Research Article

The Positive Predictive Value of Cerebroplacental Ratio in Determining Adverse Outcome among Post Date Pregnancies

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Abstract |

Background: Post date or post term pregnancy is relatively a frequent finding in obstetrics. The incidence of post-term pregnancies are reported to in the range of 4-14% with middling value of 10.5%.16 Establishing a safe period to continue pregnancy beyond the calculated estimated due date is not possible and there is little or no agreement among gynecologists at exactly what period the fetus is at risk. There is also controversy that among these post-term pregnancies we can predict the risk of fetal hypoxia accurately. Several researchers have found a statistically significant association of increased perinatal morbidity and mortality among the postdate pregnancies especially after 42 weeks. Various antepartum tests have been proposed for the detection of compromised fetus in post-dated gestations including the Doppler Ultrasonography (USG).

Objective: The study objectives were to determine the positive predictive value for Cerebroplacental ratio (CP ratio) of <1.05 as a predictor for adverse pregnancy outcome among these post-term pregnancies in terms of:

1. Caesarean section for fetal distress.
2. Apgar score of <7 at 5mins.

Patients and Methods: It is a cross sectional study conducted in Department of Obstetrics & Gynaecology, of a Teaching Hospital, Lahore. The duration of the study was six months. Purposive non probability sampling technique was used in present study. Patients with singleton viable pregnancy and vertex presentation as assessed on ultrasound with gestational age exceeding 40 weeks of gestation and Cerebroplacental (CU) ratio of <1.05 were included in this study.

Results: We enrolled 250 cases fulfilling the inclusion/exclusion criteria and revealed 17.2% (n=43) cesarean and 14.8% (n=37) had low apgar score, The diagnostic accuracy, specificity, sensitivity, positive predictive value and the negative predictive value of cerebroplacental ration of <1.05 for cesarean section was calculated as 95.6% 93.02%, 97.10%, 86.96%, 98.53% and 96.4% respectively and these values for low apgar score were 86.94%, 97.18%, 84.21%, 97.64% respectively.

Conclusion: The study concluded that a high positive predictive value for cerebroplacental ration of <1.05 in predicting adverse outcome in post-date pregnancy in terms of caesarean section for fetal distress and Apgar score of < 7 at 5mins which may be used in future for predicting perinatal outcome.

Introduction

Post-dated pregnancies are prevalent in about 5-10% deliveries which have established the high risk to perinatal complication.[1] According to Internatioal Federation of Gynecology and Obstetrics (FIGO) and American College of Obstetricians and Gynecologist (ACOG) a pregnancy lasting 41weeks or more is defined as post-term. Epidemiological studies have shown that after 41 weeks the rate of maternal, fetal and neonatal complication increase.[2] Though, it is very less likely that there is actual biologic variation as most frequent reason to label a pregnancy as post-date is miscalculating expected date of delivery.[3] There are several risk factors a confirmed post-term pregnancy such as primipara, previous history of a post-date pregnancy, a male fetus & genetic factors.[4]

Post-date pregnancy associated maternal risks are most frequently under estimated for high risk of dystocia in labor room which approximately ranges 9-12% as compared to at term pregnancy of 2-7%. There is also an elevated risk of various perineal damage which may lead to 3rd and 4th degree cuts associated with macrosomia. High rate of caesarean section and vaginal delivery through operation is noticed which is almost twice as compared to at term pregnancy(14% vs 7%).[5] The caesarean sections are also related to an elevated danger of complications including thromboembolism, hemorrhage and endometritis. Also apart from these medical complications, there is an emotional disorders like anxiety & hindrance to delivery even 1- 2weeks after the calculated last day and its e ects are underestimated.[6]

Stillbirths and newborn mortality at early stage of upto 42nd week of pregnancy (4-7/1000 deliveries) is almost double as compared to pregnancies at 40 weeks (2-3/ 1000 deliveries). There is also a fourfold increase at 43 weeks and a 5 - 7-fold increase at 44 weeks. This data also depict that, when ongoing pregnancies / 1000 are calculated the neonatal and fetal morality rates increase suddenly after 40 weeks.[7] Fetal complications like existence of meconium increases the danger of newborn academia has been reported highest at 40th and 41st week of pregnancy comparing at 39th week of gestations.[8]

Management of postdate pregnancies without complications has remained a major challenge since while. A prospective meta analysis has concluded the issue that Initiation of labor must be consulted with bearer at or after 41st week of pregnancy which increase safety of labor and also acceptable.[9] The main objective of antenatal vigilance is to identify early onset of placental insu ciency before the onset of fetal hypoxia.[10] Malfunctioning of placenta has been thought as a pathophysiologic condition which leads to intrapartum asphyxia and aspiration of meconium though the main mechanism leads to distress of intrapartum fetal through umbilical cord compression.[11]

Various antepartum tests have been proposed for the detection of compromised fetus in post-dated gestations. Including the biophysiological profile, non stress, index of amniotic fluid (AFI) and Doppler Ultrasonography (USG).[12] A number of techniques have been developed which exploit the reflection from blood movement through alterations in USG frequency. This alteration in frequency is said to be the doppler e ect. Studies have revealed changes in blood flow by doppler among postdated gestational cases and concluded di erent findings likewise, few researcher have shown that in these postdate pregnancies there is a reorganization in flow of blood circulation of fetus.[13] For assessment of high risk postdated pregnancies, an analysis of fetus cerebral blood flow is of great value. The doppler of most extensively studied fetal middle cerebral artery remained useful in management of high risk fetuses due to placental compromise. This doppler waveform findings of Middle Cerebral Artery (MCA) are co-related with Cerebroplacental (CU) ratio and Umbilical Artery (UA) remained very much useful for clinical simplificatoin[14] and that values of <1.05 yield sensitivies of 80% and specificities of 90% in predicting an adverse outcome.[15] The aim of present study is to evaluate the waveform findings of doppler in umbilical artery and cerebroplacental ratio in uncomplicated postdate pregnancies and evaluate any correlation of findings with the perinatal outcome.

Patients and Methods

This cross-sectional study was undertaken in Department of Gynaecology and Obstetrics of a Teaching

Hospital, Lahore.

Duration of Study: Six months.

Sample size of 250 cases were calculated with 5% margin of error, 95% confidence interval with an expected positive predictive value of cerebroplacental ratio<1.05 i.e 80% (as per operational definition) in predicting adverse outcome in post-date pregnancy. Purposive non probability sampling technique was used in present study.

Patients with singleton viable pregnancy and vertex presentation as assessed on ultrasound with gestational age exceeding 40 weeks of gestation and CU ratio of <1.05 were included in this study. Patients having other medical disorders in pregnancy (hypertension, diabetes, rhesus isoimmunization) diagnosed on previous antenatal visits, additional maternal complications, pre-labor rupture of membranes assessed on per-speculum examination and congenital fetal anomalies assessed on ultrasound were excluded from this study

Selected patients from antenatal clinic and emergency department were explained procedure. Informed consent was taken. Patients were admitted after taking an informed consent and physical, pelvis and obstetric examination was completed. Obstetrical ultrasound to confirm single viable pregnancy and to rule out any fetal anomaly was done. We performed a pulsed Doppler ultrasound to determine the waveform of umbilical arter, MCA and blood flow velocity. The mean, end diastolic and peak systolic velocities were noted from corresponding vessels and systole diastole ratio along MCA The peak systolic, end-diastolic and mean velocity was recorded from these vessels and pulsatility index (PI) was calculated. The mean of three values creating waveform was utilized for calculation of CU ratio. Patients with CU ratio <1.05 were followed for the presence of adverse outcome, described as caesarean section done due to fetal distress os Apgar score of <7 at 5min of birth.

Data was entered in Statistical Package for the Social Sciences (SPSS) version 10 and analyzed through its statistical program. The quantitative variables were cerebro-placental ratio taken as mean and adverse outcome in the form of caesarean section for fetal distress and low Apgar as number and percentages.

Results

A total of 250 cases those fulfilling the inclusion criteria were enrolled to determine the positive predictive value of cerebro-placental ratio of <1.05 in predicting adverse outcome in post-date pregnancy in terms of caesarean section for fetal distress and Apgar score of <7at 5mins.

Age distribution of the patients was done, which shows 34.8 %(n=87) between 20-25 years, 40.8 % (n=102) between 26-32 years and 24.4 %(n=61) between 31-35 years of age, mean and sd was calculated as 26.32+6.21 years. Gestational age of the patients was done in Table 2, where 74.8% (n=187) had a gestational age between 40-41 weeks and 25.2% (n=63) having a gestational age of 42 weeks. The cesarean section was performed in 17.2%(n=43),

Table 1: *Demographic and Clinical Profile (n=250)*

Age (yrs)	Frequency	Percentage
20-25	87	34.8
26-30	102	40.8
31-35	61	24.4
Gestational age (wks)		
40-41	187	74.8
42	63	25.2
Cesarean Section		
Yes	43	17.2
No	207	82.8
Low Apgar Score		
Yes	37	14.8
No	213	85.2

Table 2: *Positive Predictive Value of Cerebro-Placental ratio of <1.05 in Predicting Adverse Outcome in Post-Date Pregnancy(n=250)*

Maternal Outcome	Cesarean section on cerebro-placental ratio of <1.05		Total
	Positive	**Negative**	
Positive	True positive (a) 40(16%)	False positive (b) 6(2.4%)	a + b 46(18.4%)
Negative	False Negative (c) 3(1.2%)	True Negative (d) 201(80.4%)	c + d 204(81.6%)
Total	**a + c 43 (17.2%)**	**b + d 207 (82.8%)**	**250(100%)**

Sensitivity = a / (a + c) x 100 = 93.02%
Specificity = d / (d + b) x 100 = 97.10%
Positive predictive value = a / (a + b) x 100 = 86.96%
Negative predictive value = d / (d + c) x 100 = 98.53%
Accuracy rate = a + d / (a + d + b + c) x 100 = 96.4%

while 82.8 % (n=207) had normal vaginal delivery. Frequency of low apgar score was recorded in 14.8% (n=37), while in 85.2% (n=212) had normal apgar score(Table 1)

Specificity, sensitivity, positive predictive value, negative predictive value and diagnostic accuracy of

Table 3: *Positive Predictive Value of Cerebro-Placental ratio of <1.05 in Predicting Adverse Outcome in Post-Date Pregnancy(n=250)*

Maternal Outcome	Low Apgar score on cerebro -placental ratio of <1.05		Total
	Positive	**Negative**	
Positive	True positive (a)	False positive (b)	a + b
	32(12.8%)	6(2.4%)	38(15.2%)
Negative	False Negative (c)	True Negative (d)	c + d
	5(2%)	207(82.8%)	212(84.8%)
Total	**a + c** **43 (17.2%)**	**b + d** **207 (82.8%)**	**250(100%)**

Sensitivity = a / (a + c) x 100 =86.49%
Specificity = d / (d + b) x 100 = 97.18%
Positive predictive value = a / (a + b) x 100 = 84.21%
Negative predictive value = d / (d + c) x 100 = 97.64%
Accuracy rate = a + d / (a + d + b + c) x 100 = 95.6%

cerebro-placental ratio of <1.05 was calculated which 93.02%, 97.10%, 86.96°k, 98.530/0 and 96.4% respectively. (Table 2) Specificity, sensitivity, diagnostic accuracy positive and negative predictive values and of cerebro-placental ratio of <1.05 was calculated which 86.94%, 97.18%,95.6% 84.21% and 97.64% respectively. (Table 3).

Discussion

Postdate pregnancy has been a communal problem with an incidence ranging 4-14% with mean value of 10.5%.[16] There is no promising time of fetal jeopardy due to various point of views in literature therefore no safe limit beyond expected delivery date has been established yet. Prediction of fetal hypoxia risk in such pregnancies is also controversy. An older study done by Rayburn et. al. however supposed the danger of postdate maturity starts at 40 weeks.[17]

A strong association of perinatal morbidity and mortality has been reported with postdate pregnancies and it increases after 42 weeks.[18] There has been a increased rate of cesarean section, an increased

instrumental delivery, induction of labor, shoulder dystocia, fetal distress with low score of Apgar, congenital deformation, aspiration of meconium and asphyxia to fetus are linked with postdated pregnancies.[18,19]

Various antepartum tests have been proposed for the detection of compromised fetus in post-dated gestations. Including the biophysiological profile, non stress, index of AFI and Doppler USG.[12]

A little work has been reported on value of cerebrospinal placental ratio for determination of fetus delivery among non-danger postdated pregnancies. Henceforth present study assessed waveforms of doppler in umbilical artery & cerebroplacental ratio in non-complicated post-date labor and correlation of findings with perinatal deliveries.

In our study we revealed 17.2% (n=43) cesarean and 14.8% (n=37) had low apgar score, while sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV) and accuracy rate of cerebro-placental ratio of <1.05 for cesarean section was calculated as 93.02%, 97.10%, 86.96%, 98.53% and 96.4% respectively and these values for low apgar score were 86.94%, 97.18%, 84.21%, 97.64% and 95.6% respectively, respectively. The findings of our study are in agreement with the study conducted by Allan 1315 who recorded sensitivities of 80% and specificities of 90% thus predicted hostile results and the di erence between current study was that they calculated overall diagnostic accuracy while we concluded these findings separately for low apgar score and cesarean section.

In a study done by Seyam et al[20] on 100 pregnant women between 28 weeks and 41 weeks of gestation and growth-restricted fetuses. Doppler od the UA and fetuses outcome were evaluated. The study findings revealed that early delivery had at increased risk with abnormal PI and Standard Deviation (SD) ratio, while around 68% of such cases had low weight at birth, depleted amniotic fluid and a high 22% had an admission in Neonatal ICU of which 11% needed a ventilation with positive pressure.

In another study by Anthony et al[21] compared the influence at age specific gestational levels as reference for CPR and categorized threshold categorical threshold to foresee the dangerous perinatal

outcomes growth depleted fetuses and concluded that there is a strong association between among both groups. Reference levels of age specific showed great accuracy as is shown by categorized threshold, though these findings were calculated for IUGR but in post date pregnancy, it shows the authenticity of cerebroplacental ratio of doppler in predicting dangerous perinatal outcome among patients with prolonged pregnancy.

However, in light of the results of the study, we are of the view that doppler waveforms in umbilical artery and cerebro-placental ratio in uncomplicated post-date pregnancies may be used for future for predicting perinatal outcome.

Conclusion

The results of to study reveal a higher positive predictive value of cerebro-placental ratio of <1.05 in predicting adverse outcome in post-date pregnancy in terms of caesarean section for fetal distress and Apgar score of < 7at 5mins which may be used in future for predicting perinatal outcome.

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