

Assessment of the Fetal Middle Cerebral Artery in Postdate Pregnancy using Doppler Ultrasound

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Abstract

Original Research Article

This was prospective study carried out in -Khartoum state –Sudan, Khartoum Bahri Teaching hospital in the period from august 2016 to December 2018. The problem of study was the post term pregnancy constitutes a challenge to clinicians; knowing who to induce, who will respond to induction and who will require a caesarean section (CS) and the risk of stillbirth increases beyond 41 weeks, additional fatal risks of postdate pregnancies include macrosomia, caesarean deliveries and shoulder dystocia, as well as meconium aspiration syndrome and oligohydramnios, on the other hand the Doppler ultrasound can be used as an excellent tools to aid in management. The main aim of the study was to assess MCA in postdate pregnancies by spectral Doppler ultrasound. The study was done in 64 pregnant women with normal singleton pregnancy with mean age 27 years, with gestational age ranged from 40 weeks 1day to 46 week, no maternal medical condition that may affect pregnancy outcome such as diabetic and hypertension. The data was collected by data collection sheet designed especially for this study and including all variables; then analyzed by statistical package for social sciences (SPSS). The study found that most of postdate were nulliparous 73.4%, 67.2% had adverse outcome. 40.6% delivered by CS, 6.2% had oligohydramnios, 10.9% had macrosomia, 1.6 % prenatal mortality. The study concluded that no significant difference in Doppler indices of MCA in postdate with adverse outcome and normal outcome (PI, RI, S\D ratio and CU ratio) ($p > 0.05$) but are slightly increased in case with adverse outcome than in normal outcome.

Keywords: Postdate, MCA, PI, RI, S\D ratio, CU Ratio.

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INTRODUCTION

Postdate pregnancy is a common problem, incidence has reported to be between 4-14% [1]. Fetal, neonatal and maternal complications associated with Postdate pregnancies have always been underestimated. It is not well understood why some women become postdate although in obesity, hormonal and genetic factors have been implicated [2]. The issues of postdate pregnancy, its risks, and its management options have generated considerable discussion for more than a hundred years and are still a matter of controversy. The problem was described in modern obstetric terms for the first time in 1902 by Ballantyne, who wrote: 'The postmature infant has stayed too long in intrauterine surroundings; he has remained so long in utero that his difficulty is to be born with safety to himself and to his mother. The problem of the postmature infant is intranatal [3]'.
Doppler ultrasonography (DU) of fetal and uterine vessels is a well-established method for antenatal monitoring. Certain Doppler waveforms indicating circulatory changes can be used to predict adverse perinatal outcomes, such as Doppler for MCA used for diagnosis of fetal anemia. DU used to reflect blood velocity, provide information on various aspects of blood flow such as presence and direction of flow, velocity profile, flow volume, and impedance. Among all vessels studied in DU, the UA and MCA are relatively easier to access and evaluate and are reported to be more reproducible. MCA of fetuses had been extensively studied for evaluation of placental compromise and fetal anaemia [4].

Several studies have examined the potential value of Doppler assessment in the prediction of adverse outcome (usually defined as fetal distress in

labor) in postdate pregnancies and provided conflicting results; Impedance in the fetal cerebral circulation was reported as being decreased in three studies [5-7] and normal in two studies [8, 9].

OBJECTIVE

To assess MCA in Postdate Pregnancies using spectral Doppler Ultrasound.

METHODOLOGY

The study done in 64 postdate pregnant Sudanese women in GA LMP beyond 40 weeks (40weeks 1day to 46 weeks 3days). The S/D ratio, pulsatility index (PI) and resistance index (RI) of the middle cerebral artery and CU ratio (PI MCA\ PI UA) were measured.

Including Criteria are

1. Normal singleton pregnancy in 40 weeks 1d to 46 weeks 3days GA
2. Normal fetus
3. Known date of LMP.

Exclusion Criteria are

1. Any pregnant women with fetal anomaly before recruitment
2. Multi-fetal pregnancy
3. History of maternal smoking
4. Known complications in the current pregnancy before recruitment

5. History of any pre-existing maternal medical condition (such as hypertension, diabetes mellitus, renal disease) likely to affect the fetus
6. Inability to obtain perinatal data were excluded
7. Uncretain date of LMP

Ethical approval is taken from department in area of study and verbal consent from each pregnant women was also taken. MCA nearer to the probe was identified in each case using color Doppler. Spectral trace was obtained from the MCA immediately after its origin with a sample volume of 4 mm. Angle correction was done in each case and it was ensured that the angle of insonation was between 0 and 60°. PI and RI were measured both manually as well as in auto mode over three consecutive cardiac cycles. The measurements were repeated and two successive readings showing same results were noted for the study. The data collected by data collection sheet then analyzed using SPSS version 16, frequency and percentage were taken then corrlation to determine asossiation between doppler indicies and other variables were done and significant if P value <0.05.

RESULTS & DISCUSSION

The study found that the most age group in postdate was 24-30 years 51.6 % and 17-23 years 26.6, the mean age was 27.17 ± 5.81 years (as shown in Table-1), this demonstrate that the postdate occurs in younger age pregnant women, due to that most of them were nulliparous as shown in Table-2.

Table-1: Frequency distribution of age \years

Age\years	Frequency	Percent	Valid Percent	Cumulative Percent
17-23	17	26.6	26.6	26.6
24-30	33	51.6	51.6	78.1
31-37	11	17.2	17.2	95.3
38-45	3	4.7	4.7	100.0
Total	64	100.0	100.0	
Mean age = 27.17 ± 5.81 years				

The study found that most of postdate were nulliparous 73.4%, this results go online with previous studies which stated that postdate pregnancy prevalence

increased in nulliparous women than multiparous, the ratio 2.75:1 (as shown in Table-2).

Table-2: Frequency distribution of parity

Parity	Frequency	Percent	Valid Percent	Cumulative Percent
Nulliparous	47	73.4	73.4	73.4
Multipara	17	26.6	26.6	100.0
Total	64	100.0	100.0	

The study clarified that the mean Doppler indices for AF volume, EFW, and GA are 5.22 ± 2.54 cm, 3.75 ± 0.48 kg, 41.72 respectively. MCA Doppler indices are 2.28, 1.13, 0.59 for S\D ratio, PI,RI respectively (as shown in Table-3). The placental ratio

in this study is higher than in all previous studies 1.82, some of previous studies stated it was 1.3, others stated 0.8, 1.01, the difference in these measurements may be due to that in this studies no maternal medical condition affect the flow rather than post term.

Table-3: Descriptive statistic for AFV, EFW and measurements of GA, Doppler indices of MCA (minimum, maximum, mean \pm Std. Deviation)

Variables	N	Mean \pm Std. Deviation
AFI	64	5.22 \pm 2.54
EFW	64	3.75 \pm .48
GA	64	41.72 \pm 1.17
MCA SD ratio	64	2.28 \pm .67
MCA PI	64	1.13 \pm .67
MCA RI	64	.59 \pm .43
Placental ratio (PI MCA\PI UA)	64	1.82 \pm 1.20
Valid N (listwise)	64	

Out of 64 patients, 32.8 % of these cases had normal outcome, while 67.2% had adverse outcome. 40.6% delivered by CS this results agree with A. M. Maged *et al.*, [13] whom stated that rate of cesarean section among postdate patients was 56%, also agrees with Freeman *et al.*, and Tasic *et al.*, who documented increased cesarean section rates in case of prolonged pregnancy [14, 15].

6.2% had oligohydramnios, 10.9% had macrosomia, 1.6 % prenatal mortality. (as shown in Table-3), this results go online with all previous studies done which mention that there are pregnancy complication such as oligohydramnios occurs in postdate pregnancy.

Table-4: Frequency distribution of outcome

Adverse	Frequency	Percent	Valid Percent	Cumulative Percent
C\S	26	40.6	40.6	40.6
oligohydramnios	2	3.1	3.1	43.8
macrosomia	3	4.7	4.7	48.4
macrosomia and C\S	4	6.2	6.2	54.7
C\S and polyhydramnios	3	4.7	4.7	59.4
normal outcome	21	32.8	32.8	92.2
oligo and C\S	2	3.1	3.1	95.3
macrosomia, C\S and polyhydramnios	2	3.1	3.1	98.4
prenatal mortality	1	1.6	1.6	100.0
Total	64	100.0	100.0	

No significant difference in Doppler indices of MCA in post term with abnormal outcome and post term with normal outcome ($p > 0.05$), in general all Doppler indices is more in complicated than non-complicated one. MCA S\D ratio is (2.23 \pm 0.53, 2.29 \pm 0.74) in normal and adverse outcome respectively. MCA PI (1.06 \pm 0.41 and 1.16 \pm 0.77) in normal and adverse outcome pregnancy with no significant difference ($P > 0.05$), this value is slightly lower than in study done by Gupta Usha, Chandra Suhasini, Narula MK [1] in our study done in India and find that the no significant difference in PI values of MCA in the pregnancies with normal and adverse perinatal outcome (1.30 \pm 0.27 vs 1.33 \pm 0.21) (Table-5) [1].

No significant difference found in PI MCA\PI UA Ratio in normal and adverse outcome pregnancy ($P > 0.05$), the value is 1.67 \pm 0.95 versus 1.89 \pm 1.31 respectively, this value is more than in previous studies done by Gupta Usha, Chandra Suhasini, Narula MK and stated that the mean CU ratio was 1.39 \pm 0.26 and 1.23 \pm 0.12 in pregnancies with normal and adverse perinatal outcome respectively [1]. Also more than value mention by Devin *et al.*, [7] Grammellini *et al.*, [11],

Michał Migda *et al.*, [12] and other whom stated that CPR values are constant throughout the last ten weeks of pregnancy and have a value of 1.08 as a cut-off point, and if (< 1.08) considered abnormal. Other authors suggest a value of CPR < 1.05 to be a good predictor of an adverse perinatal outcome, but included high-risk pregnancies such as pregnancy complicated with arterial hypertension or gestational diabetes [7, 11, 12]. These authors observed that CU ratio in their study had high positive predictive value for determining adverse perinatal outcome. The difference in this study from others may be due to that they included postdate pregnancies with complicating factors like hypertension while in this study uncomplicated post term pregnancies were included. The pregnancy with complication such as preeclampsia affect the vascular bed of the placenta and the fetal blood vessels, and increase the vascular resistance in umbilical artery and other fetal blood vessels which effect on Doppler indices. "On the other hand, in uncomplicated postdate pregnancies, the mechanism of fetal compromise is perhaps the decrease in the flow of nutrients across the placenta and decrease in the efficiency of utilization of nutrients by the placenta and the fetus. These changes are not reflected in increase in resistance in the blood vessels of placenta or fetus. This may explain the absence of any significant statistical difference in umbilical artery S/D

ratio and MCA PI ratio in women with normal and adverse perinatal outcome" [1].

These results of CU ratio and PI of MCA is also not similar to A. M. Maged *et al.*, 2014 whom

stated that PI and CU ratio increased in normal than in adverse outcome postdate pregnancy (1.04±0.19 and 1.83±0.37 for CU ratio) adverse versus normal and (0.89±0.12 and 0.72±0.12 for PI) adverse versus normal with significant difference $p < 0.01$ [13].

Table-4: Compares mean Doppler indices and outcome in post term

Doppler indices	Outcome	N	Mean	Std. Deviation	Std. Error Mean
MCA S\D ratio	Normal	21	2.2376	.53043	.11575
	Abnormal	43	2.2970	.74441	.11352
MCA PI	Normal	21	1.0624	.41588	.09075
	Abnormal	43	1.1609	.77035	.11748
MCA RI	Normal	21	.5276	.11687	.02550
	Abnormal	43	.6249	.52827	.08056
CU ratio	Normal	21	1.6711	.95434	.20825
	Abnormal	43	1.8965	1.31714	.20086
P value	>0.05				

CONCLUSION

The study concluded post term occurs more frequent in no parity women, caesarian section, oligohydramnios, prenatal mortality, macrosomia are occurs in post term. The study demonstrate that slightly increased in Doppler indices (MCA RI, PI, S\D ratio and placental ratio (PI MCA\PI UA)) in adverse than normal outcome post term but this changes had no significant value.

RECOMMENDATION

As there is not agreements in the studies which was done in Doppler indices in adverse outcome postdate pregnancy versus normal outcome, some authors stated increased, some of them stated decreased and some of them stated no changes, so further studies with larger sampling consider medical condition of maternal or fetus that affect Doppler indices should be done.

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