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A CLINICAL STUDY OF AMNIOTIC FLUID INDEX AND UMBILICAL ARTERY DOPPLER STUDY AT OR BEYOND 34 WEEKS GESTATION AND ITS RELATION TO PERINATAL OUTCOME

Nirmala Shivalingaiah[1], Reethu Varadarajan[2], M. S. Mamatha[3]

ABSTRACT: Amniotic fluid index (AFI) is one of the indicators of fetal well-being. Fetal umbilical artery Doppler velocimetry is a newer modality in assessing the fetal wellbeing, and thus helps in identifying compromised fetuses. **OBJECTIVE:** To study the perinatal outcome in ultrasono graphically detected normal and decreased AFI ≥ 34 weeks of gestation and to compare the usefulness of umbilical artery Doppler velocimetry and AFI in predicting the perinatal outcome in oligohydramnios ≥ 34 weeks of gestation. **METHODOLOGY:** This is a comparative, non-randomized study done over a period of 18 months on 150 pregnant women between gestational ages of 34-42 weeks. Ultrasonography was done for all women and AFI was calculated by four quadrant technique. Umbilical artery Doppler velocimetry was done in cases of AFI ≤ 5 cm. **RESULTS:** There was increased incidence of intrauterine growth restriction (IUGR), labour induction, and caesarean section for fetal distress and NICU admission in cases with AFI < 5 cm, compared to cases with AFI > 5 cm. Among the cases with oligohydramnios, cases with abnormal umbilical artery Doppler velocimetry had higher incidence of IUGR, LSCS for fetal distress and NICU admissions compared with normal umbilical artery Doppler. **CONCLUSION:** AFI ≤ 5 cm after 34 weeks of gestation is an indicator of poor perinatal outcome. Umbilical artery Doppler velocimetry in cases with oligohydramnios would help in identifying high risk cases for poor perinatal outcome. Hence, all patients with oligohydramnios, umbilical artery Doppler should be done to recognize the compromised fetus and thus reducing the perinatal morbidity and mortality.
KEYWORDS: Amniotic fluid index, amniotic fluid volume, intrauterine growth restriction, oligohydramnios, umbilical artery, Doppler velocimetry.

INTRODUCTION: Assessment of fetal well-being is important in timely diagnosis of fetal compromise and management. Amniotic fluid plays a major role in the development of the fetus. It cushions the fetus and protects it against injuries. Abnormalities of the amniotic fluid volume can interfere directly with the fetal development. Amniotic fluid index (AFI) ≤ 5cm is considered as oligohydramnios and it is associated with increased incidence of adverse perinatal outcome.

Oligohydramnios is associated with maternal morbidity in the form of increased rates of induction and or operative interference.[1] Oligohydramnios can also be associated with fetal morbidity in the form of IUGR and fetal congenital anomalies, poor tolerance of labour by the fetus, low APGAR scores with poor perinatal outcome. The fetal umbilical artery Doppler evaluates the impedance to the flow in umbilical arteries. An abnormal umbilical artery Doppler is an indicator of fetal peripheral vasoconstriction leading to reduced fetal oxygenation. Hence Doppler study helps in identifying compromised fetus early and thus reduces the adverse perinatal outcome.

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The objectives of the study included studying the perinatal outcome in ultrasonographically detected normal and abnormal amniotic fluid index, at or beyond 34 weeks of gestation and also to compare the usefulness of umbilical artery Doppler velocimetry and AFI in predicting the perinatal outcome in cases with oligohydramnios at or beyond 34 weeks of gestation.

METHODS: This is a comparative, non-randomized study done over a period of 18 months on 150 pregnant women between gestational age of 34 - 42 weeks admitted to our hospital. The first group includes women with AFI ≤5 cm with umbilical artery Doppler study. The second group consists of women with AFI≤5 cm. The third group with AFI between 5-20 cm constituted the control group. These groups were similar with regard to antepartum variables. All women with gestational age >34 weeks, singleton pregnancy, cephalic presentation and with intact membranes were included in this study. Women with polyhydramnios, multiple pregnancy, fetal anomalies, ruptured membranes, antepartum haemorrhage (APH) and malpresentation were excluded from the study.

For all the selected cases, a thorough history was taken and complete examination was done. They were subjected to baseline investigations. Ultrasonography was done for all women and AFI was calculated by four quadrant technique. Doppler study of umbilical artery was done in cases with preeclampsia, IUGR and very low AFI. Women with no other risk and with normal Doppler were monitored regularly with NST and repeat Doppler till 37 weeks. If there was development of abnormal Doppler findings, they were intervened early.

In group 2, women with no risk factor were followed up with daily NST and biweekly AFI and BPP till 37 weeks. Intervention was planned when any of the above showed abnormalities. In labour, nature of the amniotic fluid was noted and classified as either clear/ thin/ thick meconium stained liquor. If fetal distress was detected such cases were taken up for LSCS. Perinatal variables were assessed by pediatrician. Neonates were followed up for 7 days. The results were recorded, tabulated and statistically analysed (mean, Standard deviation and Chi square test).

RESULTS: The study conducted on 3 groups (Group 1 – AFI ≤ 5cm with umbilical artery Doppler study, Group 2 – AFI ≤ 5 cm, Group 3 – AFI between 5 - 20 cm, control group) were as follows: Maximum number of cases was found between the age group of 21-25 years in all groups with a mean age of 24.6 years. Majority of the cases, in all the groups were primigravida. The mean gestational age for group 1, 2 and 3 was 38.3 weeks, 38.7 weeks and 38.7 respectively. Most of the abnormal Doppler was detected between 35-39 weeks of gestation. Table 1 shows the distribution of gestational age in the Doppler group. Maximum number of cases belonged to middle socio- economic status and they had education upto high school. Most of the cases were booked outside and were referred to our institute in view of pregnancy associated complications.

The commonest antenatal complication observed was preeclampsia accounting for 24% in group 1 and 10% in group 2. The Bar chart 1 shows the occurrence of antenatal complications in the Doppler group. With respect to the distribution of AFI, group 1 had more cases in the low AFI range. Bar chart 2 shows the distribution of AFI in the study group. The study also showed that those cases which had low AFI also had abnormal umbilical artery Doppler changes. Table 2 shows the distribution of AFI in the Doppler group. The rate of labor induction was observed to be 52% in group 2 compared to 26% and 38 % in study group 1 and 3 respectively. Twenty percent of patients had thick meconium stained liquor in group 1 as compared to 6% in group 2.

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Among the patients with abnormal Doppler study, 23.8% had thick meconium as compared to 17.24% in patients with normal Doppler study. Group 1 had more cases going in for LSCS(74%) as compared to group 2 (56%) and control group (46%). This was observed to be statistically significant (p<0.005). Incidence of LSCS was observed to be 85.7% in patients with abnormal umbilical artery Doppler as compared to 65.5% in patients with normal Doppler. Incidence of full term normal delivery was 27.5% in patients with normal Doppler and 9.5% in abnormal Doppler study. Hence p – 0.005, which is statistically significant. A low APGAR score was noted in 38.2% and 27.5% with abnormal and normal umbilical artery study group respectively.

IUGR accounted for 80% and 34.4% in cases with abnormal and normal Doppler group respectively. This was statistically significant observation in patients with IUGR. NICU admissions were noted to be 76.19% and 44.88% in abnormal and normal umbilical artery Doppler group respectively. Tachypnea was the most common indication for NICU admission in group 1 (31%) and group 2 (42%). Bar Chart 3 shows the perinatal outcome in umbilical artery Doppler group with AFI < 5 and table 3 shows the perinatal outcome in the abnormal Doppler study group. The mean birth weight in group 1 was 2.35kg, group 2 was 2.73 kg and group 3 was 2.92kg. Statistically significant difference in mean birth weight was observed between the groups (p<0.001). There were 2 perinatal deaths, one died of respiratory distress syndrome due to meconium aspiration in group 2 and the other had an IUD.

DISCUSSION: The present study was conducted on pregnant women who were admitted to the hospital with gestational age between 34 - 42 weeks. In the present study, among 2780 pregnant women examined, 105 women were detected to have oligohydramnios (3.7%) and the literature mentions an incidence of 0.5 to 5 %.[2] The mean gestational age in the present study was 38.6 in group one and 38.7 weeks in group two, which is comparable with the mean gestational age of 37.5 weeks in a study by Casey et al.[3] For the sake of comparison with other studies, the findings of our study in group one and two are taken together. In the present study, on patients with oligohydramnios, 44% had mild or severe preeclampsia, compared to 38.46% and 31% in study by Chandra P et al and Sriya R et al respectively.[4,5] Any cause of chronic placental in-suffiency including hypertensive disorders, chronic abruption and chronic diabetes mellitus can cause fetal growth restriction and oligohydramnios in term pregnancies. Induction of labour was more common in oligohydramnios group (39%) compared to the control group. Similar results were observed by Casey et al (42%).[3]

The incidence of meconium stained amniotic fluid was high in women with AFI < 5 cm. Thick meconium stained liquor was noted in 26% in our study group as compared to 38.88% in a study by Sriya R et al and 54% in a study by Rutherford et al.[5,6] Rate of LSCS for fetal distress in patients with AFI < 5 cm, was 70% in the present study which is comparable with other studies where the rates were 51% in Casey et al study and 43.5% in Sriya et al study.[3,5] Oigohydramnios (AFI ≤5) has been used as a screening test for the development of fetal distress during intrapartum period.

Low APGAR score at 1 minute in oligohydramnios group was seen in 54% in contrast to the study by Sriya et al, where the low APGAR score was 39%.[5] Low birth weight was observed in 55% of pregnancies which is comparable with other Indian studies by Chandra P et al of 61.53% and Sriya R et al with a value 58.38%. The high rate of low birth weight may be due to chronic placental insufficiency.[4,5] The rate of NICU admission in oligohydramnios group was 78%, which is comparable to the observation by Sriya et al (88%).[5] Perinatal death was 2% in oligohydramnios group

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comparable to 5% in study by Casey et al.[3] Carroll BC et al conducted a study in 1998 to evaluate the Doppler velocimetry in predicting perinatal outcome in patients with oligohydramnios.[7] They identified 81 cases with oligohydramnios and did umbilical artery Doppler velocimetry in them. Among them 50 (61.7%) patients had normal S/D ratio, out of which 12 patients (24%) were associated with identifiable perinatal morbidity. Thirty one (38.3%) patients had abnormal Doppler findings among which 74% had adverse perinatal outcome. In the present study, out of 50 cases 29 (58%) had normal umbilical artery Doppler velocimetry and the adverse perinatal outcome was 35.7%. Abnormal umbilical arteries Doppler were seen in 21(42%) patients, and 73.3% had adversere perinatal outcome. Induction of labour in cases with abnormal Doppler was 23.8% and with normal Doppler was 27.5% comparable to study done by Arora et al which showed an induction rate of 17.1% in abnormal Doppler and 29% in normal Doppler velocimetry.[8]

In the present study, among patients who had normal Doppler findings, 31% had non-reactive NST, 27.5% had low APGAR and NICU admission was 44.8%. In the study by Arora et al, non-reactive NST was 6.3%, low APGAR score was 13.3% and NICU admission was 40%.[8] In cases with decreased end diastolic flow (S/D ratio> 95th percentile), 57% had non-reactive NST, 28.5% had low APGAR and 71.4% had NICU admissions. The findings by Arora et al was 22%, 10% and 70% respectively.[8] In the cases with absent/ reversal of diastolic flow, incidence of non-reactive NST was 90%, low APGAR was 60% and NICU admission was 70%. The observation by Arora et al was 64.3%, 57% and 100% respectively. One of the cases with reversal of end diastolic flow was an IUD, hence not included in analysis.

To conclude, AFI< = 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.

DISCLOSURE STATEMENT: The present work does not hold any conflict of interest and does not hold any financial support or relationships with companies that have financial interest.

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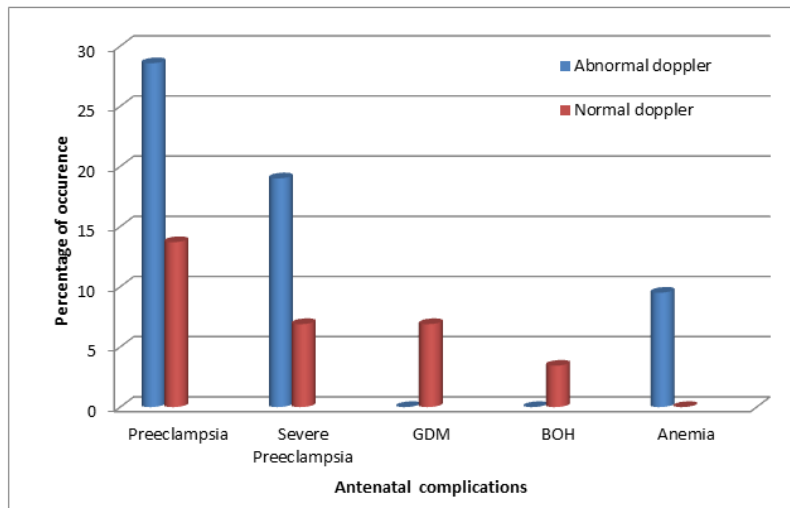| Distribution of gestational age in Doppler group		
Gestational age	Abnormal Umbilical artery Doppler in AFI ≤ 5cms (n=21)	Normal Umbilical artery Doppler in AFI ≤ 5cms (n=29)
34	0	0
35	4	1
36	2	0
37	2	5
38	2	8
39	5	10
40	4	4
41	2	1
Total	21	29

Table 1: Showing the distribution of gestational age in the Doppler group

AFI distribution ≤ 5 cms (n=50)	With abnormal umbilical artery Doppler (n=21)	With Normal umbilical artery Doppler (n=29)
1 – 2	6	0
2.1 – 3	3	1
3.1 – 4	2	5
4.1 – 5	10	23

Table 2: Showing the distribution of Amniotic Fluid Index (AFI) in Doppler group

Doppler variables	IUGR	Fetal distress	APGAR ≤ 7 1min	APGAR ≤ 7 5min	NICU admission	Perinatal death
S/D ratio > 95th percentile	12	8	5	0	11	0
AEDF	5	5	3	1	4	0
REDF	2	1	1	1	1	1

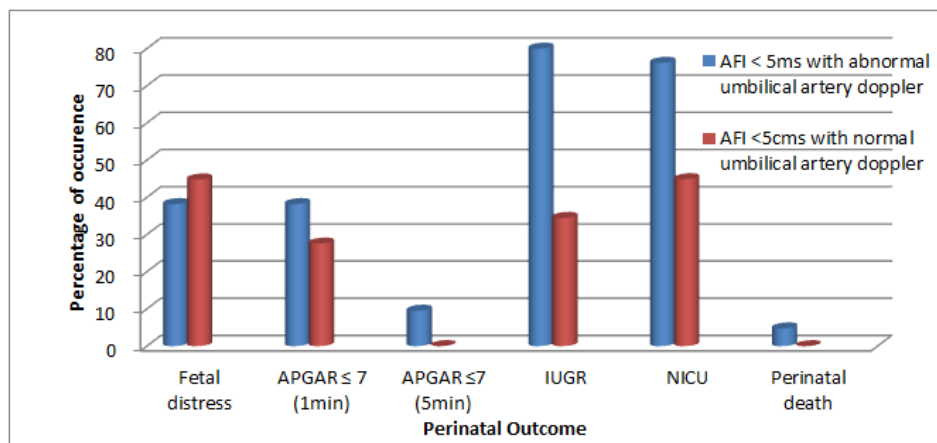Table 3: Showing nature of abnormal doppler study and perinatal outcome

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Bar chart 1: Bar chart showing antenatal complications in Doppler group
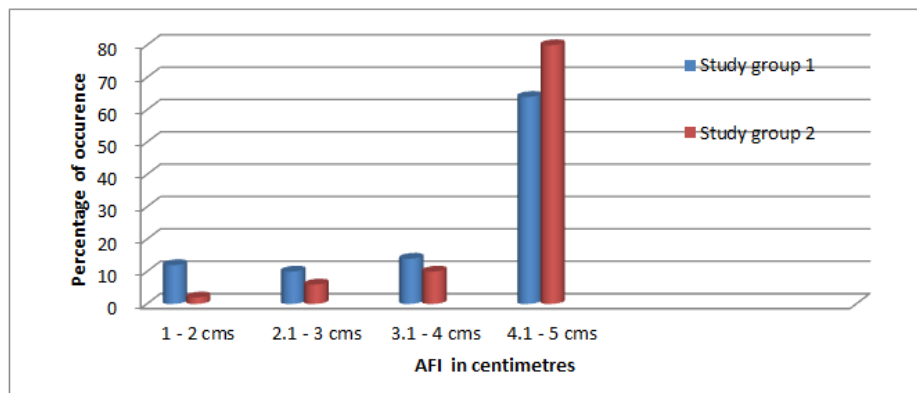
Bar chart 2: Showing distribution of Amniotic Fluid Index (AFI) – study group

Bar chart 3: Showing perinatal outcome in umbilical artery Dop

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AUTHORS:
1. Nirmala Shivalingaiah
2. Reethu Varadarajan
3. M. S. Mamatha

PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Obstetrics & Gynaecology, KIMS, Bangalore.
2. Assistant Professor, Department of Obstetrics & Gynaecology, KIMS, Bangalore.

FINANCIAL OR OTHER COMPETING INTERESTS: None

3. Post Graduate, Department of Obstetrics & Gynaecology, KIMS, Bangalore.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Reethu Varadarajan,
55, 6th Main Road,
Chamarajpet,
Bangalore-18.
E-mail: reethu.nandeesh23@gmail.com