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Study of Doppler Velocimetry abnormalities in term low risk pregnancies with borderline amniotic fluid index

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Abstract
Amniotic fluid is an indicator of normal placental function. Normal range is 5-24 cm. Less than 5 cm is considered oligohydramnios which is Associated with perinatal complications. Doppler study of umbilical artery is an independent predictor of perinatal outcomes. Combining Doppler study and amniotic fluid index can give better overview of management of borderline AFI i.e., 5-8 cm.
Objectives: 1. To study Doppler velocimetric abnormalities in term low risk pregnancies with borderline "AFI". 2. To study perinatal outcome in such women.
Methods: After taking written informed consent, 100 women were selected who fulfilled the eligibility criteria. They were subjected to USG and AFI was measured and umbilical artery Doppler and velocimetric changes and perinatal outcomes were analysed.
Results: Out of the 100 women selected, 87 underwent Caesarean section, 10 delivered vaginally and 3 underwent instrumental delivery, 29 in caesarean section group and 2 in outlet forceps group had fetal distress respectively. Doppler abnormalities were seen in 5 women, non-reassuring NST in 9 women.16 babies were admitted in NICU for a varying period.27 babies were LBW out of which 2 were Fetal Growth Restriction. Respiratory distress was noted in 6 babies, however 5' APGAR was > 7 in all of them and there was no perinatal mortality.
Conclusion: In the present study it was noted that Caesarean section rates were high in Women with borderline AFI, It was also found to be associated with adverse perinatal outcomes and abnormal umbilical artery Doppler. However perinatal mortality did not show any adverse association with borderline AFI.

Keywords: Amniotic fluid index, oligohydramnios, non-stress test, Doppler Velocimetric abnormalities, perinatal outcome

Introduction
Amniotic fluid volume indicates fetal status and placental function. Hence, oligohydramnios indirectly indicates chronic fetal hypoxia. There are several subjective and semi quantitative methods of ultrasound measurement of "amniotic fluid volume". "Four quadrant method" of calculating "Amniotic Fluid Index" ("AFI") first described by "Phelan *et al.*" in 1987 is the most acceptable one. "Amniotic Fluid Index" of 5-8 cm defines Borderline Oligohydramnios as, originally described by Phelan *et al.*" [1]. It has been found to be associated with a variety of adverse pregnancy and perinatal outcomes including fetal Doppler velocimetric abnormalities. The normal values of "Amniotic Fluid Index" in uncomplicated pregnancies was measured by Moore and Cayle2 from 16-44 weeks. 36 At term the mean "AFI" is 12 cm, 95th corresponds to 20 cm (polyhydramnios) and 5th percentile to 7 cm (oligohydramnios) [3] Umbilical artery is most commonly used. "A S/D ratio more than 95th percentile for gestational age, absent end diastolic flow or reversed end diastolic flow signifies increased impedance and is associated with fetal growth restriction. Absent or reversed end diastolic flow and umbilical venous pulsations have a grave prognosis for fetus as reported by Zelop and colleagues (1996) [4] the PNM rate for reversed end diastolic flow is 33% and for absent diastolic flow is 10%". When fetal hypoxemia occurs, fetus switches on a compensatory mechanism and increases the blood flow to brain (Brain sparing effect). The ratio of middle cerebral arterial RI to umbilical arterial RI less than one is considered to be indicator or fetal compromise and early evidence of FGR.

Williams and colleagues have found "Doppler velocimetry and NST to be equivalent in their ability to predict pregnancy outcome [5]" ACOG (2000) has concluded that "no benefit has been demonstrated for umbilical artery velocimetry in conditions other than IUGR where it has been recommended as a useful adjunct to other techniques of fetal surveillance".

Objectives

1. To study Doppler velocimetry abnormalities in term low risk pregnancies with borderline "AFI".
2. To study perinatal outcome in such women.

Methodology

This was a hospital based prospective study. A total of 100 term low risk pregnant women from January 2018 to December 2019 were included in the study carried out at Mamata Medical College and Hospital, Khammam, Telangana State in the department of Obstetrics & Gynecology. Written informed consent was taken from each of the patient included in the study. Demographic data, past obstetrics and medical history were recorded. On admission, fetal surveillance was done by Non Stress Test and USG with BPP including fetal biometry and umbilical artery Doppler. For the purpose of this study "Borderline Oligohydramnios" was defined as "AFI" of 5-8 cm measured by Trans abdominal ultrasonography using 4 quadrant technique. The transducer was placed on the maternal abdomen along the longitudinal axis. The vertical diameter of the largest amniotic fluid pocket in each quadrant was measured with the transducer head held perpendicular to the foot. These measurements were ummed in centimeter and the result was recorded as the "Amniotic Fluid Index" ("AFI"). Gestational age at the time of delivery was recorded. Amniotic fluid was assessed at the time of artificial rupture of the membranes, during labor and at the time of lower segment caesarean section. For all women baseline investigations like Hb%, blood group and Rh typing, urine examination were done. Women with term singleton low risk pregnancies (37-40 weeks), Borderline "AFI" (5-8 cm), intact amniotic membrane, Cephalic Presentation were included in the study. Any maternal systemic illness, Vaginal bleeding, Ruptured membranes, multiple gestation, Malpresentation and fetal malformations were excluded. The pregnancies with fetal malformations were also excluded from the study except for the deformities that can be caused by oligohydramnios like CTEV. The cases in which amnioinfusion was done were also excluded from the study to avoid confounding outcome. Those who developed significant variable decelerations and repetitive late decelerations or other ominous FHR pattern with or without meconium stained liquor which persisted inspite of corrective measures like change in maternal position, hydration, O2 inhalation and stopping oxytocin were delivered by LSCS or forceps delivery. All new borns were attended by neonatologists. Various outcome measures recorded were, induced vs spontaneous labor, gestational age at delivery, nature of amniotic fluid, FHR tracings, mode of delivery, indication for cesarean section or instrumental delivery Apgar score at one minute and five minutes, respiratory distress, birth weight, admission to neonatal ward, perinatal morbidity and perinatal mortality. All relevant information recorded was appropriately analysed by SPSS methods.

Results

Table 1: Age Distribution in Years

Age in Years	No. of Women	Percentage
18-20	02	02%
21-25	54	54%
26-30	40	40%
>30	04	04%
Total	100	100%

Maximum number of women were in between 21 to 25 years age group.

Table 2: Obstetric score

Gravidity	No. of Women	Percentage
Primigravida	68	68%
Multi Gravida	32	32%
Total	100	100%

Majority of the women were Primigravidas

Table 3: Distribution of Gestational Age at delivery in Weeks

Age in Weeks	No. of Women	Percentage
37	40	40%
38	24	24%
39	32	32%
40	04	04%
Total	100	100%

Only 4% of the women delivered at 40 weeks

Table 4: Amniotic Fluid Index ("AFI")

AFI (cm)	Number	Percentage
≥5, <6	42	42%
≥6, <7	24	24%
≥7, <8	22	22%
8	12	12%
Total	100	100%

42% of the women were with AFI 5 To 6 cms

Table 5: Abnormal Doppler changes

Doppler findings	Number of women	Percentage
Brain Sparing Effect	01	01%
Fetoplacental insufficiency	02	02%
INCREASED PI	01	01%
Abnormal MCA	01	01%
Normal findings	95	95%
Total	100	100%

Table 6: Non Stress Test Pattern

NST	Number	Percentage
Reactive	91	91%
Non-Reactive	09	09%

P =0.9 – not significant

Table 7: Nature of Amniotic Fluid

Amniotic Fluid	Number	Percentage
Clear	75	75%
Thin Meconium	03	03%
Thick Meconium	19	19%
Absent	03	03%
Total	100	100%

p<0.017-significant

The amniotic fluid was found to be thick meconium stained in 19% and thinly meconium stained in 3% women which was statistically significant.

Table 8: Mode of Delivery

Mode of Delivery	Number	Percentage
Normal Vaginal Delivery	10	10%
LSCS	87	87%
Forceps delivery	03	03%
Total	100	100%

Table 9: Interventions for Fetal Distress

Interventions	Number	Percentage
LSCS	29	93.5%
Instrumental delivery	02	6.5%
Total Interventions	31	100%

X_2 = 4.457 P=0.035-significant

A total of 31 women developed fetal distress. 29 (93.5%) of them underwent cesarean section and 2 (6.5%) of them by forceps delivery which was statistically significant showing increasing trend towards caesarean section.

Table 10: Apgar Score < 7

Apgar Score	Number	Percentage
1 minute	04	04%
5 minutes	0	0

Only 4% of the babies had one minute Apgar < 7, However this was not statistically significant.

Table 11: Birth weights

Weight in Kgs	Number	Percentage
< 2.5 kg	27	27%
> 2.5 kg	73	73%
Total	100	100%

P-0.075 not significant

Low birth weight defined as BW <_2.5 KG was noted in 27 newborns, out of which 2 were < 3 SD (IUGR) which was not significant statistically. 3 of these babies had ultrasound Doppler velocimetry abnormalities.

Table 12: Admission to Neonatal Ward

Duration of Admission	Number	Percentage
No	84	84%
< 1 week	10	10%
> =1 week	06	06%
Total	100	100%

P-0.35 not significant

16% neonates required admission to NICU for various indications like birth asphyxia, respiratory distress syndrome and meconium aspiration.6% required admission for more than 1 week out of which one had severe asphyxia. But, this was not statistically significant.

Discussion

In the present study, 54 out of 100 women were in the age group 21-25 years (54%). 32 percent women were multigravida. Cosey *et al.*, Magann *et al.* [6] and Chauhan also concluded that age and parity are not significantly related with oligohydramnios. Gestational age at delivery was around 37 weeks among 40% of the women. Jamal *et al.* 2016 [7] also found similar results. In the present study Non-Reactive Non Stress Tests was found in 9% of the women which is correlating with the study done by Petrozella *et al.* in 2011 [8] i.e., 9%. We did not find any correlation between non-reactive NST and oligohydramnios. However it was an indication for caesarean section. We also found that NST is not a very specific test in predicting fetal distress. (RCOG 2017-false positive rate=50%). Doppler velocimetry patterns were abnormal in 5% of the study population in our study which is almost similar to a study done by Asgharnia *et al.* in 2013 [5] (3.5%) Kwon *et al.* 2006 [9] found that incidence of adverse perinatal outcome was three times increased in borderline AFI group and five times when combined with abnormal umbilical artery Doppler. Goel *et al.* did not find any significant relation between Doppler abnormality and severity of oligohydramnios. In studies done by Chandra P *et al.* in 2000 [10] and Jamal *et al.* in 2016 [7] the Occurrence of Thick Meconium Stained Liquor was 23.7% and 17.2% respectively which is in close relation to our Present Study i.e., 19% Gummus *et al.* [11] also reported higher rates of meconium staining in their study. LSCS for Fetal Distress was done in 29% of the women in our present study. We have a study done by Gupta *et al.* in 2015 where they had CS for fetal distress in 18% of women. Which was not correlating with our study. This high incidence in our study is due to Caesarean section rates were found to be more in those with "borderline oligohydramios" and non-reactive NST. However, even when NST was reactive, some of them developed fetal distress and underwent caesarean section. Whereas Jamal *et al.* in 2016 [7] had a very high incidence of CS rate i.e., 43.6% when compared to our findings which was only 29%. 27% of Low Birth Weight babies were found in our study. Their were different variations in the results obtained from different studies. Jamal *et al.* in 2016 [7] had 18.7% of low birth weight babies whereas studies done by Asgharnia *et al.* in 2013 [5], Petrozella *et al.* 2011 [8] and Gupta *et al.* [13] in 2015 had 47.9%, 43% and 24% of low birth weight babies respectively. 16% of the babies in our study got admitted to Neonatal Ward which is comparable to study done by Asgharnia *et al.* in 2013 [5] they had 14.9% neonatal admissions. 7.6%, 6% and 10.5% of neonates got admitted to NICU in studies done by Magann *et al.* in 1999 [6], Gupta *et al.* in 2015 and Jamal *et al.* in 2016 [7] respectively. Sixteen percent of neonates required admission to NICU for various indications such as respiratory distress, birth asphyxia, meconium aspiration etc. There were no neonatal deaths in our study. It could be attributed to level of NICU facilities in our hospital. We observed respiratory distress in 6% of newborns at birth whereas 3.4% was noted by Casey *et al.* Garmel *et al.* found the rate of NICU admission to be 19% which is in accordance to our results (16%).

Conclusion

An amniotic fluid index of 5-8 cm leads to various adverse outcomes such as abnormal umbilical artery Doppler, non-reactive NST, thick meconium stained liquor, fetal distress, increased need for operative intervention and increased admission to NICU. However the trend was more towards lower values of AFI i.e. 5-6. Most of the cases with AFI had good outcome. Even though clear association cannot be established, cases with AFI in borderline range need to be watched more carefully and monitored NICU care cannot be denied and therefore such pregnancies should be monitored in hospitals which have a good neonatal care unit.

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