

## A Clinical Study on Amniotic Fluid Index and Perinatal Outcome

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### Abstract

**Background and Aim:** The aim of antepartum fetal surveillance is to identify fetus at increased risk of harm. Amniotic fluid volume has been proved an indirect measure of fetoplacental function and hence the estimation of amniotic fluid volume assists in risk assessment by application of dynamic ultrasonographic methods. Of the various semiquantitative methods the four quadrant technique provides a fetal convenient method for evaluating amniotic fluid volume. **Materials and Methods:** This was a comparative, non-randomized study done over a period of 18 months on 100 women with the gestational age of 34 to 42 weeks. They are divided on amniotic fluid index done with study of umbilical artery Doppler. **Results:** 100 cases of complicated and uncomplicated pregnancy of term gestation are included in the study. 70 cases are booked and 30 cases are unbooked. 37 cases are primigravidae, 63 cases are multigravidae. Low AFI values are most commonly associated with primigravidae and high AFI volume are associated with multigravidae. Out of 14 cases with very low AFI 35.71% had PIH, 35.71% of post dates, 28.57% cases are IUGR. This indicates low AFI values are more commonly associated with complications like post dates, PIH, IUGR. 64.28% of cases are associated with meconium staining of liquor in low AFI values. Cesarean section rate and forceps delivery is

significantly higher in patients with low AFI values. Out of 14 cases with low AFI 71.42% of cases underwent cesarean section and fetal distress is commonly associated with low AFI and is the leading indication of LSCS. **Conclusion:** The risks of meconium staining of liquor, intrapartum fetal distress, operative delivery and perinatal mortality significantly higher in patients with amniotic fluid values of less than 5 compared to those with amniotic fluid index ranging between 8 and 18.

**Keywords:** Amniotic Fluid Index; Intrapartum Fetal Distress; Perinatal Mortality.

### Introduction

Amniotic fluid plays a major role in the development of the fetus. It provides a medium in which the fetus can readily move and grow as well. Also, cushions the fetus against the external injuries, maintains even temperature and prevents infection during antenatal period. During labour it helps in even distribution of the pressure of uterine contraction over the fetus, prevents cord compression and helps in cervical dilatation. Abnormalities of the amniotic fluid volume can interfere directly with the fetal development or may be an indirect sign of underlying disorder. Oligohydramnios can be associated with fetal congenital anomalies and IUGR, it is usually proportional to the degree of IUGR and it indicates placental dysfunction [1,2].

Oligohydramnios can also cause asymmetrical fetal growth, contracture of the joints and hypoplasia of fetal lungs by decreasing the lung expansion due to compression of the fetal abdomen which limits the movements of the fetal diaphragm and decreases the flow of the amniotic fluid

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into and out of the fetal lung. Oligohydramnios is associated with IUGR, FHR abnormalities, cord compression, poor tolerance of the labor by the fetus, low APGAR scores with a poor perinatal outcome [3,4]. Doppler ultrasound is a non-invasive technique that can be used to evaluate maternal and fetal hemodynamics. The fetal umbilical artery Doppler velocimetry evaluates the downstream impedance to the flow in the umbilical arteries

## Materials and Methods

This was a comparative, non-randomized study done over a period of 18 months from August 2012 to July 2014 on 100 women with the gestational age of 34 to 42 weeks admitted in department of gynecology and obstetrics.

They are divided on amniotic fluid index done with study of umbilical artery Doppler. First group consists of women with amniotic fluid index of less than or equal to 5 cm, second group with only amniotic fluid index of less than or equal to 5 cms. The third group with amniotic fluid index between 5 to 20 cms which was taken as a control group.

These groups were similar with regard to ante partum variables like maternal age, gravidity, gestational age and antenatal complications.

All the cases available up to the study period have been taken for the study.

Women who had 4 or more visits were considered as booked cases. Women with 3 or less visits and referred cases were considered as booked outside cases.

### *Inclusion Criteria*

Women with gestational age of more than 34 weeks, Intact membranes, Singleton pregnancy with cephalic presentation.

### *Exclusion Criteria*

Fetal congenital anomalies, Malpresentation and malposition, Multiple pregnancy, Placenta previa, Polyhydramnios, Ruptured membranes.

For all the selected cases, through history was taken and complete examination was done. Clinical evidence of oligohydramnios was looked for. The previous obstetric records and ultrasound reports were reviewed. Only those women who remembered their date of last menstrual period correctly with previous regular cycles and had corresponding

gestational age by clinical examination and first trimester ultrasound were taken for study.

For all the women ultrasound examination was done and amniotic fluid index was calculated by four quadrant amniotic fluid volume measurement technique. Oligohydramnios was defined as amniotic fluid index of less than or equal to 5 cms. Amniotic fluid volume was normal if amniotic fluid index was between 5.1 to 20 cms.

For all women baseline investigations like Hb%, blood group and Rh typing, urine examination were done. NST and BPP were done for all the cases. Decision to do umbilical artery Doppler study was taken in cases with PET, IUGR and very low AFI among less than 5cms. All cases were monitored by continuous electronic fetal monitoring during labour. The nature of the amniotic fluid was noted at spontaneous or artificial rupture of membranes during labour or caesarean section.

It was classified as clear, thin meconium stained liquor and thick meconium stained liquor. Those who developed variable deceleration and late deceleration with or without meconium stained liquor which persisted after corrective measures like maternal position, oxygen inhalation, hydration and stoppage of oxytocin were taken up for LSCS. All the new borns were attended by pediatricians and perinatal variables were determined by them.

Various outcome measures recorded were gestation age at delivery, induction of labour, nature of amniotic fluid, mode of delivery, FHR tracing, indication for caesarean delivery, APGAR score at 1 minute and 5 minutes, birth weight, IUGR, admission to

NICU, perinatal morbidity and mortality. Neonates were followed up for 7 days.

The results were recorded, tabulated and statistically analyzed using parameters like mean, standard deviation and chi square test. In addition epidemiological parameters like sensitivity, specificity, positive predictive value and negative predictive value were determined.

After satisfying all this criteria AFI was measured in this patients using linear array real time B scan with the patient in the supine position, landmarks for the 4 quadrants of maternal abdomen are used to divide a uterine cavity into 4 sections.

Umbilicus divides transversely into upper and lower halves and then linea alba divides into right and left halves. The linear transducer head is placed along mothers longitudinal axis and held perpendicular to the floor for all measurements. The maximum vertical of the largest fluid pocket is measured in cms in each of the quadrants 'vertical' is defined as perpendicular

to the transducer head. Brief appearance of cord or an extremity are ignored but aggregation of either to the exclusion of the fluid is not considered part of the fluid pocket. The measurement obtained from each quadrant are summed to form the AFI. Oligohydramnios was defined as amniotic fluid index of less than or equal to 5 cms. Amniotic fluid volume was normal if amniotic fluid index was between 5.1 to 20 cms.

Very low AFI	0 to 5 cms
Low AFI	6 to 8 cms
Normal	9 to 18 cms
High	More than 19 cms

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## Results

Hundred cases of complicated and uncomplicated pregnancy of term gestation and reactive NST were included in the study to assess the correlation between amniotic fluid index and perinatal outcome.

More number of cases from 18-20 yrs age group. Most of the cases from 37-38 weeks of gestational age (Table 1).

This table 2 shows that low AFI is more common in unbooked cases compared to the booked cases indicating that proper antenatal care and early admission reduces the number of cases with low AFI. Low AFI values are more commonly associated with primigravidae and high AFI values are associated with multigravidae.

Most common group ie 42% patients are with adequate for gestational age (Graph 1).

This table 3 shows low AFI values are more commonly associated with complications like post dates, PIH, IUGR than in uncomplicated pregnancies.

Meconium staining of liquor is more commonly associated with low values of AFI. Caesarean section rate and forceps delivery significantly higher in patients with low AFI values (Table 4).

**Table 1:** Age distribution in study

Age intervals in years	Number of Cases	Percentage
18-20 yrs	40	40%
21-25 yrs	29	29%
26-30 yrs	22	22%
>31 yrs	9	9%
Gestational Age		
37-38 wks	50	50%
39-40 wks	31	31%
41-42 wks	19	19%

**Table 2:** Amniotic Fluid Index in cases

Number of Cases	0-5	6-8	9-18	>18
Booked (n=70)	2 (2.8%)	23 (32.8%)	42 (60%)	3 (4.2%)
Unbooked(n= 30)	10 (33.3%)	6 (20 %)	6 (20 %)	8 (26.7%)
Primigravidae (37)	10(27.02%)	12(32.43%)	11(29.72%)	4(10.81%)
Multigravidae (63)	8(12.69%)	17(26.98%)	29(46.03%)	9(14.28%)

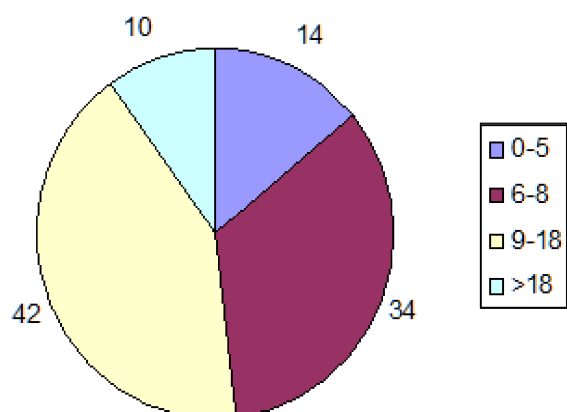


Fig. 1: Ultrasound Evaluation of Amniotic Fluid

Low AFI values are associated increased risk of perinatal mortality and morbidity compared to normal group. Fetal distress is commonly associated with low AFI and is the leading indication for LSCS in this group (Table 5).

### Discussion

The present study consists of amniotic fluid volume and it relations to perinatal outcome. Oligohydramnios accompanies a number of pregnancy complications including IUGR, fetal anomalies and is associated with increased perinatal morbidity and mortality. The recognition of there data inspired many workers to include amniotic fluid

Table 3: Amniotic Fluid Index in Complicated and Uncomplicated Pregnancies

	0-5	6-8	9-18	>18
Normal		6 (17.64%)	29 (69.04%)	
PIH	5 (35.71%)	18 (52.94%)	5 (11.90%)	
Post dates	5 (35.71%)	6 (17.64%)	8 (19.04%)	
IUGR	4 (28.57%)	4 (11.76%)		
Hydramnios	-	0		10(100%)
Total Cases	14	34	42	10

Table 4: Meconium Staining of Liquor and mode of Delivery in Associated with AFI

	0-5	6-8	9-18	>18
<b>Meconium Staining of Liquor</b>				
Total No of Cases	14	34	42	10
Clear Liquor	5 (35.72%)	20 (58.82%)	40 (95.23%)	8 (80%)
Meconium staining	9 (64.28%)	14 (41.17%)	2 (4.77%)	2 (20%)
<b>Mode of Delivery</b>				
Spontaneous vaginal delivery	2 (14.28%)	16 (47.05%)	22 (52.38%)	4 (40%)
Forceps	2 (14.28%)	2 (5.88%)	6 (14.28%)	
LSCS	10 (71.42%)	16 (47.05%)	14 (33.33%)	6 (60%)
Total No of Cases	14	34	42	10

Table 5: Fetal Outcome and Indication of Caesarian Section in relation to Amniotic Fluid Index

Fetal Outcome	0-5	5-8	8-18	>18
No of Cases	14	34	42	10
Still birth	1 (7.14%)	-	-	-
Apgar < 7 at 1 min	7 (50%)	6 (17.64%)	5 (11.90%)	2(20%)
Apgar < 7 at 5 min	4 (28.57%)	4 (11.76%)	2 (4.76%)	2(20%)
<b>Indication of Caesarian Section</b>				
No of Cases	10	16	14	6
Foetal distress	8 (80%)	8 (50%)	5 (35.72%)	
Failure to Progress		2 (12.5%)	2 (14.28%)	6 (100%)
Other Caused	2 (20%)	6 (37.5%)	7 (50%)	

volume assessment in antepartum surveillance. Out of 100 cases, 70 cases are booked and 30 cases are Unbooked cases. Low AFI is more common in unbooked cases compared to booked cases indicating that proper antenatal care and early admission reduces the number of cases with low AFI.

Thirty seven cases are primigravidae, 63 cases are multigravidae and low AFI values are more common in primigravidae and high AFI values are associated with multigravidae due to associated complication like gestational diabetes. Out of 14 cases with very low AFI, 5 cases had gestational hypertension, 5 cases post dates, 4 cases of IUGR. This Indicates very low AFI are more commonly associated with complications like post dates, PIH, IUGR. Out of 14 cases with very low AFI, 9 cases had meconium staining of liquor due to foetal distress. In Chauhan, Sanderson, Hendrix, Megann [3] conducted a study about perinatal outcome and amniotic fluid index in the antepartum and intrapartum periods. The main objective is metaanalysis study of risk of cesarean delivery for fetal distress, 5 minutes apgar score <7, with antepartum or intrapartum AFI >5 or <5cm. The inclusion criteria that associated AFI <5cm, verses >5cm. They studied 10,551 patients and concluded an antepartum or intrapartum AFI <5cm is associated with significantly increase risk of cesarean for fetal distress and low apgar score at 5 minutes which is consistent with present study .

Baron C, Morgan [5] concluded a study about impact of amniotic fluid volume on perinatal outcome and reported 50% increased in variable deceleration during labour and a seven fold increased cesarean delivery rate low AFI and in the present study, out of 8 cases with low AFI <5cm, 7 cases underwent cesarean section due to fetal distress. The relationship between oligohydramnios and poor perinatal outcome has been studied by Manning and Morrision [6]. Gross and corrected perinatal mortality in association with normal qualitative amniotic fluid volume ranged from 4.65/1000 and 1.97/1000 respectively. The incidences of congenital anomaly , IUGR were significantly high. 4 cases of intrauterine growth retardation were associated with low amniotic fluid volume. Locatelli et al. [7] reported that in uncomplicated term pregnancies with oligohydramnios, the presence of an AFI <5 independently increased the risk for a SGA infant. Morris et al. [8] found that 60% of babies were of LBW in the group with AFI <5, indicating that oligohydramnios had an association with growth restriction. A study by Rutherford et al. [9] showed that when the AFI was <5 (36 %), pregnancies resulted in infants with intra uterine growth restriction (IUGR).

In the present study, the 1-min Apgar score <7 in 7 out 14 (50 %) babies in Group 1, whereas only 17.6% babies in Group 2 had a 1-min Apgar score <7, and this difference was statistically significant ( $p = 0.001$ ). However, the 5-min Apgar score <7 was almost equal in both the groups ( $p = 0.884$ ). Chauhan et al. [3] reported in their meta-analysis that antepartum AFI of B5 cm was associated with a 5-min Apgar score <7 (pooled RR -1.8, 95 % CI 1.1-2.6). A study by Driggers et al. [10] reported a 5-min Apgar score <7 in 3.8 % patients in an oligohydramnios group versus 4.6 % in a normal AFI group, and concluded that there was no significant difference. A study by Grubb et al. [11] found the 1-min Apgar score <7 in 84 % patients with AFI B 5 as compared to 14% in the normal AFI group, which was highly significant ( $p = 0.01$ ). In the same study, the 5-min score <7 was seen in 13% patients with AFI B 5 versus 5% in the normal AFI group.

Chamberlain [12] used ultrasonography to evaluate the perinatal mortality in 7562 patients , the perinatal mortality of patients with normal fluid volume was 1.97 deaths / 1000 patients. The perinatal mortality increased to 4.12 / 1000 with polyhydramnios and 56.5 /1000 patient with oligohydramnios. Our present study is consistent with Birmingham, Biggio and Coworkers [13] compared 370 women identified as having hydramnios with more that 36,000 control women having a normal index. Hydramnios was found to portend a significantly increased for adverse outcomes, among 370 women, 47% had cesarean delivery, in our present study 60% had cesarean delivery. In our present study 71.05% of cases with low AFI had cesarean delivery due to fetal distress, failure to progress and meconium staining of liquor.

To conclude, AFI  $\leq 5$  cm after 34 weeks of gestation is an indicator of poor perinatal outcome. Identification of high risk cases for poor perinatal outcome increased significantly when umbilical artery Doppler velocimetry is done in cases with oligohydramnios. Patients with abnormal Doppler findings can be taken directly for LSCS, which reduces the perinatal morbidity and mortality. Hence, all patients with oligohydramnios, umbilical artery Doppler should be done to recognize the compromised fetus thus reducing the perinatal morbidity and mortality.

## Conclusion

In the present study, antepartum oligohydramnios (AFI < 5) was associated with increased cesarean delivery, particularly for fetal distress. However, there was no difference in perinatal outcome in terms of meconium staining, 5-min Apgar score, and cord pH

between the two groups. Meconium staining of liquor is more commonly associated with low values of AFI. Caesarean section rate and forceps delivery significantly higher in patients with low AFI values. Low AFI values are associated increased risk of perinatal mortality and morbidity compared to normal group. Fetal distress is commonly associated with low AFI and is the leading indication for LSCS in this group. Therefore, patients with severe oligohydramnios with AFI <5 should undergo antepartum management in the form of induction of labor in order to improve their perinatal outcome

The risks of meconium staining of liquor , intrapartum fetal distress, operative delivery and perinatal mortality significantly higher in patients with amniotic fluid values of less than 5 compared to those with amniotic fluid index ranging between 8 and 18.

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