ORIGINAL ARTICLE

Comparison of Maternal and Foetal Outcome between Normal and Abnormal Amniotic Fluid Index in the Third Trimester of Pregnancy - A Longitudinal Analytical Study in A Tertiary Level Medical College of Suburban West Bengal, India

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ABSTRACT

Background: Amniotic fluid (AF) is the protective liquid present in the amniotic sac of a gravid uterus. Amniotic fluid has nutritive, protective and diagnostic functions. Amniotic Fluid Index (AFI) is most popular and reliable method for quantifying amniotic fluid, till date. AFI is one of the major parameters of foetal biophysical profile (BPP) that can predict perinatal and maternal outcomes. Periodical scanning of foetus is utmost essential during antenatal visits, especially in high-risk pregnancies, but there is no definite standard protocol regarding its frequency.**Methods:** This study was conducted in the department of Obstetrics & Gynaecology, College of Medicine & JNM Hospital, Kalyani, Nadia, India. This longitudinal analytical study included 356 patients, among whom 151 (42.4%) were in oligohydramnios group, 174 (48.9%) in normal group and 31 (8.7%) in polyhydramnios group.**Results:** The data revealed oligohydramnios was strongly associated with caesarean section (p = 0.0010). In oligohydramnios group, IUGR was found in 37 (24.5%) patients (p = 0.0297). Meconium-stained liquor was almost similar in all three categories i.e. 15 (10.0%) in oligohydramnios group, 18 (10.3%) in normal group and 5 (16.1%) in polyhydramnios group, respectively. There was higher SNCU admission among babies delivered by mothers with oligohydramnios (p = 0.0369). There was no statistically significant difference in 1 and 5 minutes APGAR scores among normal and abnormal AFI groups. **Conclusions:** It was inferred that LSCS, IUGR baby and SNCU admission rates were more in oligohydramnios group compared to other categories. The perinatal death was 3.3% with oligohydramnios compared to 1.7% with normal liqour. The results from this study emphasize on the importance of AFI among the various means of antepartum surveillance and predictors of foetal outcome.

KEY WORDS: Oligohydramnios, Polyhydramnios, Foetal Outcome, IUGR, AFI.

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Introduction

Amniotic fluid (AF) is the protective liquid present in the amniotic sac of a gravid uterus. Amniotic fluid has nutritive, protective and diagnostic functions. In some cases, the liqour volume can also be more or less than expected. There can be pregnancies with no fluid inside the amniotic sac, known as anhydramnios. [1]

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If the AF volume result is less, it is called oligohydramnios. Polyhydramnios occurs if there is increased production or decreased removal of AF. There is significant risk of foetal death in abnormally high or low AF volumes. [1]

Fluid present in the AF originally comes from the maternal plasma and passes through the foetal membranes, based on hydrostatic and osmotic forces. After development of placenta and foetal vessels, maternal plasma and solutes pass across the placenta to the foetus and then enters AF. AF exchange occurs through bi-directional diffusion between the foetus and the AF across the foetal skin, before keratinization. Swallowing and urination through the urethra become most important mechanisms after keratinization of the foetal skin. [1]

Ultrasound is a non-invasive method by which the amount of AF in the amniotic sac can be estimated. [2,3] Amniotic fluid assessment by ultrasound is an important tool for evaluation of foetal well-being beyond the period of viability. [4] There are many ways for amniotic fluid quantity assessment like clinical palpation, measurement of single deepest vertical pocket, amniotic fluid index (AFI) by four-quadrant technique as described by Phelan et al. in 1987. [5] AFI is most popular and reliable method among them for quantifying amniotic fluid, till date. AFI between 5 cm to 25 cm is normal, AFI less than 5 is called oligohydramnios and AFI more than 25cm is polyhydramnios. [1] It is one of the major parameters of foetal biophysical profile (BPP) that can predict perinatal and maternal outcomes, especially beyond the period of viability. [4]Hence it is crucial to scan the patient to note such a trend periodically during antenatal visits. Although there is no definite protocol for identifying compromised foetus, multiple opinions suggest that biweekly non-stress test and AFI assessment should be offered to all women at risk. [6] An ideal frequency of AFI monitoring for low-risk pregnancy is still unknown. As frequent monitoring may become more expensive with higher maternal anxiety, optimizing the number of ultrasound examinations is the need of the day.This study aimed to ascertain a reliable and convenient sonographic method of quantifying amniotic fluid and thereby predicting neonatal outcome in a suburban medical college with a limited-resource setting with SNCU facility.

Methods

Study design
Observational Longitudinal Analytical Study

Study population
Pregnant women of third trimester attending ANC outdoor clinic or admitted in the Maternity ward of the Department of Obstetrics & Gynaecology, College of Medicine & JNM Hospital, Kalyani, Nadia.

Inclusion criteria
- Antenatal patients in third trimester with USG proven singleton pregnancy
- Patients willing and consented for study participation.
- Gestational Age more than 28 weeks.

Exclusion criteria
- Mothers having major renal or heart diseases.
- Multi-foetal gestation.
- Gestational or pre-gestational Diabetes Mellitus.
- Foetuses with USG-proven Spina Bifida, Facial Cleft, Aneuploidy, Renal Agenesis, and Obstructive Uropathy.

Study area
Maternity, HDU and SNCU Wards of College of Medicine & J.N.M. Hospital, Kalyani, Nadia, West Bengal, India.

Study duration
This study was conducted for 1.5 years after getting approval

- Preparation - 2 months.
- Data Collection - 13 months.
- Analysis - 3 months.

Sample size
$n = z (1- a/2) \{p (1-p)\} / d2$

d = marginal error rate = 5% (assumed)

a = level of significance = 5%

p = expected proportion = 2% Polyhydramnios, 11% Oligohydramnios, 87% Normal.

Total Sample size = 31 (Polyhydramnios) + 151 (Oligohydramnios) + 174 (Normal) = 356.

Sampling (Recruitment of the participants)
Stratified Sampling.

Tools/ Description of procedure
After taking informed consent, pregnant mothers with singleton pregnancy at third trimester pregnancy attending ANC OPD or admitted in Maternity Ward were included for study participation. USG evaluation and questionnaire proforma were filled up. The participants were followed up as per protocol. After delivery, maternal and perinatal outcome evaluation was done. The latest USG was considered for the study.

Intervention
Not done.

Statistical Analysis
For statistical analysis data were entered into a Microsoft excel spreadsheet and then analysed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph-Pad Prism version 5. Data was summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. A chi-squared test ($\chi 2$ test) was performed considering the null hypothesis to be true. If the calculated p-value was below the threshold chosen for statistical significance ($\leq$ 0.05) then the null hypothesis was rejected in favour of the alternative hypothesis.

Results and Analysis
In our study, 151(42.4%) patients were included in the oligohydramnios group, 174(48.9%) patients in normal group and 31(8.7%) in polyhydramnios group (Figure 1).

Table 1 shows that majority of the patients were in 21-25 years age group i.e.174 (48.9%), followed by 26-30 years i.e.125 (35.1%) and least number was in 16-20 years age group with 28 (7.9%) women. It was found only 42% (n = 150) were booked cases. Among the un-booked mothers, oligohydramnios was found in 83 (40%) patients, normal AFI in 106 (51%) patients and 17 (9%) mothers had polyhydramnios. Most of the women participating in our study were from lower middle (n = 129) and upper lower (n = 113) categories according to Modified Kuppuswamy scale. It was found that the numbers of primigravida in oligohydramnios, normal AFI and polyhydramnios groups were 82 (42%), 95 (49%) and 16 (9%), 2nd gravida 49 (43%), 55 (48%), 11 (9%) and multigravida or gravida >2 were 20 (41%), 24 (50%) and 4 (9%) respectively.

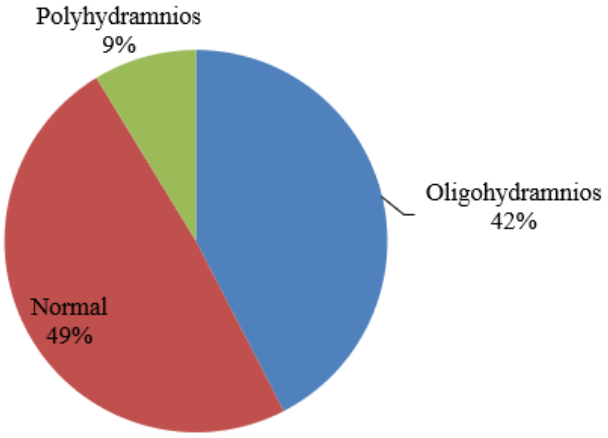

Figure 1: Pie Diagram showing group distribution

In normal group, 48 (27.6%) patients required LSCS and 126 (72.4%) patients delivered vaginally, whereas in oligohydramnios group, 68 (45.0%) patients underwent LSCS and 83(55.0%) patients delivered vaginally. Among women with polyhydramnios, 8 (25.8%) delivered by LSCS and 23 (74.2%) delivered vaginally. Thereby, association of LSCS with oligohydramnios was found to be statistically significant (p = 0.0010) (Figure 2).

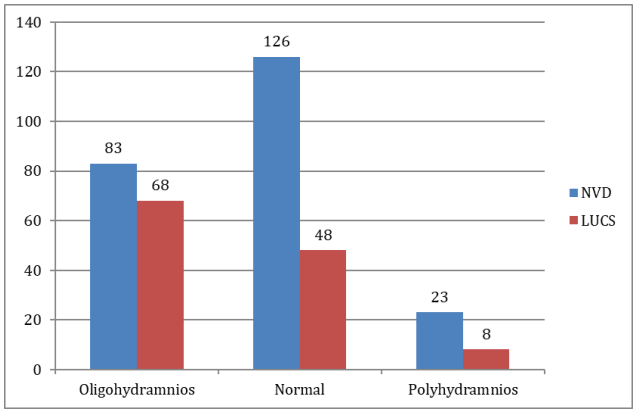

Figure 2: Bar Diagram showing type of delivery according to oligohydramnios, polyhydramnios and normal AFI

37 (24.5%) patients had IUGR in oligohydramnios category whereas the respective integer was 26 (14.9%) in patients with normal AFI and 2 (6.5%) in hydramnios cases (Table 2), oligohydramnios vs Normal Group Chi-square value: 4.7288; p-value: 0.0297 Polyhydramnios vs Normal Group Chi-square value: 1.6086; p-value: 0.2047). Thus, association

Table 1: Demographic distribution of patients according to oligohydramnios, polyhydramnios and normal AFI

		Oligohydramnios	Normal	Polyhydramnios	Total
Age Distribution (in years)	16-20	13 (46%)	14 (50%)	1 (4%)	28 (100%)
	21-25	71 (41%)	88 (50%)	15 (9%)	174 (100%)
	26-30	56 (45%)	58 (46%)	11 (8%)	125 (100%)
	>30	11 (38%)	14 (48%)	4 (14%)	29 (100%)
Gestational Age	Pre-term	20 (57%)	13 (37%)	2 (6%)	35 (100%)
	Term	129 (41%)	160 (50%)	28 (9%)	317 (100%)
	Post-Term	2 (50%)	1 (25%)	1 (25%)	4 (100%)
Booking Status	Yes	68 (45%)	68 (45%)	14 (10%)	150 (100%)
	No	83 (40%)	106 (51%)	17 (9%)	206 (100%)
Socio-economic Status	Upper	4 (40%)	5 (50%)	1 (10%)	10 (100%)
	Upper Middle	5 (18%)	17 (61%)	6 (21%)	28 (100%)
	Lower Middle	56 (43%)	60 (46%)	13 (11%)	129 (100%)
	Upper Lower	51 (45%)	55 (49%)	7 (6%)	113 (100%)
	Lower	35 (46%)	37 (49%)	4 (5%)	76 (100%)
Gravida	1	82 (42%)	95 (49%)	16 (9%)	193 (100%)
	2	49 (43%)	55 (48%)	11 (9%)	115 (100%)
	>2	20 (41%)	24 (50%)	4 (9%)	48 (100%)

of IUGR with oligohydramnios was statistically significant (p = 0.0297).

In oligohydramnios group 15 (10.0%) patients, normal AFI group 18 (10.3%) and in polyhydramnios group 5(16.1%) patients had meconium in liquor. The association of meconium with abnormal AFI was not statistically significant (Table 3), oligohydramnios vs normal Group Chi-square value: 0.015; p-value: 0.9026, oligohydramnios vs normal Group Chi-square value: 0.8838; p-value: 0.3472).

30 (19.9%) neonates underwent SNCU admission in mothers with oligohydramnios whereas those values were 20 (11.5%) in normal and 5 (16.1%) in the hydramnios categories respectively. The association of neonatal SNCU admission with oligohydramnios was statistically significant (p = 0.0369) (Table 4), oligohydramnios vs normal group Chi-square value: 4.3541; p-value: 0.0369, polyhydramnios vs normal group Chi-square value: 0.5278; p-value: 0.4675).

In oligohydramnios group, the mean APGAR SCORE 1 minute (mean± S.D.) of babies was 7.1921± 1.6762 and the mean APGAR SCORE 5 minutes (mean± S.D.) was 8.9139± 1.4280.In normal group, the mean neonatal APGAR SCORE 1 minute (mean± S.D.) was 7.3103± 1.6539 and the mean APGAR SCORE 5 minutes (mean± S.D.) of patients was 9.0747± 1.3257.In the third category, the mean APGAR SCORE 1 minute (mean±S.D.) of neonates was 6.9677± 1.3780 and the mean APGAR SCORE 5 minutes (mean± S.D.) was 8.8065± 1.4473 (Table 5), oligohydramnios vs normal group p value 0.524 at 1 minute and 0.296 at 5 minutes polyhydramnios vs normal group p value 0.223 at 1 minute and 0.342 at 5 minutes respectively).

Discussion

This longitudinal analytical study was conducted at ANC OPD, Maternity, HDU and SNCU wards of College of Medicine & JNM Hospital including 356 patients, among whom 151 (42.4%) patients were in oligohydramnios group, 174(48.9%) normal group and 31 (8.7%) and polyhydramnios group, respectively.

The association of gravidity with abnormal AFI was statistically not significant in our study.Ahmar R et al found that incidence of oligohydramnios was more in primipara (64.4%) in their study and the operative morbidity was also more in primipara (51.7%).[7] Our study revealed that in 78 (51.7%) patients with oligohydramnios, 68(39.1%) with normal AFI and 14(45.2%) patients with polyhydramnios were booked and there was no statistically significant association of abnormal AFI with booking status. In comparison to our study Ghimire S. and others found

Table 2: Distribution of IUGR with oligohydramnios, polyhydramnios and normal AFI

IUGR	Oligohydramnios	Normal	Polyhydramnios	Normal
Yes	37 (24.5%)	26 (14.9%)	2 (6.5%)	26 (14.9%)
No	114 (75.5%)	148 (85.1%)	29 (93.5%)	148 (85.1%)
TOTAL	151 (100.0%)	174 (100.0%)	31 (100.0%)	174 (100.0%)

Table 3: Distribution according to presence to meconium with oligohydramnios, polyhydramnios and normal AFI

Meconium	Oligohydramnios	Normal	Polyhydramnios	Normal
Yes	15 (10.0%)	18 (10.3%)	5 (16.1%)	18 (10.3%)
No	136 (90.0%)	156 (89.7%)	26 (83.9%)	156 (89.7%)
TOTAL	151 (100%)	174 (100%)	31 (100%)	174 (100%)

Table 4: Distribution according to neonatal SNCU admission with oligohydramnios, polyhydramnios and normal AFI

SNCU admission	Oligohydramnios	Normal	Polyhydramnios	Normal
Yes	30 (19.9%)	20 (11.5%)	5 (16.1%)	20 (11.5%)
No	121 (80.1%)	154 (88.5%)	26 (83.9%)	154 (88.5%)
TOTAL	151 (100%)	174 (100%)	31 (100%)	174 (100%)

Table 5: Distributionof mean Apgar score 1 min and 5 min with oligohydramnios, polyhydramnios and normal AFI

	APGAR SCORE 1 min			APGAR SCORE 5 min		
	Number	Mean	SD	Number	Mean	SD
Oligohydramnios	151	7.19	1.67	151	8.91	1.42
Normal	174	7.31	1.65	174	9.07	1.32
Polyhydramnios	31	6.96	1.37	31	8.80	1.44

94% booked cases in oligohydramnios group and 87% in normal AFI group.[8]

It was found that in oligohydramnios group 20 (13.2%) patients had preterm delivery compared to 129 (85.4%) women with term delivery. In normal AFI category, 1 (0.6%) patient had post-term delivery, 13 (7.5%) hadpreterm delivery and 160 (92.0%) had term delivery. Oligohydramnios group was associated with higher rate of preterm delivery but this was not statistically significant (p = 0.2608). We observed that patients with oligohydramnios was found to be significantly associated with LSCS (p = 0.0010). Most common indications for LSCS were foetal distress and non-progression of labour. Hederlingová J et al observed significant differences in number of obstetricinterventionrequired for patients with oligohydramnios, they had higher number of caesarean sections (71% compared to 33.9% in control group) and also the number of inductions was significantly higher (27.4% compared to 18.8%).[9]The most common indication for caesarean delivery in his study was presumed foetal hypoxia. On the contrary Bakhsh H et al established a statistically significant relation between polyhydramnios and late term deliveries (p = 0.005) and caesarean section rates (p = 0.008).[10] The rate of term deliveries was equal in normal AFI and oligohydramnios group (p = 0.005). Oligohydramnios was mostly associated with vaginal deliveries (p = 0.008) in their study.

The data in this study showed that oligohydramnios was associated with IUGR (p = 0.0297). Among participants with oligohydramnios 2 babies had club foot and in polyhydramnios group 1 baby had anencephaly. Ray P et al found that oligohydramnios associated with IUGR (21.4%).[11]Asgharnia M *et al* also observed that borderline AFI group had higher

rate of neonatal complications such as Apgar score of less than 7 (p = 0.004), IUGR (p = 0.0001), low birth weight (p = 0.001), and crucial need to NICU (p = 0.003).[12]

The relation of abnormal AFI with meconium in our study was not statistically significant.Ray P et al recorded the incidence of meconium-stained liquor in 75% of oligohydramnios cases which was significantly high. He also notified high risk of adverse perinatal outcome and higher rate of operative delivery in cases of borderline AFI at term.[11]

According to our observation, oligohydramnios was strongly associated with SNCU admission, which was statistically significant (p = 0.0369). The commonest cause of SNCU admission was respiratory distress 18 (60%) followed by pneumonia 8 (26%). On the other hand, polyhydramnios was not connected with increased SNCU admission.Bansal L et al concluded that liquor plays important role both in the development of the foetus and antenatal assessment of the foetal wellbeing. In their analysis, 24 (26.7%) neonates required NICU admissions and causes were respiratory distress in 12 (12.3%), neonatal jaundice in 5(5.5%) and congenital pneumonia in 1 (1.1%).[13]Casey B *et al* noted that pregnancies complicated with oligohydramnios were associated with increased admission in NICU (7% vs 2%, p < 0.001).[14]

In our study the mean APGAR SCORE 1 minute (mean± S.D.) of patients was higher in normal group [7.3103± 1.6539] compared to oligohydramnios group [7.1921± 1.6762] and polyhydramnios group [6.9677± 1.3780] but they were not of statistical importance. The mean APGAR SCORE at 5 minutes (mean± S.D.) was higher in normal group [9.0747± 1.3257] compared to oligohydramnios [8.9139± 1.4280] and polyhydramnios patients [8.8065± 1.4473]. Thus, statistical significance was not established between abnormal AFI and APGAR score. Shrem G et al included twelve studies with 35,999 women found patients with isolated oligohydramnios had higher rates of APGAR score < 7 at 1 and 5 minutes (OR 1.53, CI 1.03-2.26, and OR 2.01, CI 1.3-3.09, respectively).[15]

limitations

The sample size and study duration were limited. This study was done in a government hospital in West Bengal, India in a limited sample population which might not be the representative of the entire population. Only immediate follow-up of study subjects was done This was only an observational study and might not be suitable for confirmed protocol deduction because of unforeseen confounding factors.

Conclusion

The results from the present study showed that the LSCS rate, IUGR incidence, SNCU admission and perinatal mortality rates were specifically higher in oligohydramnios cases compared to the other two categories. It can be thereby inferred, that AFI is an acceptable and accessible means of antepartum surveillance and clearly predicts the foetal outcome.

Abbreviations

AF-Amniotic fluid, AFI-Amniotic Fluid Index, USG-Ultrasonography, BPP-Bio physical profile, LSCS-Lower Segment Caesarean Section, IUGR: Intrauterine growth restriction, ANC OPD-Antenatal care outpatient department, HDU-High Dependency Unit, SNCU- Sick Newborn Care Unit, NICU-Neonatal Intensive Care Unit

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