Study of Normal and Abnormal Liquor Volume and Its Correlation with Perinatal Outcome

Sayeeda Parveen[1], Swarnim Swati[2], Chanchal[3]

[1]Senior Resident, Department of Obstetrics and Gynaecology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar
[2]Senior Resident, Department of Obstetrics and Gynaecology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar
[3]Associate Professor, Department of Obstetrics and Gynaecology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar

Abstract:

Background: Surrounding the developing embryo, amniotic fluid (AF) is essential to the correct development of the fetus. A decrease in the volume of amniotic fluid may be the initial sign of an illness in the mother or a fetal defect. This study compares and evaluates the perinatal outcomes for mothers whose amniotic fluid volume is abnormal or normal.

Method: A prospective comparative study was conducted for a period of 8 months from September 2021 to April 2022. Group I consist of 50 patients with normal amniotic fluid and group II consists of 50 patients with either oligohydramnios or polyhydramnios. Amniotic fluid index (AFI) was calculated using Phalen's four quadrant technique using ultrasound. The perinatal outcome was judged by assessing the fetal distress predicted by abnormal fetal heart rate (FHR) or meconium stained liquor, one minute and 5 minute Apgar score, frequency of admission to neonatal intensive care unit (NICU), baby weight of less than 10th percentile for gestation age and perinatal mortality.

Results: In contrast to normal AFI subjects, patients in group II (abnormal AFI) were found to have higher rates of induction of labor, cesarean section, and meconium-stained liquor. Similarly, perinatal outcome measures such as low birth weight, increased frequency of NICU admission due to respiratory distress, and a low APGAR score were found to be more common in the abnormal AFI group, with the difference being found to be statistically significant.

Conclusion: Women who require heightened antepartum surveillance for pregnancy difficulties can be identified with the aid of an AFI measurement during the antepartum or intrapartum period. These women should be treated in a dedicated unit to adequately address the complications.

Keywords: Amniotic fluid index, perinatal outcome, oligohydramnios, polyhydramnios.

Introduction

Modern obstetrics is more concerned with the health of the important part of fetal assessment as variation in its and wellbeing of both the mother and the unborn child. Amount has been related to a variety of pregnancy Recognition of a fetus at risk for death or damage in complications including intra-uterine death. Amniotic utero, quantifying the risk, balancing the fetal risk against fluid acts as a protective milieu for the growing fetus, the risk of neonatal complications from immaturity, and cushioning it against mechanical and biological injury in determining the optimal time and mode of intervention such a way it prevents the compression of the umbilical are the cornerstones of modern perinatal medicine, cord, placenta and protects the fetus from vascular and Clinical estimation of amniotic fluid volume (AFV) is one nutritional compromises. In 1989, Brace and Wolf had demonstrated the progressive increase of AFV starting from 10 to 22weeks of gestation and later on from 22 to 39 weeks gestation the AFV remained stable (averaging 777 ml with a 95% confidence interval of 302 to 1997 ml) and then onwards it starts gradually declining. [4] The average amniotic fluid volume was approximately 7ml at 8 weeks, 30ml by 10 weeks, 190ml by 16 weeks and 780ml by 32-35weeks then decreasing to about 400-450ml by 42weeks of gestation. After 40 weeks amniotic fluid decreases at a rate of 8% per week and averages only 400-450ml at the end

of the 42 weeks. It reduces further to a mean of 250ml and 160ml at 43 and 44 weeks respectively. The net turnover of amniotic fluid is about l000ml/day. Quantification of amniotic fluid is an important component of the biophysical profile in ultrasound evaluation of fetal wellbeing, especially in the third trimester. Antenatal tests use amniotic fluid volume as a fundamental assessment of chronic in utero stress. Ultrasound being a non-invasive test is ideal for application on a large scale and can be used frequently for repeat AFV determination in the cases of suspected abnormalities. Links have been found between decreased amniotic fluid volume and stillbirths, fetal anomaly, abnormal FHR tracings in labor, increase in cesarean section for fetal distress, and possibly fetal acidosis. Over the past decades, a number of sonographic methods have been used to measure the amniotic fluid. Phelan et al described quantification of amniotic fluid using the amniotic fluid index (AFI). The four-quadrant technique termed AFI is in which a vertical pocket of amniotic fluid, free of umbilical cord, in each of four equal uterine quadrant was summated. An amniotic fluid volume more than two standard deviation below the mean for specific gestational age or volume reduced below the 5th percentile for particular gestational age would define oligohydramnios. Based on this definition, volume <300ml at term would constitute oligohydramnios. According to Phelan et al oligohydraminos is defined by AFI <5cm.

Studies had been conducted for assessing the correlation between the AFV and the foetal outcome but very few studies had been carried out in this part of world and so the present study was done to assess the foetal outcome among the mothers with oligo or polyhydramnios in comparison with normal AFV.

Material and Methods

A prospective comparative study was conducted in Department of Obstetrics and Gynaecology, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar for a period of 8 months from September 2021 to April 2022. A non-random purposive sampling was followed to select the 100 study subjects, which was divided into two groups of 50 each. Group I consist of 50 patients with normal amniotic fluid and group II consists of 50 patients with either oligohydramnios or polyhydramnios. The inclusion criteria for group I includes normal AFI of 5 to 24 cms and for group

II, AFI either <5 or >25 cms were included for the study. Among all singleton term pregnancies only those with intact membranes were included in the study. Pregnancy with congenital anomaly, premature rupture of membranes, multiple pregnancy, post term pregnancy and malpresentations were excluded from the study. After obtaining the informed consent from the patients a detailed clinical history including their demographic details were obtained from all the patients. Routine blood investigations were performed. A complete obstetric examination including per-vaginal examination was conducted. AFI assessment was done by the following method. The patient was made to lie in supine position; a linear or curvilinear ultrasound probe was used. Uterus was divided into 4 quadrants using the maternal sagittal midline vertically and an arbitrary transverse line approximately halfway between symphysis pubis and upper edge of uterine fundus. Transducer was kept parallel to the maternal sagittal plane and perpendicular to the maternal coronal plane throughout the process. The deepest unobstructed (free of umbilical cord or fetal parts) and clear pocket of amniotic fluid is visualized and the image was frozen. Ultrasound calipers were manipulated to measure the pocket in a strictly vertical direction. The same process was repeated in all four quadrants and it was summed to get the AFI. When the AFI was less than 8, the four quadrant evaluation was performed 3 times and the average was taken as the final reading.

The perinatal outcome was judged by assessing the fetal distress predicted by abnormal FHR or meconium stained liquor, one minute and 5 minute Apgar score judged by paediatrician, frequency of admission to NICU, baby weight of less than 10th percentile for gestation age and perinatal mortality. All data were entered and analyzed using SPSS version 21. Mean and SD were derived for all the parametric variables. Chi square test was carried out at 5 % (0.05) level of significance to derive the statistical inference.

Results

The age wise distribution of the study subjects was shown in table 1. It is seen from the table that majority of the study subjects in both the groups were in the age group between 21 and 30 years and the mean age was 22.6 among group I patients and it was 23.5 among group II patients, there was no statistical significant difference in the age between the two groups.

<div align="center">Table 1: Age wise distribution of the study subjects</div>

Age group	Group I (Normal AFI) No. (%)	Group II (Abnormal AFI) Frequency	Chi-square value	P value
18-20	7(14%)	2(4%)		
21-30	41(82%)	45(90%)		

Above 30	2(4%)	3(6%)	3.73	0.443
Mean±SD	22.65±3.5	23.51±2.86		
Total	50(100%)	50		

Among our study subjects 46 were primigravida and the remaining 54 were multigravida and it was almost equally distributed between the two groups. Similarly the mean gestational age was between 38 to 40 weeks among both the groups and no statistical significant difference was observed between the groups with respect to gestational age and the gravida and the distribution of the consanguinity history of marriage was also equal in both the groups. The abnormal amniotic fluid index was classified as < 5 (oligohydramnios) and more than 25 (polyhydramnios) and among the abnormal AFI, 74% of the subjects were oligohydramnios and 26% were polyhydramnios (table 2).

Table 2: Distribution of the study subjects according to their AFI

AFI (cm)	Group I (Normal AFI) No. (%)	Group I (Abnormal AFI) No. (%)
<5	0	37 (74%)
6-25	50 (100%)	0
> 25	0	13 (26%)
Total	50 (100%)	50 (100%)

In our study the most common cause for the abnormal AFI was found to be idiopathic followed by anaemia, gestational hypertension, hypothyroidism and gestational diabetes particularly among polyhydramnios. Almost all the subjects in thecontrol group showed the colour of liquor to be colourless whereas 22% of the subjects with abnormal AFI showed meconium stained liqueur and in that majority were having AFI <5 (oligohydramnios) and the difference was found to be statistically significant (table 3). The ultrasonogram Doppler velocimetry had shown that there was no difference in the distribution of normal and abnormal Doppler between the two groups.

Table 3: Distribution of the study subjects based on the colour of amniotic fluid

Colour of Liquor	Group			To-tal	Chi square	P value
	Oligohydram-nios (Group II) N(%)	Polyhydram-nios (Group II) N(%)	Control (Group I) N(%)			
Colorless	27 (73%)	12(92%)	50 (100%)	89		
Meconium-stained liquor	10 (27%)	1 (8%)	-	11		
Total	37 (100%)	13 (100%)	50 (100%)	100	16.03	<0.001**

The nature of labour was found to be spontaneous in more than 50% of the study subjects in normal AFI group whereas in abnormal AFI group it was only 28% and for the remaining subjects the labour was induced. The most common drug used for inducing the labour was oxytocin and the difference was found to be statistically significant.

Seventy eight percent in normal AFI group had a full term normal delivery (FTND) compared to only 24% with abnormal AFI had FTND and this difference was found to be statistically significant.

Among the mode of delivery the most common mode of delivery among the group I patients was normal vaginal delivery whereas among the group II patients it was caesarean section and in that majority of them were taken for emergency caesarean section and the difference was found to be statistically significant (table 4).

Table 4: Distribution of the study subject according to their spontaneous labour and mode of delivery

Variable	Group I (Normal AFI) No. (%)	Group II (Abnormal AFI) No. (%)	Chi-square value	P value
Spontaneous Labour	27 (54%)	14 (28%)	18.76	<0.001
FTND	39 (78%)	12 (24%)	29.49	0.0001

Of the foetal outcome 6 neonate in group I and 16 neonates in group II got admitted in NICU post-delivery and the difference was found to be statistically significant and the common reasons for getting admitted in NICU were respiratory distress syndrome followed by hyperbilirubinemia (table 5).

Table 5: Various causes for NICU admission among the study subjects

Reasons for NICU admission	Group I (Normal AFI) (n=50)		Group II (Abnormal AFI) (n=50)		Chi-square value	P value
	Frequency	Percentage	Frequency	Percentage		
Hyperbilirubinemia	1	2%	4	8%		
Hypolycemia	0	0	2	4%		
RDS	4	8%	8	16%	10.67	0.014
IUGR	1	2%	2	4%		
Total	6	12%	16	32%		

The mean birth weight of the newborn in group I was found to be within normal limits whereas the birth weight of the newborns among the mothers with oligohydramnios was lesser than the normal and among the polyhydramnios it was higher than the normal and the difference was found to be statistically significant (table 6).

Table 6: Distribution of the study subjects based on their birth weight

Birth weight in kg	Oligohydramnios (Group II)		Polyhydramnios (Group II)		Control (Group I)		P value
	Frequency	%	Frequency	%	Frequency	%	
1.5-2	1	3%	0	0	0	0	
2-2.5	6	16%	1	8%	0	0	
2.5-3	28	76%	3	23%	36	72%	
3-3.5	2	5%	6	46%	14	28%	
>35	0	0	3	23%	0	0	<0.001
Total	37	100%	13	100%	36	100%	
Mean±SD	2.16±0.81		3.52±0.74		2.51±0.93		<0.0001*

P value derived by applying Man-Whitney U test; *- P value derived by applying ANOVA test

Similarly the APGAR score was higher among babies with mothers having normal AFI both at 1 min and 5 mins after birth compared to babies born to mothers with abnormal AFI for whom the APGAR score was less and the difference was found to be statistically significant (table 7).

Table 7: Distribution of the study subjects based on their APGAR score

Time	Apgar Score	Oligohydramnios (Group II) (n=37)		Polyhydramnios (Group II) (n=23)		Control (Group I) (n=50)		P value
		Frequency	%	Frequency	%	Frequency	%	
At 1 min	<7	19	51.3%	6	46%	11	22%	<0.001
	>7	18	48.6%	7	53.8%	39	78%	
At 9 mins	<9	18	48.6%	6	46%	16	32%	<0.001
	>9	29	78.3%	7	53.8%	34	68%	

Discussion

The present study was carried out to assess the effectiveness of measuring the AFI and its association with maternal and foetal outcome during the time of labour.

In the present study the mean age of the mothers in both the groups were between 23 to 24 years and the results are in comparable to the study conducted by Ghike et al where he found the mean age of women in study group was 24.65 years and among controls it was 24 years.

In our study we found that the distribution of primi gravida and multi gravid among both the groups were almost equal in numbers and the mean gravida was found to be 1.6 which is comparable to the study done by Baron et al in which he quoted that the mean gravida of his study subjects was 2

and another study done by Monica Chetani where they found the mean gravida as 1.7.13

In the current study 60% of oligohydramnios were primigravida and it was similar to the results derived by Garmel et al [14] in which they observed that 67% were primigravida and in the study done by Monica Chetani it was 63%.The mean gestational age in our study was 38.42 weeks in study group and 38.64 weeks in control group which is in par with the mean gestational age of 37.5 weeks in a study done by Casey et al. [15]

There was no significant difference according to gestational age in our study and control groups. In the current study we found that meconium stained liquor was more common among the abnormal AFI group when compared to the normal AFI and the difference was found to be statistically significant. Our study was well supported by Crowley et al,

who found statistically significant increase in MSL in patients with reduced amniotic fluid volume.

Similarly, Rutherford et al, Ergun et al, Magann et al, Casey et al, also observed that MSL was significantly higher in patients with oligohydramnios as compared with normal amniotic fluid index, whereas a study conducted by Voxman et al concluded that there was no difference between the groups with regard to meconium-stained liquor. In present study, induction of labour was more in oligohydramnios group than that in control group and the difference was found to be highly significant (p<0.001) and a similar association was also seen in the study done by Casey et al, in which they found that the rate of induction in patients with oligohydramnios as 42% and similar studies done by Rainford et al, Jandial et al, Gumus et al had also substantiated the findings.

Literatures had quoted that uteroplacental insufficiency and fetal compromise might be the reasons for the higher rate of induction in pregnancy with oligohydramnios. Chauhan et al. in their meta-analysis found that intrapartum AFI ≤ 5 was associated with increased risk of cesarean section for fetal distress (pooled RR = 1.7), which was similar to our study, whereas as an inverse relationship between amniotic fluid index and cesarean section for fetal distress was observed in a study done by Rutherford et al.

In the studies conducted by Sarno et al, Conway et al and Sriya, the rate of LSCS for fetal distress was higher in abnormal AFI group when compared to normal AFI group which is similar to present observation. Incidence of low birth weight (birth weight <2.5kg) was 20% in the study group compared to 0% in the control group and the difference was found to be statistically highly significant (p<0.001) and a similar results was mentioned in a study done by Ghike et al.

The reasons for low birth weight in patients having reduced AFI are either due to preterm birth or chronic placental insufficiency leading onto IUGR. In the current study we found a higher rate of admissions to NICU among the newborn babies delivered by the mother's with low AFI and the difference was found to have statistically significant association when compared to mothers with normal AFI and a similar type of results were reported in the studies done by Voxman et al, Gumus et al and Jandial et al. With relation to APGAR score we found a poor APGAR score at 1 min and 5 mins after birth among the babies delivered with abnormal AFI when compared to normal AFI and the difference was found to be statistically significant and it is in par with the results quoted by Grubb et al and Morris et al.

Conclusion

Abnormal AFI is associated with increased rate of pregnancy related complication like increased chance of inducing labour, meconium stained liquor, LSCS and increased perinatal morbidity like low birth weight, low APGAR score and higher incidence of respiratory distress syndrome leading on to the admission in NICU. So, AFI measurement in antepartum or intrapartum period can help to identify women who need increased antepartum surveillance for pregnancy complications and such women should be managed in a special unit to combat the complications effectively.

References

1. Arias F. Practical guide to high-risk pregnancy and delivery. 2nd ed. Missouri: Mosby; 1993.
2. Brace RA, Wolf EJ. Normal amniotic fluid volume changes throughout pregnancy. Am J Obstet Gynecol. 1989; 161: 382-8.
3. Casey BM, Mc-Intire DD, Donald D. Pregnancy outcome after diagnosis of oligohydramnios at or beyond 34 weeks of gestation. Am J Obstet Gynecol. 2000; 182(4): 902-12.
4. Chamberlain PF, Manning FA, Morrison I, Harman CR, Lange IR. The relationship of marginal and decreased amniotic fluid volumes to perinatal outcome. Am J Obstet Gynecol. 1984;150(3):245–9.
5. Chetani M, Deepika, Khajotia S, Kochar S. A Clinical study of amniotic fluid index at or beyond 28 weeks of gestation and its relation to perinatal outcome. Int J ReprodContraceptObstet Gynecol. 2017; 6(8): 3280-6.
6. Collen B, Morgan MA, Garite TJ. The impact of amniotic fluid volume assessed intrapartum on perinatal outcome. Am J Obstet Gynecol. 1995; 173(1): 167-74.
7. Dashe JS, Mclntire DD, Ramus RM, Santos Ramos R, Twickler DM. Hydramnios: anomaly prevalence and sonographic detection. Obstetrics and Gynecology. 2002;100 (1): 134-9.
8. Garmel SH, Chelmow D, Sha SJ. Oligohydramnios and appropriately grown fetus. Am J Perinatol. 1997; 14(6): 359-63.
9. Ghike S, Reddy G, Ghike NW. Increasing severity of oligohydramnios: A risk factor for outcome. J South Asian Feder Obst Gynecol. 2013; 5(1): 8-10.
10. Kofinas A, Kofinas G. Differencesinamniotic fluid patterns and fetal biometric parameters in third trimester pregnancies with and without diabetes. J Matern Fetal Neonatal Med. 2006; 19(10): 633–8.
11. Manning FA. Antepartum fetal testing: a critical appraisal. CurrOpinObstet Gynecol. 2009; 21(4): 348–52.
12. Nageotte MP, Towers CV, Asrat T, Freeman RK. Perinatal outcome with the modified bio-

physical profile. Am J Obstet Gynecol. 1994;170(6):1672–6.

13. Pauer HU, Viereck, Krauss V, Osmers R, Krauss T. Incidence of fetal malformations in pregnancies complicated by oligo and polyhydramnios. Archives of Gynecology and obstetrics. 2003; 268(1): 52-6.

14. Phelan JP, Smith CV, Small M. Amniotic fluid volume assessment with four quadrant technique at 36-42 weeks of gestation. J Reprod Med. 1987; 32(7): 540-2.

15. Thompson O, Brown R, Gunnarson G, Harrington K. Prevalence of polyhydramnios in third trimester in a population screened by first and second trimester ultrasonography. Journal of Perinatal Medicine. 1998; 26(5):371-7.