitative variables were expressed in frequencies and percentages, while quantitative variables were expressed in mean and standard deviations. Chi-square was used to determine the relationship between AFI and fetal gender, fetal lie and presentation and placental localization, at a P-value of <0.05.

Results: The AFI ranged between 9.00 cm and 31.80 cm with a mean of 17.11±3.92 cm. There was no relationship between AFI and fetal gender, fetal lie and presentation, but there was a significant relationship between AFI and placental localization ($p = 0.048$).

Conclusion: This study indicates that the range of amniotic fluid index in our environment in Umuahia is 9.00 cm to 31.80 cm with a mean value of 17.11±3.92 cm and suggests a possible association between placenta localization and measured AFI.

Keywords: Amniotic fluid index, Estimation, Ultrasound, Umuahia.

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INTRODUCTION

Amniotic fluid is a clear fluid that surrounds the fetus, it is necessary for a healthy fetal development.¹ Reduction in the amniotic fluid volume to less than 500 ml is called oligohydramnios while increase in amniotic fluid volume greater than 2000 ml is called polyhydramnios. Oligohydramnios or polyhydramnios usually leads to complications in pregnancy. At first, amniotic fluid consists of water from the mother's body but gradually a larger proportion is made up of the baby's urine and secretions from the fetal lungs. By 20 weeks of gestation, the amniotic fluid is entirely replaced by fetal urine as the fetus swallows and excretes the fluid.¹ Amniotic fluid volume is an important marker of intrauterine fetal

wellbeing and its quantification is also a means of assessing fetal status.² It is a component of an obstetric ultrasound scan and forms part of the obstetrician's decision making in the management of pregnancy. The amniotic fluid index (AFI) technique is a rapid, readily reproducible, non-invasive method of determining the amniotic fluid volume. This was developed by Phelan et al,² it is calculated sonographically by the summation of the values of the maximum vertical heights of the amniotic fluid in four quadrants of the gravid uterus and measured in centimeters. Its validity has been demonstrated by Moore and Cayles.³ Establishing normal values of amniotic fluid volume for a given population will help in determining pregnant women with

oligohydramnios and polyhydramnios and their complications. The aim of this study was to determine the amniotic fluid index (AFI) and relationship with some fetal biometrics in women during their routine antenatal visits in Umuahia Abia state.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional study of pregnant women who were on their routine antenatal ultrasound visit in Alpha Clinics and Radio-Diagnostic centre, Umuahia, Abia state, Nigeria. The study was carried out from January, 2022 to July, 2022. Umuahia is the capital of Abia state, in the South-east geopolitical zone and it is dominated by civil servants.

Eligibility Criteria

The inclusion criteria were all singleton healthy pregnant women with no underlining pathology, while the exclusion criteria were diabetes mellitus in pregnancy, hypertension in pregnancy, multiple gestation, grand-multiparity and fetus with congenital abnormalities.

Sample Size Determination

The sample size was calculated using the formula for estimating a population mean⁴;

$$\text{Sample size, } N = Z^2\delta^2 / \epsilon^2$$

N= Sample size

Z= the abscissa of the normal curve (1.96).

δ = Population standard deviation or variance (4.95).

ϵ = Error range (0.97)

$$N = (1.96)^2 (4.95)^2 / (0.97)^2$$

$$N = 100$$

Procedure

Consent was obtained from the patients prior to inclusion in the study. Subjects were scanned transabdominally in supine position. A digital real time ultrasound scan with a 3.5 MHz convex transducer was used. To determine the AFI, the uterus was divided into four imaging quadrants with the linear nigra and a mediolateral line running through the umbilicus acting as the vertical and the horizontal axes respectively. Measurement of the pocket of amniotic fluid in the four quadrants was in centimeters, avoiding the placenta tissue and umbilical cord. The sum of the maximum vertical pool of amniotic fluid in all the four quadrants gave the AFI in cm.⁵

Data Analysis

Data was analysed using IBM Statistical Package for Social Science (IBM SPSS Inc., USA) Version 16.0. Qualitative variables like gender, fetal lie and presentation and placentation were expressed in frequencies and percentages, while quantitative variables like maternal age and fetal biometrics were expressed in mean and standard deviations. Chi-square was used to determine the relationship between AFI and fetal gender, fetal lie and presentation and placental localization, at a P-value of <0.05.

RESULTS

Table I below shows that the women were aged between 20 and 42 years, with a mean age of 28.60±4.95 years. The gender distributions of the fetuses were as shown in the table.

Table I: Sociodemographics

Variable	Minimum	Maximum	Mean ± SD	Median (IQR)
Age (years)	20.00	42.00	28.60±4.95	28.0 (25.0, 31.0)
Variable				
Gender	<i>n (%)</i>			
Male	55 (55.0)			
Female	45 (45.0)			

The fetal parameters on ultrasound are reported in Table II, and it can be seen that most of the fetuses were in

cephalic presentation (70%) while oblique cephalic and unstable presentation both had 3 counts each.

Table II: Ultrasound Findings

Variable	Minimum	Maximum	Mean ± SD	Median (IQR)
Femoral Length (mm)	14.86	41.43	30.87±6.79	32.2(32.2,36.4)
Biparietal Diameter (mm)	15.00	41.57	30.75±6.57	31.9(25.2,36.4)
Abdominal Circumference (mm)	15.57	42.00	30.72±6.65	32.0(25.4,35.8)
Head Circumference (mm)	16.00	41.43	31.42±6.87	33.6(25.5,36.7)
AFI	9.00	31.80	17.11±3.92	17.4(14.6,19.0)
Average GA (weeks)	15.57	40.85	31.04±6.66	32.5(25.6,36.4)
Fetal Heart Rate (beats/minute)	122.00	162.00	142.80±8.93	143.0 (136, 149.8)
Estimated Fetal Weight (g)	137.00	6999.00	2040.50±1263.58	2052.0 (949.8, 2942)
Variable				
<i>Fetal lie and Presentation</i>	<i>n (%)</i>			
Breech	17 (17.0)			
Cephalic	70 (70.0)			
Oblique Cephalic	3 (3.0)			
Transverse	7 (7.0)			
Unstable	3 (3.0)			

Table III shows the association between AFI and gender, fetal lie and presentation and placentation, and only placentation showed significant association ($p = 0.048$).

Table III: Association between Amniotic Fluid Index (AFI) and gender, fetal lie and presentation and placentation.

Fetal Characteristics	AFI		χ^2	p value/F
	Normal n (%)	Polyhydramnios n (%)		
<i>Gender</i>				
Male	53 (96.4)	2 (3.6)		1.000
Female	44 (97.8)	1 (2.2)		
<i>Fetal lie and Presentation</i>	<i>n (%)</i>	<i>n (%)</i>		
Breech	17 (100.0)	0 (0.0)	1.325	0.857
Cephalic	67 (95.7)	3 (4.3)		
Oblique Cephalic	3 (100.0)	0 (0.0)		
Transverse	7 (100.0)	0 (0.0)		
Unstable	3 (100.0)	0 (0.0)		
<i>Placentation</i>	<i>n (%)</i>	<i>n (%)</i>		
Anterior	44 (97.8)	1 (2.2)	7.898	0.048*
Fundal	20 (95.2)	1 (4.8)		
Posterior	30 (100.0)	0 (0.0)		
Previa	3 (75.0)	1 (25.0)		

* = statistically significant

DISCUSSION

In this study, AFI among women in Umuahia with uncomplicated pregnancy was determined and its relationship with fetal gender, fetal lie and presentation

and placental localization assessed. The AFI in this study ranged from 9.00 cm to 31.80 cm with a mean value of 17.11 ± 3.92 cm. This range is in variance with values in the works of Alao et al,⁶ and Luntsi et al⁷ in southwest and

Northern Nigeria respectively, where the values of AFI ranged from 7.9 cm to 27.3cm and 12.00 cm to 28.70 cm respectively. This variation has shown that the range of normal values of AFI varies from one geographical location to another and can be affected by racial differences. Just as Alao et al concluded in their study, the finding from this study has shown that no particular reference value should be strictly adhered to, rather AFI should be based on what is obtainable in that locality. There was no relationship between AFI and fetal gender, fetal lie and presentation, but there was a significant relationship between AFI and placental localization in this study. This suggests a possible association between placenta localization and measured AFI and contrasts the suggestion in a previous study⁸ that the fetal sex may affect AFI owing to micturition difference in male and female fetuses. Also, at variance with the finding in this study that AFI has no relationship with fetal lie and presentation, Foks et al,⁹ in their study observed that fetal position affected the measurement of AFI.

CONCLUSION

This study indicates that the range of amniotic fluid index in our environment in Umuahia is 9.00 cm to 31.80 cm with a mean value of 17.11±3.92 cm and suggests a possible association between placenta localization and measured AFI. This will be a useful guide in the assessment of amniotic fluid volume for the care of pregnant women in our environment.

SOURCE OF FUNDING

The study was funded by the author.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

ETHICAL APPROVAL

The research protocol was reviewed and approved by the Ethical and Research Committee of Alpha Clinics and Radio-Diagnostic Centre.

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