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Role of Fetal Umbilical Artery and Middle Cerebral Artery Doppler in Post Term Pregnancy and Neonatal Outcome

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Abstract

The objective of the current study was to determine the value of fetal Doppler indices named middle cerebral artery (MCA)-PI, umbilical artery (UA)-PI and cerebro-placental ratio in pregnancies after 42 weeks gestational age and their correlation with the mode of delivery and perinatal outcome. This prospective, observational, clinical study was carried out on 150 women whose gestational age (GA) after 42 weeks' gestation from the first day of last normal menstrual period confirmed by early ultrasound examination during the first trimester attending the antenatal clinic of Benha University Hospital CerebroPlacenta Ratio with cutoff point 1.09 had the best specificity &Middle Cerebral Artery Pulsatily Index with cutoff point = 1.01 had the best sensitivity in prediction af adverse perinatal outcome in prolonged pregnancy . Cerebro-placental ratio shows a highest specificity (93.76%) %) in comparison with middle cerebral artery and umbilical artery pulsatility indices(MCA-PI , UA-PI), so it may be a good test to reassure the obstetricians of the fetal wellbeing.

keywords: Post term pregnancy ,Umbilical artery Doppler,middle cerebral artery Doppler.

1. Introduction

Post-term pregnancy, by definition, refers to a pregnancy that has extended to or beyond 42 weeks of gestation (294 days, or estimated date of delivery [EDD] +14 days) [1].

The expressions post-term, postdate, postmature, & prolonged are often loosely used interchangeably to signify pregnancies that have exceeded a duration considered to be the upper limit of normal [2].

The incidence of post term pregnancy ranges from 4% to 19% [3] .Post-term pregnancies are associated with numerous adverse outcomes. In addition to mortality, there is an increased risk of meconium aspiration syndrome, neonatal seizure and long term handicap [4].

Complications of prolonged pregnancy include instrumental delivery, macrosomia, meconium-stained amniotic fluid, oligohydramnios, increase rates of cesarean delivery, retained placenta, birth injury and perinatal deaths [5].

Fetal hypoxia is one of the major causes of high perinatal morbidity and mortality rates [6] The perinatal mortality rate (stillbirths plus early neonatal deaths) at 42 weeks of gestation is twice that at 40 weeks and increases 4 folds at 43 weeks [7].

Maternal-fetal risks increase from 41 weeks and starting antenatal testing at 41 weeks of gestation may decrease the complications [8].

In the surveillance of the uncomplicated prolonged pregnancy, Doppler information may play a role in differentiating which pregnancies may be followed by expectant management or determine whether induction is a better option [9].

Combining the Doppler waveform analysis of the middle cerebral artery (MCA) with that of the umbilical artery (UA) by a cerebroplacental ratio (the ratio of their pulsatility indices) has been suggested as a useful clinical simplification [10].

The cerebro umiblical ratio shows a higher sensitivity (80%) in predicting adverse prenatal outcome when compared with the UA S/D ratio (56%) the UA PI (40%) and the MCA PI (50%) [11].

However, D'Antonio et al.,(2013)found that cerebroplacental ratio is not predictive of unfavorable outcome in women with pregnancies lasting more than 41 weeks [12].

2. Material and methods

150 women whose gestational age (GA) after 42 weeks' gestation from the first day of last normal menstrual period confirmed by early ultrasound examination during the first trimester attending the antenatal clinic of Benha University Hospital

were involved This prospective, observational, clinical study, conducted berween January2017 and July 2019.. Patients with Maternal medical disorders as: hypertension, diabetes mellitus, hepatic, cardiac, renal, autoimmune diseases (antiphospholipid syndrome, Systemic lupus erythematosus) & anemia with pregnancy.Multiple pregnancy.Non-cephalic presentation.Premature rupture of membranes. Antepartum hemorrhage.In established labor. were excluded from the srudy.

All parienrs gave informed consent and the srudy prorocol was approved by the Hospital Research Ethics Committee.

Adetailed history taking.Physical examination.Routine baseline investigations. Ultrasound: Ultrasound and Doppler study had been done twice weekly till the onset of labor or termination of pregnancy in order to assess the following:

Gestational age determination.Fetal weight estimation.Placental site and grading.Fetal Biophysical profile scoring system . Aminotic fluid volum (oligohydraminos had been diagnosed if the largest vertical pocket<2cm)Parameters of biophysical profile (fetal movements, fetal tone, fetal breathing and amniotic fluid volume) had been assessed

Doppler studies: was done to assess the following:Umbilical artery Doppler indices : umbilical

artery pulsatility index (UA-PI), umblical artery resistence index (UA-RI) , umblical artery systolic/diastolic ratio (UA-S/D).Middle cerebral artery Doppler indices: middle cerebral artery pulsatility index (MCA-PI), middle cerebral artery resistence index (MCA-RI) ,middle cerebral artery systolic/diastolic ratio (MCA – S/D). Cerebro-placental ratio: had been calculated as a ratio of MCA-PI / UA-PI .. Pulsed wave Doppler sonographic srudies were performed on women in Transabdominal ultrasound was performed to all patients while women in a slightly tilted position with the head of the bed raised 30 degrees & a small pillow under the right loin. The ultrasound machine used was voluson 730 pro made in South Korea

2.2 Umbilical artery doppler

The patient was placed in a semi-recumbent position with a left lateral tilt, & the uterine contents was scanned to select an area of amniotic cavity with several loops of umbilical cord. Ideally these cord loops should not be close to the cord insertion. Then using a pulsed wave Doppler on a free loop of cord, the characteristic sound & shape of the umbilical artery identified.

When the screen show several waveforms of similar height, the image was frozen and the pulsatility index was estimated. A minimum of 3 separate reading were averaged before the final values obtained. Because of the potential effect of the fetal breathing movements on waveform variability, recording was performed during periods of fetal apnea **.** [13]

a) Middle cerebral artery Doppler:

An axial section of the brain, including the thalami and the sphenoid bone wings, should be obtained and Magnified. Color flow mapping should be used to identify the circle of Willis and the proximal MCA . The pulsed-wave Doppler gate should then be placed at the proximal third of theMCA, close to its origin in the internal carotid artery (the systolic velocity decreases with distance from the point of origin of this vessel). The angle between the ultrasound beam and the direction of blood flow should be kept as close as possible to 0◦ . Care should be taken to avoid any unnecessary pressure on the fetal head. At least three and fewer than 10 consecutive waveforms should be recorded. The highest point of the waveform is considered as the PSV(peak systolic velocity)(cm/s).middle cerebral artery pulsatility index (MCA-PI) estimated

2.3 Clinical management

Spontaneous vaginal delivery was awaited, but induction of delivery was done occurred if there was oligohydraminos, biophysical profile is ≤ 6

Induction of labor had done with Prostaglandin E2 vaginal suppositories, Oxytocin infusion or artificial amniotomy . With a Bishop score > 7, labor was induced by oxytocin infusion (starting with 5 IU in 500 ml Ringer solution & the dose rate increased according to the response. &/or artificial amniotomy. Otherwise, cervical ripening was performed with transvaginal prostaglandins (the suppository was placed in the posterior fornix then the patient was reassessed after 6 hours & received another dose if required).

Fetal heart sound were auscultated every 15 minutes using fetal Doppler & liquor was observed for meconium staining.

CTG was done for 20 minutes before the induction of labor for assessment of fetal wellbeing & fitness for induction. CTG was repeated when needed during the induction for intrapartum assessment of fetal wellbeing & for early detection of intrapartum fetal distress. Fetal distress was detected by an abnormal CTG tracing. CTG tracing was considered abnormal when there was persistent late decelerations or persistent variable decelerations & diminished FHR variability (< 5 bpm). These cases were terminated by CS.

2.4 Perinatal outcome measures

1. Apgar score at 1 & 5 minutes.
2. Assessment of neonatal birth weight.
3. Neonatal ICU admission.
4. Meconium aspiration syndrome.

2.5 Adverse perinatal outcome

Is defined as presence of one or more of the following conditions

- Cesarean delivery for fetal distress.
- Presence of thick meconium stained liquor.
- Apgar score < 7 at 5 minutes.
- Meconium aspiration syndrome.
- Admission to neonatal intensive care unit (NICU).

2.6 Statistics

Atistics Comparison of all variables were done using by a software package SPSS 20.Sensitivity, Specificity, Positive predictive value, Negative predictive value of different arterial Doppler indices and cerebroplacental ratio (CPR) were evaluated. A receiver operator characteristic curve (ROC) was plotted to ascertain the best cut-off value of CPR for predicting adverse perinatal outcome in post-dated A probability value (p value) more than 0.05 was considered to be not significant , P value less than 0.05 was considered to be statistically significant & p value less than 0.001 was considered to be statistically highly significant.

3. Result

Based on the presence or absence of adverse perinatal outcome , the study population was divided into two groups as follows:

1st group:

Group of adverse outcome was found to include 44 patients (24case cesarean section due to fetal distress , 4 cases neonatal ICU admission , 16 case meconium stained liquor , 3 cases meconium aspiration syndrome) .

2nd group:

Group of normal outcome was found to include 106 patients.

Table (1) Maternal Demographic data of the 2 studied groups.

Parameter	Adverse perinatal outcome (n= 44)	Normal perinatal outcome (n= 106)	P value
Maternal Age (years) Mean ±SD	25.66±5	25.51±3.14	0.854
Maternal Height (cm) Mean ±SD	160.77 ± 1.91	161.12 ± 4.45	0.655
Maternal Weight (Kg) Mean ±SD	78.19±6.09	76.98±6.69	0.372
GA at delivery (days) Mean ±SD	293.13 ± 38.29	290.3 ± 34.85	0.708
Gravidity	1.17 ± 1.59	1.12 ± 1.55	0.878
Median&range	3(1-8)	3.5(1-6)	
Parity	0.58 ± 0.87	0.58 ± 0.81	1.000
Median&range	3.5(0-7)	2.5(0-5)	

3.1 Demographic data

This table shows no statistically significant difference between the 2 groups by using unpaired t-test as regards the maternal age, height, weight, gravidity, parity & gestational age (P > 0.05).

3.2 Doppler indices

Table (2) Comparison between both groups as regards: UA-PI, MCA-PI, MCA PI: UA PI ratio.

Parameter	Adverse perinatal outcome (n=44)	Normal perinatal outcome (n=106)	P value
Mean UA- PI	0.99 ± 0.17	0.86 ± 0.2	0.002
Mean MCA- PI	0.95 ± 0.2	1.28 ± 0.28	0.004
Mean MCA-PI: UA PI ratio	0.96 ± 0.16	1.48 ± 0.22	0.004

Data were presented as mean ± standard deviation.

This table shows that adverse outcome group had higher UA-PI but had a lower MCA-PI & MCA-PI: UA-PI ratio when compared to the normal outcome group with statistically highly significant differences between both groups by using unpaired t-test (p < 0.001).

3.3 Mode of delivery

Table (3) Comparison between both groups as regards the mode of delivery and the indication of CS .

Parameter		Adverse perinatal outcome (n=44)	Normal perinatal outcome (n= 106)	P value
Spontaneous VD		5(11.36%)	50(47.17%)	0.003
Induced VD		15(34.1%)	25 (23.58%)	0.285
CS		24 (54.54)	31 (29.25%)	0.01
Indication	Failed induction	6 (25.0%)	10 (32.26%)	0.648
		2(8.34%)	18 (58.07%)	0.002
Of CS	Failure of progress	(inductioin)	12case induction 6cases spontaneous	
	Fetal distress	16 (66.66%)	3 (9.67%)	0.0004

Data were presented as number (%).

This table shows that the adverse outcome group had a higher rate of Cesarean section compared to the normal outcome group with statistically highly significant difference between both groups (p<0.001). Also This table shows that the group of adverse outcome had a higher rate of CS due to fetal distress compared to the other indications of CS with statistically highly significant differences between both

groups by using chi-square test (p< 0.001).

Neonatal birth weight and its relation to perinatal outcome

Table (4) Comparison between both groups as regards the neonatal birth weight

Parameter	Adverse perinatal outcome (n= 44)	Normal perinatal outcome (n= 106)	P valu e
Neonatal birthweight	2775.83 ± 166.15	3251.9 ± 204.94	0.0001

Data were presented as mean ± standard deviation.

This table shows highly statistically significant difference as regards the neonatal birth weight between both groups by using unpaired t-test. (p< 0.001).

1. Umbilical artery PI

Table (5) Relation between umbilical artery PI & perinatal outcome & the mode of delivery on considering the cutoff point = 1.18 (no. & %)

Parameter	UA-PI < 1.18 (n=118)	UA-PI ≥ 1.18 (n=32)	P-value
Vaginal delivery	78 (66.1%)	17 (53.13%)	
CS for fetal distress	11 (9.32%)	8 (25%)	0.1074
Other indications of CS	29 (24.58%)	7 (21.87%)	
Total no of adverse outcome	26(22.03%)	18 (56.25%)	0.01
Total no of normal outcome	92 (77.97%)	14 (43.75%)	

Data were presented as number (%) . UA-PI = umbilical artery pulsatility index.

This table shows that the rate of CS for fetal distress was higher in the abnormal group(UA-PI >1.18) compared to the normal group(UA-PI <1.18). However, the difference was not statistically significant (p>0.05) & the total number of patients who had adverse perinatal outcome was higher among the abnormal group compared to the normal group with statistically significant differences between both groups by using chi-square test. (p<0.05).

2. Middle cerebral artery PI

Table (6) Relation between middle cerebral artery PI & perinatal outcome & the mode of delivery on considering the cutoff point = 1.01 (no. & %).

Parameter	MCA-PI ≤ 1.01 (n=92)	MCA-PI > 1.01 (n=58)	P-value
Vaginal delivery	62 (67.4%)	33 (56,89%)	
CS for fetal distress	15 (16.3%)	4 (6.89%)	0.039
Other indications of CS	15 (16.3%)	21 (36.22%)	
Total no of adverse outcome	35 (38.04%)	9 (15.52%)	0.004
Total no of normal outcome	57 (61.96%)	49 (84.48%)	

Data were presented as number (%). MCA-PI = middle cerebral artery pulsatility index .

This table shows that the rate of CS for fetal distress was higher in the abnormal group (MCA-PI <1.01) compared to the normal group (MCA-PI >1.01) with statistically significant differences between both groups (P<0.05) & the total number of patients who had adverse perinatal outcome was higher among the abnormal group compared to the normal group with statistically highly significant differences between both groups by using chi-square test. (p<0.001).

3. Cerebroplacental ratio

Table (7) Relation between MCA-PI/UA-PI ratio (CPR) & perinatal outcome & the mode of delivery on considering the cutoff point = 1.09 (no. & %):

Parameter	CPR > 1.09 (n=103)	CPR ≤ 1.09 (n=47)	P value
Vaginal delivery	68 (66.02%)	27 (57.45%)	
CS for fetal distress	6 (5.83%)	13 (27.66%)	0.0003
Other indications of CS	29 (28.15%)	7 (14.89%)	
Total no of adverse outcome	10 (9.71%)	34 (72.34%)	0.0001
Total no of normal outcome	93 (90.29%)	13 (27.66%)	

Data were presented as number (%). CPR = cerebro-placental ratio.

This table shows that the rate of CS for fetal distress was higher in the abnormal group (CPR<1.09) compared to the normal group (CPR>1.09) with highly statistically significant differences between both groups (P <0.001) & the total number of patients who had adverse perinatal outcome was higher among the abnormal group compared to the normal group with highly statistically significant differences between both groups by using chi-square test. (P<0.001).

Significance Tests

Table (8) It shows the performance of the different testing parameters

Parameter	Area under curve	Cut off value	Sensitivity	Specificity	PPV	NPV
Umbilical PI	0.507	1.184	36.31%	65.93%	59.19%	70.54%
MCA PI	0.649	1.012	80.46%	48.48%	46.76%	81.86%
CPR	0.925	1.093	75.1%	93.76%	87.17%	86.97%

This table shows comparison between the performances of the different Dopper indices in antepartum fetal surveillance for adverse perinatal outcome. It was found that CPR with cutoff point 1.09 had the best specificity &MCA PI with cutoff point = 1.01 had the best sensitivity.

It was noted that there were no recorded cases of stillbirth or neonatal death among the studied population.

4. Discussion

prolonged pregnancy is associated with adverse outcomes like fetal distress, meconium aspiration syndrome and more neonatal ICU admissions. The outcome of prolonged pregnancy can be improved by proper counselling for follow up during pregnancy and proper monitoring and appropriate management during labour [14].

There is insufficient evidence to recommend a management strategy between 40 and 42 completed weeks. Thus, although not considered mandatory, initiation of fetal surveillance at 41 weeks is a reasonable option. After completing 42 weeks, recommendations are for either antenatal testing or labor induction [15].

The present study included 150 pregnant ladies who were divided into two groups based on presence or absence of adverse perinatal outcome. The group of adverse outcome included 44 patients and the group of normal outcome included 106 patients.

All the women were subjected to ultrasonographic evaluation of the Doppler velocimetry study of umbilical & middle cerebral artery.

Results of current study showed no statistically significant difference regarding maternal age between the two groups. This result agrees with [16]. [17] found that a negative effect of maternal age on the neonatal outcome may be seen even after 30 years of age. [18] found that pregnancies of maternal age ≥40 years carry increased risks for both neonatal and obstetric complications, and these risks seem to be effected by parity

Results of the present study showed no statistically significant difference regarding maternal body weight between the two studied groups. However Bali Ram etal.,(2018) [19] found that Maternal BMI have strong association with pregnancy complications and outcome.

The findings of current study showed no statistically significant differences regarding parity & gravidity between the two groups. These results agree with Yun Wang et al., (2010) [20] who found that there is no significant effect on adverse perinatal outcome irrespective of parity. But Singh & Sankaran et al.,

(2008) [21] found that nulliparity was associated with increased risk of adverse intrapartum event.

Results of the present study showed that there was statistically significant difference between the two groups as regard the fetal birth weight which is lower in the group of adverse outcome. These results agree with [21] who found that the fetal birth weight was significantly less in the group with adverse events.

But it differs from the results of [22] that reported that the fetal weight seems to be a poor predictor of the outcome of prolonged pregnancy.

Results of current study had shown that the rate of cesarean section among all patients was 37%, & the rate of vaginal delivery among all patients was 63%. This disagrees with [14] who documented increased cesarean section rates in case of prolonged pregnancy.

By analysis of data in the two studied groups regarding the mode of delivery, 11.36% % of patients who had adverse outcome & 47.17% of patients that had normal outcome were delivered by spontaneous vaginal delivery. While 34.1% of patients in the group I & 23.58%in the group II were delivered by induced vaginal delivery . Also, 54.54% of patients in the group I & 29.25% in the group II were delivered by cesarean section. Regarding the cause of CS in the two groups 25.0% due to failed induction, 8.34% due to failure of progress & 66.66% due to fetal distress in the group I , but in the group II 32.26% due to failed induction & 58.07% due to failure of progress ,9.67 % due to fetal distress. There were highly significant differences between the two studied groups regarding the mode of delivery.

These results agree with those reported by [23] who found highly significant difference between postdate and term groups as regard delivery by CS.

Induction of labour in late and post term pregnancies is associated with a significantly higher cesarean section rate. Other maternal and fetal parameters were not influenced by induction of labour [24].

Also, [25] showed that Cesarean section was significantly more common in women with post-term pregnancy. The increase was equally distributed between Cesarean sections performed for failure to progress in labor and fetal distress. This finding is consistent with the hypothesis that some cases of prolonged pregnancy are associated with a defect in the physiology of labor, in addition to any increase in risk of fetal hypoxia. However, the possibility of bias in management arising out of the knowledge that a pregnancy is post-term cannot be excluded as a factor in the increase in Cesarean section rates.

Absent or reversed end diastolic flows indicate marked placental resistance & has been associated with fetal deterioration & increased risk of perinatal mortality & operative delivery [26].

Frequency of delivery by caesarean section was higher in foetuses with abnormal Doppler. Incidence of meconium stained liquor and intra-partum death was higher (50%) in reversed end diastolic flow [27].

In the current study, no case with absent or reversed end diastolic flow was recorded.

Regarding the umbilical artery pulsatility index, the patients with abnormal UA-PI (with values above the cutoff point) had Statistically significant difference with those who had normal UA-PI as regard the incidence of adverse perinatal outcome ($p<0.05$) but there was statistically non significant difference between both groups as regard mode of delivery ($p>0.05$).

On considering the cutoff point of 1.18 for umbilical artery pulsatility index , operative interference due to fetal distress & presence of adverse outcome were found to be higher in the abnormal group compared to the normal group. This differs from the results reported by (28) who found that the average UA-PI for the low risk pregnancies was 0.92.

The results of the present study agree with those reported by [29] who found that UA-PI may be useful in assessment of FHR patterns suggesting fetal distress.

On the other hand, [30] reported that UA-PI was found to be significantly lower in cases of prolonged pregnancy with fetal distress. Also, [31] showed that fetuses that had some degree of distress had UA-PI within normal range. [32] showed that abnormal flow velocity had no significant relationship with fetal asphyxia, indicating that the structural changes of placenta during prolonged pregnancy didn't alter fetal blood flow. [33] reported that UA velocimetry is a test of placental function that does not always directly reflect fetal status.

[34] found that UA Doppler flow velocity waveform from pregnancies associated with fetal compromise & abnormal neonatal outcome were similar to those from pregnancies in which outcome was normal.

Vascular resistance in the umbilical artery and middle cerebral artery does not change abruptly when gestation exceeds 280 days. It also cannot be taken as the sole method of fetal surveillance when date is crossed [35].

But CPI ratio is a very good predictor of adverse outcome in the fetuses of women with high-risk pregnancy [36].

Evaluation of performance of the UA-PI assessment test in the current study revealed that it had a sensitivity of 36.31% & specificity of 65.93%. [37] reported that the sensitivity of UA Doppler velocimetry was about 64%.

Hypoxia is present in most of the chronic or acute fetal patency stages. The initial cardiovascular response includes a redistribution of the main fetal flows and later blood pressure increase, bradycardia, and modification of the cardiac (left and right) hemodynamics. It is generally accepted that there is a significant vasoconstriction of most of the fetal vessels (pulmonary, splanchnic, skeletal, and muscular areas) and an increased perfusion of the brain, the heart, and the adrenal glands. This phenomenon, called the "brain-sparing effect " [38].

This phenomenon, “brain-sparing,” is actually a misnomer, as it is not protective for the fetus but rather is associated with perinatal morbidity and mortality [39].

Regarding the middle cerebral artery pulsatility index, the patients with abnormal MCA-PI (with values below the cutoff point) had Statistically significant difference with those who had normal MCA-PI as regard the incidence of adverse perinatal outcome & risk of cesarean delivery especially for fetal distress ($p<0.05$).

On considering the cutoff point of 1.01 for middle cerebral artery pulsatility index , cesarean delivery due to fetal distress was found to be significantly higher in the abnormal group than in the normal group.

[40] found that MCA-PI is better than UA-PI & amniotic fluid volume assessment to predict the adverse outcome in uncomplicated postdated pregnancy. Also, [41] showed that women who developed signs of fetal distress during labor or who required intervention because of fetal distress had decreased MCA-PI.

However, [42] discovered absence of any significant statistical difference in UA-PI & MCA-PI in predicting adverse perinatal outcome. They attributed this to that in uncomplicated postdate pregnancies; the mechanism of fetal compromise is perhaps due to decrease in the flow of nutrients across the placenta & decrease in the efficiency of utilization of nutrients by the placenta & the fetus. These changes are not reflected in increase in resistance in the blood vessels of placenta or fetus.

Also, [43] found that MCA-PI is not a reliable indicator for predicting fetal distress.

The CPR index shows the highest sensitivity in prediction of FHR abnormalities and adverse neonatal outcome in uncomplicated pregnancies at 40 weeks and beyond. The CPR index is useful in clinical practice in antenatal monitoring of these women in order to select those at high risk of intra- and postpartum complications [44].

Evaluation of performance of the MCA-PI assessment test in the current study revealed that it had a sensitivity of 80.46% & specificity of 48.48%.

Regarding the cerebro-placental ratio (MCA-PI/UA-PI), the patients that had abnormal ratios (with values below the cutoff point, on considering the cutoff point of 1.09) were compared with the cases that had normal values regarding the incidence of adverse perinatal outcome & risk of cesarean delivery especially for fetal distress, highly significant differences were found between the two studied groups ($p< 0.01$).

These results agree with [45], where PI was determined in the mid-portion of the umbilical artery & the mid or distal segment of the middle cerebral artery, the CPR offers the advantage of detecting redistribution of blood flow due to two potential mechanisms: either "forced centralization" an increase of the placental resistance or decrease in the cerebral blood flow due to a "brain-sparing" effect, accordingly CPR considered better predictor of fetal compromise than either vessel considered alone.

Similarly, [46] , [47] , [48] support these results regarding CPR. They found that fetuses may undergo redistribution of arterial blood flow in response to a failing of uteroplacental unit before marked changes occur in the umbilical artery waveform. So, CPR is a better predictor of fetal compromise than neither MCA-PI nor UA-PI alone.

However, [49] in their study on UA-PI, MCA-PI & CPR in postdated pregnancies concluded that Doppler information may play a role in differentiating postdated pregnancies which may be followed by expectant management from those in whom induction is a better option. However, low positive predictive value of CPR can result in missing cases with fetal jeopardy & high false positive rate can result in undue concern, expensive tests & unnecessary interference.

Also, [50] found that CPR can predict adverse outcome only in fetuses < 34 weeks gestation.

Evaluation of performance of the CPR assessment test in the current study revealed that it had sensitivity of 75.1% & specificity of 93.76% on considering the cutoff point of 1.09 . These results agree with [51] who found that cutoff point 1.05 can predict the adverse perinatal outcome with sensitivity of 80% & specificity of 95%. In contrast, Gramellini [52]& [43] used a cutoff value of 1.08 which had a higher sensitivity & specificity when compared with UA-PI & MCA-PI . [53] found that CPR with cutoff value of 1.1 had 62% sensitivity & 74.5% specificity to predict adverse outcome. [54] used a cutoff value of 1.0 which had a higher sensitivity & specificity to predict the adverse outcome.

[12] concluded that cerebroplacental ratio is not predictive of unfavorable outcome in women with pregnancies lasting more than 41 weeks by using 0.98 as a cutoff value.

Although CU ratio of 1.3 assures the obstetrician of fetal well being, its low specificity and high false positive value can lead to unnecessary tests and intervention. Hence it is not an ideal test for routine antepartum fetal surveillance in low risk postdate pregnancies [55].

Results of the present study showed that CPR had highest specificity (93.76%) in comparison with other parameters . On the other hand, MCA-PI had highest sensitivity (80.46%)%) in comparison with other parameters followed by CPR (75%).

5. Conclusion

Doppler information may play a role in differentiating which pregnancies may be followed by expectant management or determine whether induction of labor is a better opinion.

Cerebro-placental ratio shows a highest specificity (93.76%) %) in comparison with middle cerebral artery and umbilical artery pulsatility indices(MCA-PI , UA-PI), so it may be a good test to reassure the

obstetricians of the fetal wellbeing .However further studies on large number of cases will be needed to assertion this study

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