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A study on maternal and perinatal outcome in relation to amniotic fluid volume in pregnant women at term with or without risk factors

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Abstract
Background and Objectives: Amniotic fluid index (AFI) is a quick, noninvasive and good indicator of fetal outcome in high-risk pregnancy. Amniotic fluid volume measured as AFI is a good predictor of fetal tolerance during labor.
Materials and Methods: The present study consisted of n = 280 subjects (antenatal cases) with term gestations attending the Department of Obstetrics and Gynaecology at Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram (Dist.), Andhra Pradesh state, India, during the period between June 2018 to June 2020.
Results: Among the total n = 280 study subjects n = 142 (50.9%) subjects were primipara while n = 138 (49.2%) were multipara. Among n = 224 (80.3%) subjects, majority were having AFI >8, n = 33 (11.8%) subjects were recorded having AFI ranging between 5-8 followed by n = 17 (6.1%) with AFI between 3 - 5 and n = 5 (1.8%) subjects with AFI ≤ 3. The correlation of gestational age and Amniotic Fluid Index was statistically not significant. Out of the total n = 21 study subjects with oligohydramnios all the n = 21 (100%) subjects went under emergency Lower Segment Caesarean Section (LSCS). Out of n = 230 patients with normal AFI, n = 134 (58.33%) underwent emergency LSCS followed by n = 79 (34.65%) had Full Term Normal Delivery (FTND) and n = 17 (7.39%) subjects had a pre-term vaginal delivery (PTVD). The observations were statistically significant. Among n = 29 subjects with polyhydramnios, n = 23 (79.31%) subjects underwent emergency LSCS, followed by n = 5 (17.2%) underwent FTND and n = 1 (3.44%) underwent PTVD, the observations were statistically significant. Oligohydramnios has a significant correlation with caesarean section for fetal distress, low birth weight babies and Neonatal Intensive Care Unit (NICU) admissions. Apgar score was compared among the three groups. The correlation of Apgar score at 5 minutes with amniotic fluid was found statistically significant.
Conclusion: Careful antenatal evaluation and early detection of amniotic fluid abnormalities will reduce maternal / foetal morbidity and mortality more so in pregnancies at risk of an adverse pregnancy outcome. Determination of AFI should be used as an adjunct to other foetal surveillance methods. Choosing optimal mode of delivery could reduce maternal morbidities and improve labour outcome which will influence perinatal morbidity and mortality.

Keywords: Amniotic fluid, fetal, maternal, oligohydramnios, polyhydraminos

Introduction
Modern obstetrics is concerned with the health and wellbeing of both the mother and the unborn child. Recognition of a fetus at risk for death or damage in utero, quantifying the risk, balancing the fetal risk against the risk of neonatal complications from immaturity, and determining the optimal time and mode of intervention are the cornerstones of modern perinatal medicine.[1]
Amniotic fluid index (AFI) in pregnancy is a quick, noninvasive and one of the good indicators of fetal well-being and fetal outcome in high-risk pregnancy. Amniotic fluid measurement through sonographic examination is now an integral part of sonographic evaluation of pregnant women. Ultrasonography (USG) is an ideal tool for accurately, non-invasively and repeatedly assessing amniotic fluid volume (AFV) proposed by Phelan and colleagues [2].
Decrease in amniotic fluid volume is defined as oligohydramnios and sonographic diagnosis is based on AFI ≤ 5 cms or a single deep vertical pocket of amniotic fluid ≤ 2 cms. Amniotic fluid volume measured as AFI is a good predictor of fetal tolerance during labor. Decrease in amniotic fluid volume is associated with an increased risk of abnormal heart rate patterns, meconium staining, congenital anomalies, growth retardation, dysmaturity, and fetal asphyxia [3-5]. Rates of caesarean section are found to be high in patients with oligohydramnios due to severe variable decelerations, due to cord compression [6].

Abnormally increased amniotic fluid volume is defined as polyhydramnios and is sonographic diagnosed based on an AFI ≥ 25 cms or a single deep vertical pocket ≥ 8 cms. It is associated with gestational diabetes, major fetal anomalies [7], aneuploidy, macrosomia, and stillbirth [8]. Amniotic fluid provides a more accessible means than fetal blood for surveillance of the fetus and its environment. Polyhydramnios complicates about 1-5% of pregnancies, is sometimes associated with gestational diabetes, major fetal anomalies, aneuploidy, macrosomia, and stillbirth. In order to reduce perinatal morbidity and mortality, early monitoring of AFI must be performed. Hence the present study was undertaken to evaluate the relationship between amniotic fluid volume and the maternal and perinatal outcome.

Objectives

- To estimate the Amniotic Fluid Volume based on Amniotic Fluid Index.
- To study the maternal outcome in high risk and low risk women with relation to amniotic fluid index.
- To correlate the perinatal outcome in relation to Amniotic Fluid Volume.

Materials and Methods

The present study was conducted in the Department of Obstetrics and Gynecology, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram (Dist.), Andhra Pradesh state, India. This study subjects consisted of registered antenatal patients at term gestation with single live fetus in cephalic presentation.

The study group subjects constituted n = 280 registered antenatal cases presented at gestational age above 37 weeks conducted during the period between June, 2018 to June, 2020

Inclusion Criteria

- Full term pregnancy (37 - 40 weeks of gestation)
- Primigravida and multigravida
- Singleton pregnancy
- High risk pregnancies – hypertensive disorders, Diabetes mellitus, cardiac diseases
- Previous abortions also included
- Previous vaginal delivery.
- Wiling to participate.

Exclusion Criteria

- Multiple gestation.
- Previous scar
- Premature rupture of membranes
- Anomalous foetus
- Not willing to participate

The mothers during their first visit were included for detailed history, clinical examination and blood investigations as follows. Detailed case history including age / parity / menstrual history / obstetric history/ past and family history were taken. Detailed general and systemic examination of the patient was done. Obstetric examination with special reference to height of the uterus, symphysio-fundal height, abdominal girth, presentation and position of fetus, engagement of the presenting part and fetal heart was done.

Ultrasonography was done by radiologists, available on call i.e. by multiple persons (scan machine used LOGIQ S7). All patients underwent obstetric ultrasound examination to know the amniotic fluid index which was determined using Phelan's four quadrant technique. The largest vertical pocket free of fetal parts and umbilical cord loops in each quadrant was measured and sum of these measurements gave AFI in cm. An AFI of 10-12cm was considered normal at term. AFI of < 5 cm was considered severe oligohydramnios, and > 25cm was considered as severe polyhydramnios.

Maternal and foetal wellbeing was monitored in labour and labour was managed as per the hospital policy. Maternal outcome was assessed on the mode of delivery as to whether it is vaginal delivery, instrumental or operative delivery and postnatal complications if any. Fetal outcome was noted in the form of perinatal morbidity, which was assessed using Apgar score, birth weight, maturity, IUD, still births, neonatal deaths, admission to NICU or immediate perinatal period.

Ethical Committee approval was obtained from the Institutional Ethical Committee and permission obtained from HOD, Department of Obstetrics and Gynaecology to conduct the study. Informed consent was taken from all the participants before initiating the study.

Statistical analysis

Data was compiled and was analyzed for the statistical significance using chi-square test.

Results

The data of distribution of the experimental study subjects based on different characteristics is presented in Table 1. The data of age-wise distribution of the study subjects presented in Table shows that out of the total n = 280 study participants maximum number of subjects n = 124 (44.4%) were in the age group 25-30 years, followed by n = 108 (38.5%) between age group 18-25 years and the least n = 9 (3.2%) were between 35-40 years.

The data of parity-wise distribution of study participants recorded presented in the Table shows that among the total n = 280 study participants n = 142 (50.9%) subjects were primipara while n = 138 (49.2%) were multiparous. The data of the subjects distributed according to the gestational age shows that, out of the total n = 280 study cases n = 218 (78.1%) were between 38-39 weeks of gestational age, 41 (14.6%) were between 37-38 weeks of gestation followed by n = 21 (7.5%) with 39-40 week of gestation.

The data of the study participants distributed according to AFI shows that, out of the total n = 280 study participants n = 225 (80.3%) were recorded AFI > 8, n = 33 (11.8%) subjects AFI was ranged between 5-8 followed by n = 17 (6.1%) subjects AFI was between 3-5 and n = 5 (1.8%) study subjects AFI was recorded ≤ 3.

Table 1: Distribution of Experimental group subjects

Characteristics	Number of patients	Percentage (%)
Age wise (years)		
18-25	108	38.5
25-30	124	44.4
30-35	39	14.0
35-40	9	3.2
Parity-wise		
Primi	142	50.9
Multi	138	49.2
Gestational age-wise		
37-38	41	14.6
38-39	218	78.1
39-40	21	7.5
Amniotic Fluid Index (in cm)		
>8	225	80.3
5-8	33	11.8
3-5	17	6.1
≤3	5	1.8

Table 2: Gender-wise distribution delivery outcome

Gender	Number of subjects	Percentage (%)
Male	150	53.5
Female	130	46.6

The data of gender wise distribution of the subjects based on delivery outcome is presented in Table 2. The data shows out of total n = 280 study participants delivered n = 150 (53.5%) subjects were recorded to deliver male baby and n = 130 (46.6%) subjects female babies.

Table 3: APGAR score-wise distribution of new born babies

Apgar Score (at 5 min)	No. of subjects	Percentage (%)
<7	1	.4
≥7	278	99.6

The data of the subjects APGAR score-wise distribution of new born babies is recorded in Table 3. The data shows that out of the total n = 279 babies, n = 278 (99.6%) were recorded having APGAR score at 5 min ≥7 and 1 (0.4%) was having APGAR Score <7.

Table 4: NICU admission-wise distribution of the subjects

Admission	No. of subjects	Percentage (%)
Yes	75	26.9
No	204	73.1

NICU- neonatal intensive care unit

The data of NICU admission wise distribution of the subjects presented in the Table 4 shows that among the total n = 279 subjects n = 75 (26.9%) babies needed NICU admission.

Table 5: Age-wise distribution of Amniotic Fluid Index (in cm)

Age (in years)	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
18-25	10	88	9	108	0.009
	45.45	38.60	31.04	38.45	
25-30	6	108	10	124	
	27.27	47.37	34.48	44.44	
30-35	4	25	10	39	
	18.19	10.96	34.48	13.98	
35-40	2	7	0	9	
	0.09	3.07	0	3.23	
Total	22	228	29	280	
	100	100	100	100	

AFI- Amniotic Fluid Index, Oligo- oligohydramnios

The data of the subjects according to age-wise distribution of AFI (in cm) is presented in Table 5. The data in the table indicates that out of total n = 108 study participants in the 18-25 years of age group n = 88 (82.2%) subjects were recorded normal AFI (between 5-20 cm), n = 10 (9.3%) subjects were observed having oligohydramnios (AFI < 5) and n = 9 (8.4%) study participants were recorded having polyhydramnios (i.e. AFI > 20). Out of the total n = 124 participants in the age group of 25-30 years n = 108 (87.1%) subjects recorded normal AFI, n = 6 (4.8%) recorded oligohydramnios and n = 10 (8.1%) recorded polyhydramnios. Among the total n = 39 subjects between the age group 30-35 years n = 25 were recorded having normal AFI, among n = 4 (10.3%) were having oligohydramnios and 10 (25.6%) were having polyhydramnios. Among total of the n = 9 study participants between the age group 35-40 years, n = (77.8%) were observed having normal AFI and oligohydramnios among n = 2 (22.2%) study subjects and the observations were found statistically significant.

Table 6: Parity-wise distribution of AFI (in cm)

Parity	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
Primi	11	121	11	142	0.267
	7.74%	85.3%	7.7%	100%	
Multi	10	109	18	138	
	77.57%	79%	13.04%	100%	
Total	21	230	29	280	
	100	100	100	100	

AFI- Amniotic Fluid Index, Oligo- oligohydramnios

The data of the subjects on parity-wise distribution of AFI (in cm) is presented in Table 6. The data shows out that among the total n = 21 study participants with oligohydramnios n = 11 (45.45%) were primipara and n = 10 (54.55%) participants were multipara. Among n = 230 study participants with normal Amniotic Fluid Index n = 121 (53.07%) were Primipara and n = 109 (46.93%) were multipara. Among a total of n = 29 subjects with polyhydramnios n = 11 (37.93%) were primipara and n = 18 (62.07%) were multipara.

Table 7: AFI as per gestational age of the subjects

GA	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
37-38	3	32	6	41	0.156
	7.33%	78.04%	14.63%	100%	
38-39	16	179	23	218	
	7.34%	82.11%	10.55%	100%	
39-40	2	19	0	21	
	9.6%	90.4%	0%	100%	
Total	21	230	29	280	
	100	100	100	100.0%	

GA- gestational age, AFI- Amniotic Fluid Index, Oligo- oligohydramnios

The data of the distribution of the subjects on AFI as per gestational age is shown in the Table 7. It was observed that out of the total n = 21 study participants with oligohydramnios n = 3 (7.33%) subjects gestational age was between 37-38 weeks, n = 16 (7.34%) were in the gestation age between 38-39 weeks and n = 2 (9.6%) subjects in the 39-40 weeks of gestational age. Among a total of the n = 230 subjects with normal Amniotic Fluid Index, n = 32 (78.04%) study participants were between 37-38 weeks of gestation, n = 179 (82.11%) were having 38-39 weeks of gestation and n = 19 (90.4%) were in 39-40 weeks of gestation. A total of n = 29 (25.18%) study participants in the 37-40 weeks of gestation were recorded having Amniotic Fluid Index >20. The difference of gestational age and Amniotic Fluid Index was observed to be statistically not significant.

Table 8: Mode of delivery-wise distribution of Amniotic Fluid Index (AFI)

Mode of delivery	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
Emergency LSCS	21	134	23	178	
	11.8%	75.3%	12.9%	100%	
FTND	0	79	5	84	
	0%	94.0%	6.0%	100%	
PTVD	0	17	1	18	
	0%	94.5%	5.5%	100%	
Total	21	230	29	280	
	100	100	100	100	

AFI- Amniotic Fluid Index, Oligo- oligohydramnios

The data of mode of delivery-wise distribution of Amniotic Fluid Index (AFI) of the study subjects is presented in Table 8. It was observed that among the total n = 21 subjects with oligohydramnios n = 21 (100%) subjects underwent emergency LSCS. Among n = 230 study participants with normal AFI, n = 134 (58.2%) subjects were underwent emergency Lower Segment Caesarean Section (LSCS) followed by n = 79 (34.3%) subjects Full Term Normal Delivery (FTND) and n = 17 (7.39%) participants Pre Term Vaginal Delivery (PTVD). Among n = 29 subjects with polyhydramnios n=23 (79.31%) subjects had undergone emergency LSCS, n=5 (17.24%) participants FTND and n = 1 (3.45%) participants PTVD. The correlation of mode of delivery and amniotic fluid index was found statistically significant.

Table 9: Gender-wise distribution of Amniotic Fluid Index (AFI)

Gender	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
Male	12	120	18	150	0.674
	8.6%	79.5%	11.9%	100%	
Female	8	110	12	130	
	6.15%	84.7%	9.2%	100%	
Total	21	230	29	280	
	100	100	100	100.0%	

AFI- amniotic fluid index, Oligo- oligohydramnios

The data of gender-wise distribution of Amniotic Fluid Index (AFI) is recorded in the Table 9. The data shows that out of the total n = 21 study participants with oligohydramnios n = 12 (61.9%) subjects were recorded to having male babies and n = 8 (38.09%) female babies. Among the mothers with normal Amniotic Fluid Index n = 120 (52.17%) were having male babies and n = 110 (47.82%) subjects female babies. Out of the total n = 29 subjects with polyhydramnios n = 18 (62.06%) subjects were having male babies and n = 12 (41.37%) were recorded having female babies. The observations were statistically not significant.

Table 10: Birth weight wise distribution of Amniotic Fluid Index (AFI)

Birth weight (Kgs)	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
<2.5	9	60	9	78	0.290
	11.5%	77%	11.5%	100%	
>2.5	12	170	20	202	
	5.9%	84.2%	9.9%	100%	
Total	21	230	29	280	
	100%	100%	100%	100%	

AFI- amniotic fluid index, Oligo- oligohydramnios

The data of birth weight wise distribution of Amniotic Fluid Index (AFI) of the study subjects is recorded in the Table 10. It was observed that n = 11 (50%) study participants with Amniotic fluid index <5 recorded babies with birth weight less than 2.5 kg. n = 60 (26.31%) study participants with normal Amniotic Fluid Index had babies with birth weight < 2.5kg and n = 9 (31.03%) cases with polyhydramnios had babies with birth weight < 2.5 kg.

Table 11: APGAR score wise distribution of Amniotic Fluid Index (AFI)

APGAR at 5 min	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
<7	0	0	1	1	0.013
	0.0%	0.0%	100%	100%	
≥7	21	228	28	278	
	7.9%	82.0%	10.1%	100%	
Total	21	228	29	279	
	7.9%	81.7%	10.4%	100.0%	

AFI- amniotic fluid index, Oligo- oligohydramnios

The data of the subjects based on the APGAR score wise distribution of Amniotic Fluid Index (AFI) is presented in the Table 11. It was observed that none of the study participants with AFI < 5 had babies with APGAR score < 7. Only one participant with AFI > 20 had one baby with APGAR score < 7. The correlation of APGAR score at 5 min and Amniotic Fluid Index was found statistically significant.

Table 12: NICU admission-wise distribution of Amniotic Fluid Index (AFI)

NICU	AFI (in cm)			Total	p value
	<5 (Oligo)	5-20 (Normal)	>20 (Polyhydramnios)		
Yes	18	47	10	75	<0.05
	81.82	20.70	34.48	26.98	
No	4	181	19	204	
	18.18	79.30	65.52	73.02	
Total	22	228	29	279	
	100	100	100	100	

NICU- neonatal intensive care unit, AFI- amniotic fluid index, Oligo- oligohydramnios

The data of NICU admission-wise distribution of Amniotic Fluid Index (AFI) is shown in the Table 12. It was observed that out of total n = 22 study participants with oligohydramnios n = 18 (81.82%) babies needed Neonatal Intensive Care Unit (NICU) admission. Among the study participants with normal AFI, n = 47 (20.70%) babies needed NICU admission and out of n = 29 study participants with polyhydramnios n = 10 (34.48%) babies needed NICU admission. The observation was statistically significant.

Table 13: Comparison of Amniotic Fluid Index (AFI) with age (in years), gestational age (in weeks), AFI and birth weight (in kgs.) of babies

Parameter	< 5 (oligohydramnios)	5-20 (Normal)	>20 (polyhydramnios)
	Mean ± SD	Mean ± SD	Mean ± SD
Age (in years)	27.86±4.77	26.68±3.96	28.38±3.90
GA (weeks)	37.59±2.89	38.62±2.36	38.72±1.77
AFI (cm)	3.80±0.80	12.13±3.32	23.36±1.83
Birth weight (in kg)	2.40±0.66	2.73±0.63	2.87±0.12

SD- standard deviation, GA- gestational age, AFI- amniotic fluid index

The data recorded in the Table 13 shows that the study subjects with mean age 26.68 ± 3.96 years were having normal AFI, the study participants with mean age 27.86 ± 4.77 years were recorded having oligohydramnios and the subjects with mean age 28.38 ± 3.90 years were having polyhydramnios. The study subjects with mean gestational age 38.62 ± 2.36 weeks were recorded having normal AFI, participants with mean gestational age 37.59 ± 2.89 weeks were having oligohydramnios and the subjects with mean gestational age 38.72 ± 1.77 weeks were observed having polyhydramnios.

The study subjects with babies recorded having mean birth weight 2.73 ± 0.63 kg, 2.40 ± 0.66 and 2.87 ± 0.12 had normal

AFI, oligohydramnios and polyhydramnios respectively.

Discussion

The present study consisted of n = 280 antenatal subjects at term gestation registered at Department of Obstetrics and Gynaecology, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram (Dist.), Andhra Pradesh state, India were selected as the experimental study participants. The study was conducted on outpatients and on inpatients pregnant women admitted to the labour ward.

Among a total n = 280 subjects majority n = 124 (44.4%) were in the age group 25-30 years, followed by n = 108 (38.5%) in 18-25 years age group and least n = 9 (3.2%) were between 35-40 years age group. The study conducted by Sonian Madaan *et al.* [9] observed that the majority of subjects 62% were in the age group 21–25 years, followed by 27% in the age group 26–30 years, and the least (2%) were in the age group >31 years. The results of the study conducted by Biradar and Shamanewadi [10] recorded that the mean age of the subjects was 22.4 ± 3.5 year with majority 64% were belonging to the age group 21-25 years. The study results of Sowmya *et al.* [11] observed that the average age of the study participants was 22.86 years. The study conducted by Ahmar *et al.* [12] observed that maximum 64.4% subjects were in the age group 20-25 years. Runoo Ghosh [13] study results recorded 65.5% study participants belonged to the age group 20-25 years.

In the present study 50.9% subjects were primipara while 49.2% were multiparous similar results were reported earlier by Sonian Madaan *et al.* [9] recording 48% study participants were primigravida and 52%) multigravida. Patel *et al.* [14] observed 58.75% of the study participants were primipara and 41.25% were multipara. Biradar and Shamanewadi [10] reported that one third of the study participants were primigravida and two thirds were multigravida. Sowmya *et al.* [11] reported that 52% of the paricipants were primigravida and 48% were multigravida. Runoo Ghosh [13] observed that 35.5% participants were primigravida and the rest were multigravida.

The present study results noted that 14.6% subjects were between 37-38 weeks of gestational age, 78.1% were between 38-39 weeks of gestation followed by 7.5% with 39-40 week of gestation. Sonian Madaan *et al.* [9] study results recorded that the maximum cases 36% participant's gestational age was between 36-38 weeks at the time of enrolment. Bhagat and Chawla [15] study results showed that gestational age was < 37 weeks in 56% participants. Biradar and Shamanewadi [10] observed in their study that mean gestational age was 38.5±2.1 weeks.

In the present study out of the total n = 280 study participants 80.3% were recorded having AFI > 8, 11.8% participant's AFI was between 5-8 followed by 6.1% with AFI 3-5 and 1.8% study participants with AFI ≤ 3. Kaur *et al.* [16] reported that 40% study participants had AFI 4.1-5 followed by 34% participants with AFI between 2-3 and 26% participants had AFI between 3.1 to 4. The study reports of Chiniwar *et al.* [17] showed that 36% participants recorded AFI between2-3 followed by 36% AFI between 3.1-4 and 28% AFI between 4.1 -5.

The present study results observed that all the study participants i.e. 21 (100%) with AFI < 5 and n = 228 (100%) with AFI between 5-20 had babies with APGAR score ≥ 7. Only one participant with AFI > 20 had baby with APGAR score < 7. The correlation of APGAR score at 5 min and Amniotic Fluid Index was found statistically significant. The study conducted by Bhagat and Chawla [15] observed that an APGAR score < 7 at 5 min was noted in 4% subjects. The study conducted by Puri and Sharma [18] noted that APGAR score < 7 at 5 min was observed among 28% of babies in mother having oligohydramnios. The study results conducted by Patel *et al.* [14] observed that APGAR score of ≤ 7 at 5 minute was noted in 20% of the cases with oligohydramnios. The study conducted by Lalita and Bisht [19] recorded that 54% of the cases with oligohydramnios had 5 min APGAR < 7. The study results conducted by Sowmya *et al.* [11] noted that APGAR score > 7 was observed in 86% babies of oligohydramnios mother. The study results of Ahmar *et al.* [12] recorded that APGAR score < 7 at 5 min was observed among 27.8% of the babies with mother having oligohydramnios. Runoo Ghosh [13] study results recorded that APGAR score measured < 7 at 5 minutes was in 43.6% of babies with mothers having oligohydramnios. The study conducted by Sarma [20] observed that 21.4% babies of mother with oligohydramnios had APGAR score at 5 minute ≤ 6 compared to 5% babies of mother with normal Amniotic Fluid Index had APGAR score at 5 minute ≤ 6. The study conducted by Suchithra *et al.* [21] observed that 18% of the study participants with oligohydramnios had APGAR score < 7 at 5 minutes. The study conducted by Chiniwar *et al.* [17] observed that APGAR score < 7 at 5 minutes was observed in babies of 12% mothers with oligohydramnios and 2% babies with mothers having normal Amniotic Fluid Index.

The present study results revealed that out of the total n = 108 study participants in the age group between 18-25 years 88 (82.2%) having normal AFI i.e., between 5-20, n = 10 (9.3%) were having oligohydramnios i.e. AFI < 5 and n = 9 (8.4%) study participants were having polyhydramnios i.e. AFI > 20. Out of the total n = 124 participants in the age group between 25-30 years n = 108 (87.1%) having normal AFI, n = 6 (4.8%) having oligohydramnios and n = 10 (8.1%) were having polyhydramnios. The study participants in the age group 30-35 years having normal AFI was among n = 25 (64.1%), oligohydramnios among n = 4 (10.3%) and polyhydramnios among n = 10 (25.6%). Normal AFI was observed among n = 7 (77.8%) and oligohydramnios among n = 2 (22.2%) study participants in the age group 35-40 years. The observation was found statistically significant. The study conducted by Sonian Madaan *et al.* [9] observed that the mean AFI was maximum, between 34–36 weeks i.e.,13.1 cm, after which it gradually decreased to 9.08 cm beyond 40 weeks. Mean AFI of patients with 40 weeks of gestation gradually decreased from 12.2 cm to 8.0 cm after 42 weeks (p value \ 0.05) implies significant relationship between post-term pregnancy and AFI. The study conducted by the Vasanthamani *et al.* [22] observed that 81% of the study participants in the age group 20-30 years recorded Amniotic Fluid Index < 5 cm. The study conducted by Yashodhara Gaur *et al.* [23] observed that the rate of oligohydramnios was 57.89% among the study participants in the age group 26-30 years and 5.26% among the study participants in the age group > 30 years. The study conducted by Puri and Sharma [18] noted that 52% of the study participants with oligohydramnios were in the age group 21-25 years and 36% study participants with oligohydramnios in the age group 25-30 years. The study conducted by the Lalita and Bisht [19] noted that 80% of the study participants with oligohydramnios had gestational age more than 37 weeks.

It was observed that out of total n = 21 participants with oligohydramnios n = 11 (45.45%) were primipara and n = 10 (54.55%) participants were multipara. Among n = 230 study participants with normal Amniotic Fluid Index n = 121 (53.07%) were primipara and n = 109 (46.93%) were multipara. Out of n = 29 study participants with polyhydramnios n = 11 (37.93%) were primipara and n = 18 (62.07%) were multipara. The

observation was statistically not significant. The study conducted by Puri and Sharma [18] noted that among participants with oligohydramnios 62% were nullipara, 32% were primipara and 6% multipara. The study conducted by Gayatri Mathuriya *et al*. [24] observed that maximum number of women 37% with oligohydramnios and 48% women with normal Amniotic Fluid Index were primigravida. The study results of Neeta Sarma [20] observed that 53.6% mother with oligohydramnios was primipara and 46.4% were multipara. Whereas, 53% mothers with Amniotic Fluid Index > 5 were primipara and 47% were multipara. The study conducted by Suchithra *et al*. [21] observed that 86% of the study participants with oligohydramnios were primipara and 14% were multipara.

In this study out of the total n = 21 study participants with oligohydramnios 14.2% were having gestation age 37-38 weeks, 76.2% 38-39 weeks and 9.5% were in the 39-40 weeks of gestation. Out of the total n = 230 study participants with normal Amniotic Fluid Index 13.9% were having gestational age between 37-38weeks, 77.9% were having 38-39 weeks of gestation and 8.2% 39-40 weeks. Among n = 6 (20.6%) of study participants in 37-38 weeks of gestation and n = 23 (79.4%) subjects in gestational age between 38-39 weeks were having Amniotic Fluid Index > 20. The difference of gestational age and Amniotic Fluid Index was statistically not significant. In the study results by Runoo Ghosh [13] observed that 72.2% mothers with oligohydramnios were in 34-37 weeks gestational age.

In this study it was observed that out of total n = 21 subjects with oligohydramnios n = 21 (100%) underwent emergency LSCS. Among n = 230 subjects with normal AFI n = 134 (58.33%) participants underwent emergency LSCS followed by n = 79 (34.65%) with FTND and n = 17 (7.02%) participants with PTVD.

Among n = 29 subjects with polyhydramnios n = 23 (79.31%) underwent emergency LSCS, n = 5 (17.24%) subjects with FTND and n = 1 (3.45%) participants with PTVD. The correlation of mode of delivery and amniotic fluid index was found statistically significant. The study conducted by Rashid *et al*. [25] revealed that the LSCS rate was significantly higher in the study participants with AFI < 5. The findings were similar to observations of the present study. The study conducted by Bhagat and Chawla [15] observed that total caesarean delivery was 56% among participants with Amniotic Fluid Index < 5. The study done by Soumini and Ramna [26] observed that there was increased (12.1%) caesarean section rate among the participants with polyhydramnios and rate of preterm delivery in the participants with polyhydramnios was 6%. The study results by Vasanthamani *et al*. [22] observed that rate of vaginal delivery and LSCS among the study participants with oligohydramnios was 35% and 65% respectively. The study conducted by Yashodhara Gaur *et al*. [23] observed that the rate of vaginal delivery among the study participants with oligohydramnios was 39.5%. The study conducted by Puri and Sharma [18] noted that rate of caesarean delivery among the study participants with oligohydramnios was 76% and oligohydramnios with AFI ≤ 5 is associated with statistically significant high caesarean delivery rate. The study conducted by Patel *et al*. [14] observed that rate of caesarean delivery among the participants with oligohydramnios was 81.25%. The study conducted by Kaur *et al*. [16] observed that 48% of the study participants with oligohydramnios underwent LSCS delivery and 40% participants had normal vaginal delivery. The study conducted by Lalita and Bisht [19] noted that 80% of the cases with Amniotic Fluid index < 5 underwent LSCS delivery. The study conducted by the Biradar and Shamanewadi [10] observed that 62% patients with oligohydramnios underwent LSCS delivery and 38% had vaginal delivery. The study conducted by Sowmya *et al*. [11] noted that 68% of the study participants with oligohydramnios had delivered by LSCS and 32% by the normal delivery. The study conducted by Ahmar *et al*. [12] observed that the mode of delivery was normal vaginal delivery among 60% study participants with oligohydramnios and mode of delivery was LSCS among 40% of the participants. The study conducted by Gayatri Mathuriya *et al*. [24] observed that 35% of women with oligohydramnios and 10% women with normal Amniotic Fluid Index underwent LSCS while, 90% women with normal Amniotic Fluid Index delivered normally. The study conducted by Runoo Ghosh [13] observed that mode of delivery was LSCS and normal vaginal in 49.1% and 47.3% of mothers having oligohydramnios respectively. The study conducted by Durga and Mamatha [27] noted that 71.42% subjects with Amniotic Fluid Index delivered by LSCS. The study conducted by Chiniwar *et al*. [17] observed that 58% study participants with oligohydramnios delivered baby by LSCS and 20% mothers with normal AFI delivered by LSCS.

In this study n = 9 (42.8%) subjects with Amniotic fluid index <5 had babies with birth weight < 2.5 kg. 60 (26.31%) subjects with normal Amniotic Fluid Index had babies with birth weight < 2.5kg and n = 9 (31.03%) study participants with polyhydramnios had babies with birth weight < 2.5 kg. The study conducted by Bhagat and Chawla [15] observed that birth weight <2.5 kg was found in 56% babies of the study participants with AFI < 5. The study conducted by Vasanthamani *et al*. [22] observed that 34% mothers with oligohydramnios had low birth babies i.e. < 2.5kg. The study conducted by Puri and Sharma [18] noted that the rate of low birth weight babies among the mothers with oligohydramnios was 36%. The study conducted by Lalita and Bisht [19] noted that women with oligohydramnios usually have low birth weight babies. The study conducted by Biradar and Shamanewadi [10] observed that the incidence of low birth weight (<2.5Kg) was seen in 38.6% babies with mothers having Amniotic Fluid Index < 5. The study conducted by Sowmya *et al*. [11] noted that 48% babies of oligohydramnios mother had birth weight < 2.5 kg. the study conducted by Choudhary *et al*. [28] observed that the mean birth weight was low in oligohydramnios group. The percentage of low birth weight in oligohydramnios group was 35%. The study conducted by Runoo Ghosh [13] observed that 71% babies had low birth weight among the mothers with oligohydramnios. The study conducted by Neeta Sarma [20] observed that 30% babies of mother with oligohydramnios had birth weight < 2.5 kg compared to 6% babies of mother with normal Amniotic Fluid Index had birth weight < 2.5 kg. the study conducted by Sudha Chourasia *et al*. [29] observed that 41.5% babies of mother having polyhydramnios had birth weight >2.5 kg and 69.9% were having birth weight <2.5kg

In thw current study it was observed that none of the study participants with AFI < 5 had babies with APGAR score < 7. Only one participant with AFI > 20 had baby with APGAR score < 7. The correlation of APGAR score at 5 min and Amniotic Fluid Index was found statistically significant. The study conducted by Bhagat and Chawla [15] noted that that an APGAR score < 7 at 5 min was noted in 4% women. The study conducted by Rashid *et al*. [25] revealed that the poor APGAR score at 5 min in 46.7% subjects with low Amniotic Fluid Index, the findings were in contrast to the observations in the present study. The study conducted by Vasanthamani *et al*. [22] observed that the rate of low APGAR score (<7) at 5 min was observed among 11% of babies of mother having Amniotic Fluid Index <

5. The study results by Rachana Choudhary *et al*. [28] observed that APGAR score < 7 at 5 min of birth was found in 7% of the subjects with oligohydramnios.

In this study it was observed that out of total n = 21 study participants with oligohydramnios n = 18 (81.82%) babies needed NICU admission. Among study participants with normal AFI, 47 (20.70%) babies needed NICU admission and out of 29 subjects with polyhydramnios n = 10 (34.48%) babies needed NICU admission. The observations were statistically significant. The study conducted by Bhagat and Chawla [15] observed that NICU admission was needed in 92% with AFI <5. The study conducted by Soumini and Ramna [26] observed that of 8% babies of the study participants with polyhydramnios needed NICU admission. The study conducted by Puri and Sharma [18] noted that 32% of the neonates of mothers having oligohydramnios needed NICU admission. The study conducted by Lalita and Bisht [19] noted that 60% neonates of mothers with oligohydramnios needed NICU admission. The study conducted by Biradar and Shamanewadi [10] observed that 40% new-borns of mothers having oligohydramnios needed NICU admission. The study results by Sowmya *et al*. [11] noted that 14% of the babies of oligohydramnios mother needed NICU admission. The study results of Rachana Choudhary *et al*. [28] observed that NICU admission was 15% in oligohydramnios participants. The study conducted by Neeta Sarma *et al*. [20] observed that 25.7% babies of mother with oligohydramnios needed NICU admission compared to 3% babies of mother with normal Amniotic Fluid Index needed NICU admission.

In this study it was observed that study participants with mean age 26.68±3.96 years were having normal AFI, the subjects with mean age 27.86 ± 4.77 years were having oligohydramnios and participants with mean age 28.38 ± 3.90 years having polyhydramnios. The study participants with mean gestational age 38.62 ± 2.36 weeks were having normal AFI, participants with mean gestational age 37.59 ± 2.89 weeks were having oligohydramnios and subjects with mean gestational age 38.72 ± 1.77 weeks were having polyhydramnios. The study conducted by Bhagat and Chawla [15] noted that mean maternal age was 27.04 with Amniotic Fluid Index < 5. The study conducted by Gayatri Mathuriya *et al*. [24] observed that mean age of women with oligohydramnios was 24.40 ± 3.81 years, while it was 23.83 ± 3.77 years in women with Amniotic Fluid Index between 8-20 cm. The study conducted by Lalita and Bisht [19] noted that mean maternal age was 27.40 ± 1.45 with AFI <5. The study conducted by Suchithra *et al*. [21] observed that mean age was 23.7 ± 2.3 with AFI < 5.

Conclusion

Amniotic fluid is a highly complex and dynamic system which can be utilized in the interpretation of foetal well being. When the abnormalities of amniotic fluid exist appropriate working to uncover the underlying aetiology should be initiated as foetal outcomes are sometimes associated with these variations from normalcy.

Ultrasonography is a quick, noninvasive, feasible and reliable tool to assess amniotic fluid levels in pregnancy. Careful antenatal evaluation and early detection of amniotic fluid abnormalities will reduce maternal / foetal morbidity and mortality more so in pregnancies at risk of an adverse pregnancy outcome. Determination of AFI should be used as an adjunct to other foetal surveillance methods. Choosing optimal mode of delivery could reduce maternal morbidities and improve labour outcome which will influence perinatal morbidity and mortality.

Ultimate goal of appropriate timing of delivery for the mother with abnormal liquor volume with an intention to reduce perinatal morbidity and mortality could be challenging for obstetricians.

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