

PREDICTION OF FETAL DISTRESS AND POOR OUTCOME OF PREGNANCY BEYOND 40 WEEKS USING DOPPLER ULTRASOUND COMPARED WITH FETAL HEART RATE MONITORING WITH NST

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ABSTRACT: OBJECTIVES: Postdate pregnancy is the most common indication for Antepartum. Fetal heart rate testing because of its increased perinatal morbidity and perinatal mortality. Complications are stillbirth, meconium aspiration, asphyxia, and the dysmaturity syndrome, is increased in post-term pregnancies. The most recent ACOG review of the subject of "post-term" pregnancy cites estimates of 3-14% of all pregnancies. **MATERIALS AND METHODS:** 55 patients with pregnancy beyond 40 weeks attending antenatal out-patient department of the Rajiv Gandhi medical college in the period between October 2014 to March 2015 were included. In present study, patients were monitored with twice weekly NST and once a week Doppler. In those with either NST nonreactive or Doppler abnormal, induction was done. Cases with normal results were monitored till 42 weeks when routine induction was done. **RESULTS:** A reactive non stress test in prolonged pregnancy has good negative predictive value – i.e. adverse outcomes are unlikely to occur in the setting of a reactive non-stress test – but that the positive predictive values are low. Weekly measurement of Doppler waveforms from umbilical artery (PI $p=0.02$ for Apgar <7 at 5 min, $p=0.02$ NICU admissions, $p=0.003$ for meconium staining of amniotic fluid and S/d ratio $p=0.02$ for Apgar <7 at 5 min, $p=0.04$ for NICU admission) and biweekly NST($p=0.005$ for Apgar <7 at 5 min, $p=0.0219$ for NICU admission, $p=0.0039$ for meconium staining of amniotic fluid) appears to be reliable method of establishing fetal health in pregnancy beyond 40 weeks. **CONCLUSION:** The most sensitive tests to assess the risks to the fetus of prolonged pregnancy appear to be combinations of fetal heart rate monitoring with NST combined with umbilical PI and S/D ratio. Reactive NST is reassuring and indicates fetal wellbeing, but non-reactive NST alone cannot be taken as an indicator of fetal jeopardy. Although individual randomized trials do not show significant differences in perinatal mortality between women electively induced at specific gestational ages and women followed with antepartum testing, data shows significant increase in abnormal fetal outcome after 41 weeks.

KEYWORDS: NST, Doppler, Reactive, Non-Reactive, Meconium, Caesarean section, Vaginal delivery.

INTRODUCTION: The "normal" length of gestation has traditionally been defined as 40 weeks or 280 days, after the first day of the last menstrual period. This figure is used to calculate the "estimated date of confinement" or "due-date". Post-dated pregnancy is gestation longer than 40 weeks or 280 days. Post-term pregnancy is defined by the American College of Obstetricians and Gynaecologist's (ACOG) as a gestation longer than 42 weeks or 294 days, from the onset of the last menstrual period. It has long been recognized that the risk of adverse fetal outcomes, such as

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stillbirth, meconium aspiration, asphyxia, and the dysmaturity syndrome, is increased as gestational age progresses beyond 42 to 43 weeks.

The different tests for assessing fetal wellbeing are:

- Maternal measurement of fetal movement.
- Non-stress test (NST)
- Contraction stress test (CST), using either nipple stimulation or oxytocin.
- Amniotic fluid measurements.
- Biophysical profile, using either five measures (reactive NST, breathing, tone, movement, amniotic fluid) or two measures (NST, amniotic fluid).
- Doppler measurements of umbilical, uterine or fetal cerebral blood flow.

However, not one test is completely accurate in predicting fetal distress. Doppler method is relatively recent and as it measures directly blood flowing to the organs has more expectations about accuracy.

In the present study we have evaluated the usefulness of widely used NST and Doppler flow velocity waveforms in fetal distress in pregnancy beyond 40 weeks.

AIMS AND OBJECTIVES

1. To study NST in pregnancy beyond 40 weeks.
2. To study Doppler flow velocity waveforms in pregnancy beyond 40 weeks.
3. To compare both as a means of predicting fetal distress in pregnancy beyond 40 weeks.

MATERIALS AND METHODS: Present study is conducted in a Rajiv Gandhi medical college and Chatrapati Shivaji Hospital, Thane from October 2014 to March 2015 where tertiary obstetric care and neonatal care is available.

55 patients with pregnancy beyond 40 weeks attending antenatal out-patient department of the hospital or referred from outside for suspected prolonged pregnancy were included in the study.

All patients with pregnancy beyond 40 weeks from L.M.P. were selected when

- 1) Women were sure of the dates and the dates correlated with clinical findings of 1st ANC examination done before 12 weeks.
- 2) Women were unsure of dates but clinical findings and ultrasonographic records in first half of pregnancy corresponded well.

Inclusion Criteria:

- (1) Pregnancy beyond 40 weeks
- (2) Gestational age established by
 - (a) L.M.P. – Women sure of dates and minimum three previous regular menstrual cycles.
 - (b) Ultrasound examination in first half of pregnancy
 - (c) Findings of first clinical examinations before 12 weeks.

Exclusion Criteria:

- (1) Pregnancies complicated by P.I.H.
- (2) Congenital anomalies of fetus.
- (3) LMP not known and first half of pregnancy USG not available.
- (4) Twin pregnancy
- (5) IUGR

All patients underwent non-stress testing as primary method of antepartum surveillance. Non-stress test (NST) was performed on all patients at 40 weeks or after whenever they got admitted. The NST was performed post prandially. The patient was given supine position with pillow under one hip, to prevent aorto-caval compression. Transducer was fastened to maternal abdomen at the previously confirmed site of fetal heart sounds. Tracing was taken for at least 20 minutes. Mother was instructed to press the marker whenever she perceives the fetal movement. After tracing was over it was studied critically to label it reactive or nonreactive. A test was considered reactive if there were two or more fetal heart rate accelerations of more than 15 beats per minute and lasting 15 second in a 20 minutes period. If there were no movements within 20 minutes testing was continued for 40 minutes.

A test was considered non-reactive if there were not two acceptable fetal heart rate accelerations in any given 20 minute period of observation for a total of 40 minutes.

While labelling non-stress test as reactive or nonreactive, other variables were also taken into consideration (according to criteria laid down by Phelan et al 1984).

- 1) Baseline fetal heart rate – normal baseline heart rate was considered as 120-160 beats per minutes.
- 2) Variability – Beat to beat variability of 2-3 beats was considered as normal.
- 3) Presence or absence of accelerations with movement (as defined previously).
- 4) Presence or absence of bradycardia or decelerations.

Bradycardia as defined as a decline of 110 beats per minute or less. Decelerations were defined as a decline in the heart rate of 15 beats per minute or more lasting 15 seconds in response to a fetal movement. All patients with reactive NSTs were followed by repeated non-stress biweekly till they went into spontaneous labour or were induced at 42 weeks.

All patients were subjected to Doppler examination. It was performed with Toshiba colour Doppler system using a 3.5 MHZ transducer with 3 mm sample volume and medium filter, with the patient in semirecumbent position and fetus in a quiet resting stage. Flow velocity waveforms were recorded from uterine artery, umbilical artery and fetal middle cerebral artery.

DISCUSSION: In present study, 55 women with pregnancy of more than 40 weeks gestation were studied. They prospectively evaluated the usefulness of NST and Doppler artery flow velocimetry for identifying postdate fetuses at risk. The risk of perinatal death decreases with advancing gestational age until some point between 38 and 41 weeks, when it begins to increase again. The gestational age at which the risk begins to increase and the degree of risk involved have been subject to reconsideration.

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In present study, primigravida show high tendency towards prolonged pregnancy (Table 2). The incidence of postdated pregnancy was found to be 50.9% in primigravida, 28% in second gravida, 12.1% in third gravida and 9% in fourth gravida.

The incidence of caesarian section in present study was 40%. Most common causes for LSCS were fetal distress and failure of induction. More than 60% of the patients induced underwent caesarean section. This may be because of poor Bishop's score and unengaged vertex at the time of induction. These findings are supported by Alexander and associates (2000)¹ and Shin (2004). Bodner-Adler (2005)² found that the frequency of caesarean delivery and vacuum extraction was also significantly higher in the induction group ($p=0.0001$). Hannah et al (1996) found that the caesarean section rate was significantly increased in women randomized to expectant management who were induced (42.0%). These women were significantly more likely to be nulliparous, to have a closed cervix at the onset of labour, and to have a longer interval from induction to delivery. When compared with the expectantly managed women in spontaneous labor, they had significantly higher caesarean section rates for fetal distress or dystocia.

There was no prenatal mortality in present study. We believe that the absence of perinatal deaths is due to exclusion of patients with preeclampsia and no cases of intrauterine growth restriction. Only 5(9%) patients showed evidence of post maturity syndrome.

Table 5 shows that poor neonatal outcome was mostly seen in patient who delivered after 41 weeks (33.3% had Apgar <7 at 5 min, 21.12% required NICU admission and 36.3% had meconium staining). This may be because of higher incidence of oligohydramnios and passage of meconium after 41 weeks. Walker and Turnbull (1953)³ have stated that from 41 onwards there is diminution in oxygen supply in umbilical vein which leads to fetal anoxia and this is responsible for three fold increase in un-explained deaths in comparison to anoxic deaths at term. The perinatal mortality rate (i.e. stillbirths plus neonatal deaths) approximately doubles by 42 weeks gestations and is four to six times greater at 44 weeks.

These findings are supported by the Cochrane review of 19 RCTs that found that routine labour induction at 41 weeks gestation resulted in lower perinatal mortality rates. Meconium – stained amniotic fluid was more common in the expectant management group. In a more recent meta-analysis of 16 RCTs comparing induction at 41 weeks versus expectant management, the induction group had lower caesarean delivery rates. A non-significant reduction in perinatal mortality rates also was found in the induction group. The society of Obstetricians and Gynecologists of Canada (SOGC) issued guidelines in 1997 encouraging the routine induction of labour at 41 week's gestation. Alexander et al (2000)¹, reviewed 56,317 pregnancies delivered at 40 weeks or more, the rate of caesarean section for dystocia and fetal distress was significantly more at 42 weeks compared with that of earlier deliveries.

The incidence of neonatal seizures and deaths doubles at 42 weeks. Usher and colleagues (1998) reported perinatal death rates of 1.5, 0.7, and 3 per 1000 for 40, 41 and 42 weeks respectively, Sanchez-Ramos et al⁴ in 2003 compared routine labour induction with expectant management for patients who reach or exceed 41 weeks of labor for post term pregnancies. They Concluded that a policy of labour induction at 41 Weeks gestation for otherwise uncomplicated singleton pregnancies reduces caesarian delivery rates without compromising perinatal outcomes.

In our view a large randomized trial should be conducted.

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In present study, patients were monitored with twice weekly NST and once a week Doppler. In those with either NST non-reactive or Doppler abnormal, induction was done. Cases with normal results were monitored till 42 weeks when routine induction was done. Of 55 babies, 15(27.2%) had weight between 2000 gm – 2500 gm, only 2 babies had weight more than 3500 gm. It is because average birth weight of Indian babies at term is less than western babies.

In present study, 22.3% NST's were non-reactive. Fetal outcome with respect to Apgar score at 5 minutes (less than 7- abnormal), NICU admission and presence of meconium was correlated with NST and Doppler. Non-reactive NST was significantly associated with Apgar <7, NICU admission and meconium staining of amniotic fluid. The sensitivity and specificity of NST is 60% and 82.5% for Apgar <7 at 5 minute, 66.6% and 78.2% for NICU admission, 55% and 85.7% for meconium respectively.

NST is based on the finding of acceleration of fetal heart rate in response to fetal movement. Dynamic biophysical activities are initiated by a complex integrated mechanism of fetal central nervous system. The presence of normal biophysical activity is indirect evidence that a given portion of central nervous system, that controls the activity is intact and functioning, therefore non hypoxemic. The absence of a given fetal biophysical activity is much more difficult to interpret, since it may be a pathogenic depression or normal periodicity. Fetal heart rate reactivity is most sensitive biophysical activity to hypoxia and the fetus with suboptimal oxygenation usually presents with non-reactive NST at initial stage of hypoxia. Presence of late deceleration is an important indicator.

RESULTS: Results of present study suggests that a reactive non stress test in prolonged pregnancy has good negative predictive value – i.e. adverse outcomes are unlikely to occur in the setting of a reactive non stress test – but that the positive predictive values are low.

Tables 10, 11 and 12 show that uterine artery PI, RI and S/D ratio is not significant in predicting abnormal fetal outcome respectively. Abnormal waveforms from uteroplacental circulation are associated with inadequate placental invasion. This is nearly always associated with hypertensive disorders of pregnancy and intrauterine growth restriction. These cases were not included in present study. Possible explanations for underlying pathophysiology in postdated pregnancies need to be explored. The development of abnormal fetal circulation in postdated pregnancies is probably a phenomenon of villous aging and not results of hypo perfusion of intervillous space.

This is supported by Brar et al(1989)⁵ who studied uterine resistance using Doppler velocimetry in postterm pregnancy. There were no significant differences in the uterine artery S/D ratios in the two groups. Zimmermann et al⁶ in 1995 studied Doppler flow velocimetry of the umbilical artery, uteroplacental arteries and fetal middle cerebral artery in prolonged pregnancy. Doppler resistance indices in the umbilical artery. Uteroplacental arteries in the region of placental implantation and fetal middle cerebral artery did not change significantly with increasing gestation from 41 to 43 weeks. Oligohydramnios and antepartum cardiotocography predicted asphyxia with 16% and 8% sensitivity and 95% and 96% specificity, respectively, Olofsson et al (1997)⁷ found that uterine flow was not significantly affected in any group. They concluded that in very prolonged pregnancies, fetal distress in labor was not associated with an increased placental vascular

resistance the umbilical artery pulsatility indeed was low in cases of fetal distress and meconium release.

Urban et al (2000)⁸ on study of Doppler cerebroplacental ratios and perinatal outcome in post-terms pregnancy, found significant correlations between MCA PI/UA PI, MCA RI/UA RI, non-stress testing and intrapartum fetal heart rate assessment. There was also an association between MCA PI/UA PI and 1 and 5 minute Apgar score. They concluded that the Doppler cerebroplacental ratios provide useful information about perinatal outcome. In these studies cases of IUGR were not excluded.

Table 13 shows that umbilical artery PI is statistically significant in predicting abnormal fetal outcome. Table 15 shows that umbilical artery S/D ratio is significant in predicting abnormal fetal outcome except meconium. Table 14 shows that umbilical artery RI is not significant in predicting in predicting abnormal fetal outcome.

The etiology is unknown, but a subclinical fetal hypoxia triggered a vasodilation of placental vessels. Vasodilation at an unchanged volume flow could also explain the decrease of umbilical venous flow velocity. There may be changes that do not result in increased resistance in placenta. The fetus may become less efficient in using nutrients it receives. It is suggested that fetal compromise is more feto-placental problem than uteroplacental problem. Similar results were found by Zhou et al⁹ in 1995 in a comparative study of umbilical artery Doppler Velocimetry, antenatal fetal heart rate monitoring and umbilical artery blood-gas analysis in the prediction of neonatal outcome in postterm pregnancies. Umbilical artery S/D ratio was useful in the prediction of neonatal outcome, and the abnormal umbilical artery S/D ratio is closely associated with neonatal acidosis at birth.

Umbilical artery pulsatility index and S/D ratio was significantly associated with Apgar <7, NICU admissions and meconium. Olofsson et al (2004)⁷ studied association between a low umbilical artery pulsatility index and fetal distress in labour in very prolonged pregnancies. The umbilical artery pulsatility index was significantly lower in cases of fetal meconium release (n=12) and fetal distress (n=7). Zimmermann et al⁶ in 1995 studies Doppler flow velocimetry of the Umbilical artery, Uteroplacental arteries and fetal middle cerebral artery in prolonged pregnancy. Doppler resistance indices in the umbilical artery, uteroplacental arteries in the region of placental implantation and fetal middle cerebral artery did not change significantly with increasing gestation from 41 to 43 weeks.

Olofsson et al in 2004⁷ studied low umbilical artery vascular flow resistance and fetal outcome. Perinatal outcome was compared between cases with a UA, PI less than mean -2 SD and unselected controls with a PI within mean +/- 2SD (n=863) at Doppler velocimetry. No significant differences were found regarding perinatal mortality, Apgar Scores at 1, 5 of 10 min, or arterial or venous cord blood PH. Operative delivery and neonatal intensive care were more common in group with a UA PI less than mean -2 SD.

Jorn et al (1993)¹⁰ studied Doppler ultrasound diagnosis in post-term pregnancy. No clinically significant changes were found examining the S/d – ratio of the uterine arteries and the pulsatility index of the foetal middle cerebral artery. They did not find significant changes in the medians of the means velocity of the foetal aorta, of the S/D-ratio of the umbilical artery and of the pulsatility index of the foetal middle cerebral artery. Lowery et al (1990)¹¹ did a comparison

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between umbilical artery velocimetry and standard antepartum surveillance in hospitalized high-risk patients. They concluded that Doppler umbilical artery flow studies are an important adjunct to antepartum fetal surveillance in high-risk patients but should determine clinical management when standard antepartum surveillance remains normal. Korszun et al (2002)¹² studied Doppler velocimetry for predicting outcome pregnancies with decreased fetal movements. They concluded that adding umbilical and uterine artery Doppler velocimetries might be reassuring for managing clinicians.

Zimmermann et al⁶ in 1995 found that fetal middle cerebral artery resistance index did not change significantly with increasing gestation from 41 to 43 weeks. Urban et al⁸ in 2000 studied the Doppler cerebroplacental ratio and perinatal outcome in post-term pregnancy. There was also an association between MCA PI/UA PI and 5 – minute Apgar score. They concluded that the Doppler cerebroplacental ratios provide useful information about perinatal outcome.

We conclude that weekly measurement of Doppler waveforms from umbilical artery (PI $p=0.02$ for Apgar <7 at 5 min, $p=0.02$ NICU admissions, $p=0.003$ for meconium staining of amniotic fluid and S/d ratio $p=0.02$ for Apgar <7 at 5 min, $p=0.04$ for NICU admission) and biweekly NST($p=0.005$ for Apgar <7 at 5 min, $p=0.0219$ for NICU admission, $p=0.0039$ for meconium staining of amniotic fluid) appears to be reliable method of establishing fetal health in pregnancy beyond 40 weeks.

CONCLUSION:

- 1) The most sensitive tests to assess the risks to the fetus of prolonged pregnancy appear to be combinations of fetal heart rate monitoring with NST combined with umbilical PI and S/D ratio.
- 2) Reactive NST is reassuring and indicates fetal wellbeing, but non-reactive NST alone cannot be taken as an indicator of fetal jeopardy.
- 3) Although individual randomized trials do not show significant differences in perinatal mortality between women electively induced at specific gestational ages and women followed with antepartum testing, data shows a significant increase in abnormal fetal outcome after 41 weeks.
- 4) There is reduction in perinatal morbidity in women electively induced after 41 weeks compared with women managed with antepartum testing.

BIBLIOGRAPHY:

1. Alexander JM, McIntire DD, Leveno KJ. Forty weeks and beyond: pregnancy outcomes by week of gestation. *Obstet Gynecol* 2000. 96: 291-4. (2):
2. Bodner-Adler Wien Klin Wochenschr. Influence of labor induction on obstetric outcomes in patients with prolonged pregnancy: a comparison between elective labor induction and spontaneous onset of labor beyond term 2005 Apr; 117(7-8):287-92.
3. Walker J and Turnbull: Hemoglobin and red cells in human fetus : *Lancet*: 2:312'1953.
4. Sanchez-Ramos L, Olivier F, Delke I, Kunitz AM: Labor induction versus expectant management for post-term pregnancies: a systematic review with meta-analysis; *Obstet Gynecol*; 101, 2003.

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5. Brar HS, Horenstein J, Medearis AL, et al. Cerebral, umbilical, and uterine resistance using Doppler velocimetry in post-term pregnancy. J Ultrasound Med 1989. 8: 187-91. (4):
6. Zimmeramn et al Doppler flow velocimetry of the umbilical artery, uteroplacental arteries and fetal middle cerebral artery in prolonged pregnancy.
7. Olofsson P. Olofsson H. Molin J. Marsal K. Low umbilical artery vascular flow resistance and fetal outcome: Acta Obstet Gynecol Scand. 2004 May; 83(5): 440-2.
8. Urban et al: Doppler cerebral placental ratios and perinatal outcome in post term pregnancy. Ginekol POL 2000 APR;71(4):317-21.
9. Zhou etal Comparative study of umbilical artery velocimetry, antenatal fetal monitoring and umbilical artery blood gas analysis in prediction of neonatal outcome. Hau xi yi ke da xue xue bao.1995 Mar;26(1)98-100.
10. Jorn et al Doppler ultrasound diagnosis in post-term pregnancy Geburtshilfe Frauenheil 1993 sep; 53(9)603-8.
11. Lowery et al a comparison between umbilical artery velocimetry and standard antepartum surveillance in hospitalized hight-risk patients; Am J Obst Gyn 1979 134:376-84.
12. Korszun P et al Doppler velocimetry for predicting outcome pregnancies with decreased fetal movements. Acta Obstet Gynaecol Scand 2002 Oct 81(10):926-30.

Age (years)	No. (n=55)	%
-20	15	27.2
-25	25	45.5
-30	12	21.8
-35	3	5.5

Table 1: Age

No.	Gravida	No. of patients	%
1	Primi	28	50.9%
2	Second	14	28%
3	Third	8	12.1%
4	Fourth	5	12.1%

Table 2: Gravidity

Onset of labour	No. n=55	LSCS
Induced	15 (28.8%)	9 (60%)
Spontaneous	37 (71.2%)	10 (27%)
Elective LSCS	3(5.4%)	

Table 3: Onset of labour

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Mode of delivery	No. n=55	%	Induced	Spontaneous
Vaginal	33	60%	6	26
Normal	28	50.9%	5	22
Forceps	5	9.1%	1	4
LSCS	22	40%	10	13

Table 4: Mode of Delivery

Gestation at delivery (weeks)	No.	Apgar <7 at 5 min	NICU admission	Meconium staining
40-	16	1(6%)	1(6%)	5(31.2%)
41-	33	11(33.3%)	7(21.2%)	12(36.3%)
42-	6	3(50%)	1(16.6%)	2(33.4%)
Total	55	15	9	20

Table 5: Gestational age at Delivery

NST results	No. (%)
NR	16(22.3%)
R	56 (77.7%)
Total	72

Table 6: NST Results

NST result	Apgar <7 at 5 min	NICU Admission	Meconium Staining
NR (n=16)	9 (56.2%)	6(37.5%)	11(68.7%)
R (n=39)	6 (15.3%)	3 (7.6%)	9 (23.0%)

Table 7: NST and Neonatal Outcome

Prediction of	Sensitivity	Specificity	PPV	NPV	Odds ratio	P value
Apgar<7 at 5 min	60%	82.5%	56.25%	84.6%	7.07	0.005
NICU admission	66.6%	78.2%	37.5%	92.3%	7.02	0.0129
Meconium staining	55%	85.7%	68.7%	76.9%	7.33	0.039

Table 8: Prediction by NST

Uterine artery PI result	Apgar<7 at 5 min	NICU admission	Meconium staining
Increased (n=19)	4 (21.0%)	3(15.7%)	9(47.3%)
Normal (n=36)	11(30.5%)	6 (16.6%)	11(30.5%)

Table 9: Uterine artery PI and neonatal outcome

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Uterine artery RI result	Apgar<7 at 5 min	NICU admission	Meconium staining
Increased (n=16)	6	5	9
Normal (n=39)	9	4	11

Table 10: Uterine artery RI and neonatal outcome

Uterine artery S/D ratio result	Apgar <7 at 5 min	NICU admission	Meconium staining
Increased (n=18)	3 (16.6%)	3(16.6%)	6(33.3%)
Normal (n=37)	12(32.4%)	6(16.2%)	14(37.8%)

Table 11: Uterine artery S/D and neonatal outcome

Umbilical artery PI ratio result	Apgar <7 at 5 min	NICU admission	Meconium staining
Increased (n=18)	9 (50.0%)	6 (33.3%)	12 (66.6%)

Table 12: Umbilical artery PI and neonatal outcome

Umbilical artery RI ratio result	Apgar<7 at 5 min	NICU admission	Meconium staining
Increased (n=21)	5 (23.8%)	3 (14.2%)	7 (33.3%)
Normal (n=34)	10(29.4%)	6 (17.6%)	13 (38.2%)

Table 13: Umbilical artery RI and neonatal outcome

Uterine artery S/D ratio result	Apgar<7 at 5 min	NICU admission	Meconium staining
Increased (n=18)	9 (50%)	6 (33.3%)	8 (44.4%)
Normal (n=37)	6 (16.2%)	3 (8.1%)	12 (32.4%)

Table 14: Umbilical artery S/D ratio and neonatal outcome

Middle cerebral artery PI result	Apgar < 7 at 5 min	NICU admission	Meconium staining
Decreased (n=6)	2	2	2
Normal (n=49)	13	7	18

Table 15: Middle cerebral artery PI and neonatal outcome

Middle cerebral artery RI result	Apgar < 7 at 5 min	NICU admission	Meconium staining
Decreased (n=6)	2(33.3%)	2(33.3%)	2(33.3%)
Normal (n=49)	13 (26.5%)	7 (14.3%)	18 (36.7%)

Table 16: Middle cerebral artery RI and neonatal outcome

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Middle cerebral artery PI result	Apgar < 7 at 5 min	NICU admission	Meconium staining
Decreased (n=6)	2(33.3%)	2(33.3%)	2(33.3%)
Normal (n=49)	13 (26.5%)	7 (14.3%)	18 (36.7%)

Table 17: Middle cerebral artery S/D ratio and neonatal outcome

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