

Antepartum Evaluation of Amniotic Fluid Volume and its Impact on Mode of Delivery and Perinatal Outcome

Vachhani Ashvinkumar Dayalal¹, Rajpura Siddharth Bharatbhai², Chaudhary priyanka³, Patel Krunal⁴, Baldaniya Mamta⁵, Hirani Aishwariya⁶

Author's Affiliation:

¹Professor and Head, ²Assistant Professor, ³Third year resident, ^{4,5,6}Second year resident, Department of Obstetrics and Gynecology, Surat Municipal Institute of Medical Education and Research (SMIMER), Surat, Gujarat 395010, India.

Corresponding Author:

Rajpura Siddharth Bharatbhai, Assistant Professor, Department of Obstetrics and Gynecology, Surat Municipal Institute of Medical Education and Research (SMIMER), Surat, Gujarat 395010, India.

E-mail: siddraj0903@gmail.com

Received on 15.06.2019,

Accepted on 12.07.2019

Abstract

Background: Amniotic fluid is an important part of pregnancy which plays a vital role in the normal growth of the fetus and, promotes muscular-skeletal development and allows for easier fetal movement, also its very crucial for the survival of the fetus. It also create hydrostatic wedge which helps in dilatation of cervix during labour. Women with oligohydramnios are more likely to have abnormal or non-reactive FHR tracings, increased incidence of fetal distress, and thus an increased incidence of caesarean sections. Oligohydramnios is also the leading indication for labor induction. **Aims:** (1) To know the proportion of the oligohydramnios. (2) To study the impact of amniotic fluid index on mode of delivery. (3) To study the impact of amniotic fluid index on perinatal outcome. **Study design:** Prospective Descriptive hospital based study. **Material & methods:** The study was conducted in department of obstetrics and Gynaecology, at Tertiary care center. **Statistical Analysis:** Data was analyzed using SPSS Ver 23. Frequencies, Descriptive, chi square test were done. **Result:** Out of total 384 patient, 80 patient had oligohydramnios (AFI <5 cm). oligohydramnios associated with high rate of induction of labour (86.3%), meconium stained liquor (70.1%) and fetal distress (40%), that lead to high rate of LSCS (63.8%) and NICU admission (30%) and high neonatal complication like birth asphyxia, RDS, Jaundice, MAS, Septicemia which was 23.75%, 16.3%, 25%, 6.3%, 6.3% respectively. **Conclusion:** 1. Determination of AFI is a valuable screening test for predicting fetal distress & neonatal outcome. 2. From study, it is suggested that antepartum evaluation of amniotic fluid volume may prove useful in reducing perinatal mortality and morbidity and improving pregnancy outcome.

Keywords: Oligohydramnios; Amniotic fluid volume; Induction of labour; Perinatal Outcome.

How to cite this article:

Vachhani Ashvinkumar Dayalal, Rajpura Siddharth Bharatbhai, Chaudhary priyanka, *et al.* Antepartum Evaluation of Amniotic Fluid Volume and its Impact on Mode of Delivery and Perinatal Outcome. Indian J Matern Fetal Neonatal Med. 2019;5(2):101-110.

Introduction

Amniotic fluid is an important part of pregnancy which plays a vital role in the normal growth of the fetus and, promotes muscular-skeletal development and allows for easier fetal movement.¹ Amniotic fluid assessment is an essential part of evaluation of fetus health in terms of fetal distress, meconium aspiration, caesarean and fetal mortality. Amniotic Fluid Index (AFI) is the most common way for the estimation of amniotic fluid volume which is performed by ultrasound method.²

Phelan defined oligohydramnios as amniotic fluid index (AFI) <5 cm and borderline oligohydramnios as AFI between 5 and 8 cm between 36–42 weeks of gestation.³ Oligohydramnios occurs in about 1–5% of pregnancies at term.⁴ In pregnancies of more than 40 weeks of gestation, the incidence may be more than 12% as the amniotic fluid volume declines progressively after 41 weeks of gestation.^{4,5}

Oligohydramnios is also the leading indication for labor induction; oligohydramnios are more likely to have abnormal or non-reactive FHR tracings, increased incidence of fetal distress, and thus an increased incidence of caesarean sections.^{2,4}

However, there were no specific perinatal care protocols for these patients and that could be because of different reasons such as the variations in the study designs, lack of randomized trials, our inability to calculate likelihood ratio, absence of receiver-operating characteristic curve to determine the thresholds of adverse outcomes, and therefore more research will be required to find out the effect of AFI on adverse pregnancy outcome.^{1,2,4,49}

Keeping in mind the above knowledge, the present study was carried out to find whether oligohydramnios can be used as a predictor of adverse perinatal outcome in non complicated pregnancies.

Aims and Objectives

1. To know the proportion of the oligohydramnios.
2. To study the impact of amniotic fluid index on mode of delivery.
3. To study the impact of amniotic fluid index on perinatal outcome.

Materials and Methods

Study design: Prospective Descriptive study.

Study area: The study was conducted in department

of obstetrics and Gynaecology, at Tertiary care center.

Study population: The pregnant women attending OPD or admitted in labour room who fulfill selection criteria were randomly selected.

Sample size: 384

Formula: anova, chie square test, descriptive statistics.

Inclusion criteria

1. Singleton pregnancy with cephalic presentation.
2. Gestational age more than 32 weeks.
3. Presence of intact membrane.
4. Patient should have delivered during same hospitalization when AFI was determined.

Exclusion criteria

1. Multifetal Gestation
2. Previous LSCS
3. Associated fetal anomalies
4. Gestational age less than 32 weeks
5. Premature rupture of membrane
6. Malpresentation
7. Intrauterine death of the fetus.

Grouping of patients is as follows

1. Group I : AFI <5 cms -oligohydramnios
2. Group II : AFI 5–8 cms – borderline AFI
3. Group III : AFI 8–18 cms – normal AFI

Method of Study

After taking written and informed consent and fulfilling the inclusion criteria, patients will include into the study. Detailed antenatal history including presence of high risk factors was elicited from the patient, then they were clinically examined and subjected to ultrasonography.

Amniotic fluid index technique

Each ultrasonographic examination will perform trans-abdominally with real-time equipment and a 3.5 MHz linear-array transducer.

1. Patient is placed in supine poition.
2. Divide the uterus into 4 quadrants using the maternal sagittal midline vertically and an

arbitrary transverse line approximately half way between the symphysis pubis and upper edge of uterine fundus.

3. The transducer must be kept parallel to the maternal sagittal plane and perpendicular to maternal coronal plane.
4. The deepest, unobstructed and clear pocket of amniotic fluid is visualized and the image is frozen. The ultrasound calipers are manipulated to measure the pocket in a strictly vertical direction.
5. The process is repeated in each of the 4 quadrants and pocket measurements summed = AFI.
6. If the AFI < 8 cm perform the 4 quadrant evaluation 3 times and average the values.

The management protocol was similar in all groups. Those women who had high risk factors like preeclampsia, post-term pregnancy, non-reactive NST, deranged Doppler with IUGR and oligohydramnios at term were induced using dinoprostone gel (PGE2) or oxytocin. Women with no other risk factors were allowed for spontaneous onset of labour. During labour intermittent auscultation of fetal heart rate were done to detect any signs of fetal distress. Artificial rupture of membranes were done in active phase of labour or who developed FHR drop on auscultation, to notice the color of liquor and was classified as clear, thin meconium stained liquor and thick meconium stained liquor. progress of labour was monitored on a partograph. Those who developed fetal distress with or without meconium stained liquor which persisted inspite of corrective measures were delivered by LSCS or forceps delivery. Study conducted to observe outcome of labour in form of perinatal outcome and maternal outcome:

- (1) To study the effects of Oligohydramnios on fetal outcome in form of - (a) Fetal distress (b) Growth retardation (c) NICU admission
- (2) To study APGAR scores of newborn babies in relation to Oligohydramnios
- (3) To study neonatal condition until discharge or death.
- (4) To study maternal outcome in form of induced labour and mode of delivery.

Statistical Analysis

The results were statistically analyzed using parameters like mean, standard deviation, frequencies, cross tabulations, percentages; chi-

square test is carried out and given the significance of study. In addition, epidemiological parameters like sensitivity, specificity, positive predictive value, negative predictive value were used. Data was analyzed using SPSS Ver 23. Frequencies, Descriptive, chi-square test were done.

Formulation of Hypothesis

Null Hypothesis: H_0 = There is no correlation between the AFI levels and other parameters

Alternate Hypothesis H_a = There is correlation between the AFI levels and other parameters

p -value < 0.05 is considered as statistically significant.

If p -value < 0.05 we can reject the null hypothesis and consider the alternate hypothesis

Results

1. In present study percentage of multigravida in oligohydramnios group was 58.8%, borderline group was 56.2% and in normal group was 65.8%.
2. Percentage of primigravida in oligohydramnios group was 41.3%, in borderline group was 43.8% and in normal group was 34.2%.
3. Out of 80 patients with AFI up to 5, 65% had to undergo caesarian delivery and 86.3% needed induced labour while only 7.5% had spontaneous labor. In cases with more than 5 AFI, 49.7% had spontaneous labor and 42.2% had induced labor and only few 8.8% had caesarian delivery. Their was statistically significant ($p < 0.01$) association of AFI cutoff with the type of labor.
4. The rate of ANC complications was almost comparable in all groups. PIH was found in 17.5% mothers and anaemia in 10% mothers in AFI Group 1. 9.52% of PIH and 11.4% of anaemia in AFI Group 2. In AFI group 3, 4.5% mothers had PIH and 9% had anaemia.
5. The incidence of thick meconium in oligohydramnios group was 33.8%, borderline group was 3.9%. and normal was 1%.
6. The incidence of thin meconium in oligohydramnios group was 36.3% borderline group was 15.2% and normal was 6.5%.
7. The mean of APGAR score at 1 min in oligohydramnios group was 6.8, borderline group was 7.6 and normal was 7.8.

- 8. Mean of APGAR score at 5 min in oligohydramnios was 7.9, borderline was 8.6, and normal was 8.7.
- 9. Birth weights <2500 grams was seen more in oligohydramnios group i.e., 57.5%, borderline group was 41.9% and normal group was 38.19%.
- 10. The incidence of NICU admissions was high among oligohydramnios group which was 30%, in borderline group was 6.6% and normal group was 1.5%. Most common indication being birth asphyxia and meconium aspiration.
- 11. There were 3 neonatal deaths in the whole study. all deaths occur in oligohydramnios Group 1. Cause of death is birth asphyxia with meconium aspiration.
- 12. Sensitivity of AFI up to 5 cm for caesarean delivery was 67.10% and AFI up to 5 cm had 91.77% negative predictive value

Table 1: Grouping of pregnant women according to AFI level

Group	AFI	Frequency	Percent
Group I	>5 cm	80	20.8
Group II	5-8 cm	105	27.3
Group III	<8 cm	199	51.8
	Total	384	100.0

Table 2: Distribution of study population according to gravida status.

Gravida		Groups			Total
		Group I	Group II	Group III	
Single	N	33	46	68	147
	%	41.3%	43.8%	34.2%	38.3%
Multiple	N	47	59	131	237
	%	58.8%	56.2%	65.8%	61.7%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		3.08		<i>p</i> -value	0.214 NS

NS- Not significant (*p* > 0.05)

Table 3: Distribution of study population according to gestational period

Gestation period		Groups			Total
		Group I	Group II	Group III	
<36 weeks	N	6	11	25	42
	%	7.5%	10.4%	12.5%	10.9%
37-42 weeks	N	72	92	174	338
	%	90%	87.6%	87.5%	88%
>42 weeks	N	2	2	0	4
	%	2.5%	2%	0.0%	.1%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		4.609		<i>p</i> -value	0.330 NS

Table 4: Maternal Factors and AFI

Factor	Group I (80)		Group II (105)		Group III (199)		Total	
	N	%	N	%	N	%	N	%
Low Risk	47	58.75	69	65.71	158	79.39	274	71.35
PIH	14	17.5	10	9.52	9	4.5	33	8.6
GDM	1	0	0	0	2	1	3	0.7
Anemia	8	10	12	11.4	18	9	38	9.8
Jaundice	1	1.3	1	0.9	1	0.5	3	0.7
Malaria	2	2.5	2	1.9	1	0.5	5	1.3
Hypothyroidism	7	8.8	11	10.4	10	5	28	7.2

Table 5: Comparison of type of labour and AFI

Labour		Group			Total
		I	II	III	
Spontaneous	N	6	73	180	259
	%	7.5%	69.5%	90.5%	67.4%
Induced	N	69	32	19	120
	%	86.3%	30.5%	9.5%	31.3%
Elective LSCS	N	5	0	0	5
	%	6.3%	0.0%	0.0%	1.3%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		184.759		<i>p</i> -value	<0.001**

-Statistically highly significant ($p < 0.01$)Table 6:** Colour of liquor in various groups

Color of liquor		Group			Total
		I	II	III	
Clear	N	24	86	184	292
	%	30.0%	81.9%	92.5%	76.0%
Thick Meconium	N	27	3	2	32
	%	33.8%	2.9%	1.0%	8.3%
Thin Meconium	N	29	16	13	58
	%	36.3%	15.2%	6.5%	15.1%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		140.839		<i>p</i> -value	<0.001**

-Statistically highly significant ($p < 0.01$)Table 7:** Comparison mode of delivery in various groups.

Mode of delivery		Group			Total
		I	II	III	
LSCS	Count	51	14	11	76
	%	63.8%	13.3%	5.5%	19.8%
Instrumental	Count	4	3	1	8
	%	5.0%	2.9%	0.5%	2.1%
Normal Delivery	Count	25	88	187	300
	%	31.3%	83.8%	94.0%	78.1%
Total	Count	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		136.062		<i>p</i> -value	<0.001**

-Highly significant ($p < 0.01$)Table 8:** Indication of LSCS in various groups

Indication of LSCS		Group			Total
		I	II	III	
CPD	N	2	0	3	5
	%	2.5%	0.0%	1.5%	1.3%
DTA	N	0	1	1	2
	%	0.0%	1.0%	.5%	.5%
Failure of Induction	N	5	2	2	9
	%	6.3%	1.9%	1.0%	2.3%
Fetal Distress	N	2	0	2	4
	%	2.5%	0.0%	1.0%	1.0%

Indication of LSCS		Group			Total
		I	II	III	
IUGR+ OLIGO+	N	4	1	0	5
Fetal Distress	%	5.0%	1.0%	0.0%	5.0%
IUGR+ OLIGO+	N	3	0	0	3
REDF	%	3.8%	0.0%	0.0%	.8%
MSL + Fetal	N	32	8	0	40
Distress	%	40.0%	7.6%	0.0%	10.4%
NPOL	N	4	2	3	9
	%	5.0%	1.9%	1.5%	2.3%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		160.132		<i>p</i> -value	<0.001**

**-Statistically highly significant ($p < 0.01$)

Table 9: AFI as screening test for mode of delivery.

Groups	LSCS	Vaginal Delivery
AFI <5	51 (a)	29 (b)
AFI >5	25 (c)	279 (d)
Sensitivity	$a \div (a + c) \times 100$	67.10%
Specificity	$d \div (b + d) \times 100$	96.87%
Positive predictive value	$a \div (a + b) \times 100$	63.75%
Negative predictive value	$d \div (c + d) \times 100$	91.77%

Table 10: Fetal birth weight in various groups

Fetal Birth Weight		Group			Total
		I	II	III	
<1.5 kg	N	4	1	0	5
	%	5.0%	1.0%	0.0%	1.3%
1.5-2.5 kg	N	42	43	76	161
	%	52.5%	41.0%	38.2%	41.9%
>2.5 kg	N	34	61	123	218
	%	42.5%	58.1%	61.8%	56.8%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq			17.703	<i>p</i> -value	0.001**

**-Statistically highly significant ($p < 0.01$)

Table 11: APGAR score in various groups

APGAR Score			Group			Total	Chi-Sq
			I	II	III		
1 Min	> 7	N	44	32	48	124	25.103
		%	55.0%	30.5%	24.1%	32.3%	
	< 7	N	36	73	151	260	<i>p</i> -value <0.001**
		%	45.0%	69.5%	75.9%	67.7%	
	Total	N	80	105	199	384	
		%	100.0%	100.0%	100.0%	100.0%	
5 Min	> 7	N	23	5	4	32	Chi-sq 55.804
		%	28.8%	4.8%	2.0%	8.3%	
	< 7	N	57	100	195	352	<i>p</i> -value <0.001**
		%	71.3%	95.2%	98.0%	91.7%	
	Total	N	80	105	199	384	
		%	100.0%	100.0%	100.0%	100.0%	

**-Highly significant ($p < 0.01$)

Table 12: Comparison of NICU admission in various groups

NICU Admission		Group			Total
		I	II	III	
No	N	56	98	196	350
	%	70.0%	93.3%	98.5%	91.1%
Yes	N	24	7	3	34
	%	30.0%	6.7%	1.5%	8.9%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		58.257		p-value	<0.001**

**-Statistically Highly Significant ($p < 0.01$)

Table 13: Neonatal complications in various groups

Parameters	Group I		Group II		Group III	
	N	%	N	%	N	%
Birth asphyxia	19	23.75	5	4.8	0	0
RDS	13	16.3	1	1	0	0
Jaundice	20	25	9	8.6	9	4.5
MAS	5	6.3	0	0	0	0
Septicemia	5	6.3	1	1	0	0
Congenital abnormalities	0	0	1	1	0	0

Table 14: Neonatal outcome in various groups

Neonatal outcome		Group			Total
		I	II	III	
Neonatal Death	N	3	0	0	3
	%	3.8%	0.0%	0.0%	.8%
Survived	N	75	105	199	379
	%	93.8%	100.0%	100.0%	98.7%
Still Birth	N	2	0	0	2
	%	2.5%	0.0%	0.0%	.5%
Total	N	80	105	199	384
	%	100.0%	100.0%	100.0%	100.0%
Chi-sq		19.251		p-value	0.001**

**-Statistically highly significant ($p < 0.01$)

Discussion

As in Table 2, in present study there is no statistically significant difference between gravida status and amniotic fluid volume which is comparable with Brian M. Casey *et al.*⁶ and Kaur P⁵ studies.

As per Table 3, prolonged pregnancy (>40 weeks) associated with 13 women (16.25%) with AFI <5 cm, 19 women (18.09%) with borderline AFI (5 to 8 cm) and 16 women (8.04%) with normal AFI. Which was comparable to Chandra P *et al.*⁷ and Sriya R *et al.*⁸ post-term pregnancy was seen in 15.38% and 25% women with AFI <5 cm respectively. It indicates that as pregnancy is prolonged more than expected date of delivery, there is high chance of decrease in liquor volume.

Hypertensive disorders cause chronic placental insufficiency and leads to oligohydramnios. As per Table 4, In the oligohydramnios group 17.5% (14/80) had mild or severe preeclampsia compared to 38.46% and 31% of oligohydramnios group in study by Chandra P *et al.*⁷ and Sriya R *et al.*⁸ Also study of K Madhvi *et al.*⁴ (2015) found 52% (26/50) association of preeclampsia with oligohydramnios.⁴ Hence preeclampsia can be attributed to be one of the aetiological factors for oligohydramnios. So any cause of chronic placental insufficiency including chronic hypoxia can cause fetal growth restriction and oligohydramnios in pregnancy.

As per present study, IUGR was present in 17 patients out of that 15 patients had oligohydramnios and 2 patients had borderline AFI. It means IUGR is quite common in oligohydramnios.

Table 5 shows that induction of labour was significantly associated with oligohydramnios group (86.3%). The significance of association was found to be high ($p < 0.001$) using chi-square test. In comparison to studies of Casey *et al.*⁶ and Madhvi *et al.*⁴ have significant association of induction of labour with oligohydramnios. (48% and 42% respectively).

The occurrence of meconium stained amniotic fluid is high in women with AFI <5 cm, as shown in Table 6 The thick meconium stained liquor was

noted in 33.8% (27/80) in Group 1, 2.9% in Group 2 and 1.0% in Group 3 in present study which is similar to other studies.

Out of these 27 cases with thick meconium in Group 1, 6 had preeclampsia and 6 had associated IUGR. Reduced liquor is a known factor for intrauterine growth restriction. The inhibitive role may be aggravated by preeclampsia and hypertension. Rest of the cases with only Oligohydramnios also got thick meconium stained liquor.

Table 15: Comparison of thick meconium stained liquor in various studies.

Studies	Occurrence of thick meconium stained liquor in AFI<5cm
Madhvi <i>et al.</i> ⁴ (2015)	36%
Kaur P <i>et al.</i> ⁵ (2015)	48%
Chandra P <i>et al.</i> ⁷ (2000)	23.7%
Present study	33.8%

As per Table 7 and Table 8, LSCS rate in Group 1 was 63.8%, Group 2 was 13.3% and in Group 3 was 5.5%. It was statistically significant that Group 1 had highest caesarean rate. It compared with kaur p *et al.*, madhavi *et al.* had caesarean section rate of 48% and 58% respectively. Most of them are because of fetal distress (51.25%) in Group 1. It may be because of higher induction rate in this group

that leads to higher chances of meconium passage and fetal distress, because in oligohydramnios and IUGR fetus cannot withstand stress of induced labour.

So oligohydroamnios can be considered as a screening test for occurrence of fetal distress in intra-partum period requiring caesarean delivery

Table 16: Comparison of LSCS for Fetal distress in various studies

Studies	Percentage of LSCS in AFI <5 cm
Kaur P <i>et al.</i> ⁵ 2015	48%
Madhvi <i>et al.</i> ⁴ 2015	40%
Casey <i>et al.</i> ⁶ 2000	51%
Present Study	51.25%

Table 17: Comparison of sensitivity, specificity, positive predictive value and negative predictive value for requirement of LSCS in oligohydramnios patients.

Parameters	Kaur P <i>et al.</i> ⁵	Chandra p ⁷	Present study
Sensitivity	68%	76.92%	67.10%
Specificity	60%	73%	96.87%
Positive Predictive Value	48%	50%	63.75%
Negative predictive Value	78%	99%	91.77%

As per Table 10 occurrence of low birth weight (<2.5kg) was 52.5% (42/80) in Group 1 which is comparable with studies of Chandra P *et al.*⁷ 61.53% and Sriya R *et al.*⁸ 58.38%. In present study, 18 hypertensive patients were un-booked and poorly treated, as early detection could not be done and

that may lead to chronic placental insufficiency, causing fetal growth restriction and low birth weight. The remaining cases of newborn with low birth weight were mostly due to oligohydramnios which cause restricted fetal growth.

Table 18: APGAR score <7 in oligohydramnios in various studies.

Studies	APGAR < 7 at 1 min	APGAR < 7 at 5 min
Present study	45%	28.8%
Kaur P <i>et al.</i> ⁵	41%	40%
K Madhvi <i>et al.</i> ⁴	-	20%
Sriya R <i>et al.</i> ⁸	38.88%	9.72%

APGAR score at 5 min is considered a better predictor of neonatal long term outcome. It indicate that oligohydramnios associated with high chances of fetal distress and birth asphyxia that lead to low APGAR score at birth.

As per Table 12 of present study Group 1 had 30% (24/80) NICU admissions which was comparable to study of Chandra P⁷ (46.15%), Kaur P⁵ (040%) and Madhvi *et al.*⁴ (34%),

Table 13 of present study shows different neonatal complications. Birth asphyxia, RDS and MAS were significantly high in Group 1 which was 23.75%, 16.3% and 6.3% respectively. High incidence of neonatal Jaundice in Group 1 was due to early induction of labour and low birth weight or IUGR. Higher incidence of septicemia (6.3%) might be due to frequent intervention during induction or during progress of labour and during neonatal resuscitation. High incidence of MAS (6.3%) in present study was comparable with study of Madhvi *et al.*⁴ which was 6%.

Table 14 states that perinatal deaths occurred in 5 neonates all of them belonged to Group 1 out of them 3 were neonatal death and 2 were still birth. All of them died, due to Meconium Aspiration Syndrome with severe birth asphyxia and sepsis. That is comparable with kaure P study 8% (8/100) perinatal death.

Perinatal mortality was especially in cases in which timely vigilant intervention was not done either before birth or just after birth. So this experience teaches us that patient with AFI <5 needs continuous vigilant monitoring for fetal heart rate, color of liquor and progress of labour by partograph to detect earliest stage of fetal distress so that the earliest best intervention can be done to save the life.

Conclusion

1. Amniotic fluid index measurement is useful indicator as screening test for fetal surveillance & to identify those neonates at risk for poor perinatal outcome.

2. AFI ≤ 5 cm is associated with high incidence of thick meconium stained liquor, fetal distress, operative delivery and caesarean section, poor APGAR score, meconium aspiration and perinatal mortality and morbidity. So, it can be considered that AFV is a predictor of the fetal tolerance of labour.
3. Oligohydramnios occurs frequently during pregnancy which demands intensive fetal surveillance and proper antepartum and intrapartum care by Partograph. Artificial rupture of membrane in active phase of labour and grading of liquor and early decision making regarding mode of delivery are the steps to be taken to prevent poor perinatal outcome. Immediately after birth, proper resuscitation by a pediatrician is mandatory.

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