Measurement of Cerebro-Placental Doppler Ratio and Amniotic Fluid Index as a Predictor of Perinatal Outcome in Prolonged Pregnancy

Thesis

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By

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Omer Nasser Abbas Ali

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List of Abbreviations

Abb.	Full term
AFI	*Amniotic fluid index*
AFV	*Amniotic fluid volume*
BPP	*Biophysical profile*
CPR	*Cerebro placental ratio*
CS	*Caesarean Section*
CW	*Continous wave Doppler*
EDD	*Expected date of delivery*
FR	*Frequency received*
FT	*Frequency transmitted*
FVWs	*Flow velocity waveforms*
LMP	*Last menstrual period*
MAS	*Meconium aspiration syndrome*
MCA	*Middle cerebralartery*
MDV	*Minimum diastolic velocity*
MPSV	*Maximum peak systolic velocity*
MSL	*Meconium stained liquor*
NICU	*Neonatal Intensive Care Unit*
PI	*Pulsatility index*
PRF	*Pulse repetition frequency*
PSV	*Peak systolic velocity*
PW	*Pulsed wave Doppler*
RC/RP	*Resistance brained/resistance placenta*
RI	*Resistance index*
S/D	*Systolic/diastolic ratio*
SGA	*Small for gestational age*
UA	*Umbilical artery*

Abstract

Objective: To study the role of Doppler velocimetry of the umbilical and middle cerebral arteries, represented by the cerebroplacental ratio, and amniotic fluid volume in the prediction of adverse fetal outcome in post-term pregnancies. **Patients and Methods:** Design. A prospective case control study. Setting. Ain Shams University Teaching Hospital for Obstetrics and Gynecology, Egypt. Subjects: 50 pregnant patients divided into two groups; Group1: This group included 25 pregnant ladies with gestational age of 41 weeks attending the casuality department in labour or in prodroma of labor. Group 2: This group included 25 pregnant ladies with gestational age of 41 weeks not in labor and reaching the hospital for ANC, who were selected for termination based on the biophysical profile and poor Doppler indices or CTG changes. Interventions: All patients were submitted to antenatal fetal surveillance tests including modified biophysical profile (MBPP) which consists of the non-stress test (NST), amniotic fluid index (AFI), and color Doppler velocimetry of fetoplacental and fetal vessels including MCA PI, UA PI, and CPR. Main outcome measures. The accuracy of cerebroplacental ratios (the middle cerebral artery PI divided by the umbilical artery PI) and amniotic fluid volume as a meansof predicting intrauterine fetal distress and adverse perinatal outcome in post-term pregnancies. **Results:** Cerebroplacental ratio show highest sensitivity (95%) in comparison with other parameters, so it is a good test to reassure the obstetricians of the fetal well being. Prominent changes in AFI (i.e. <50% increase or decrease) is not associated with adverse perinatal outcome irrespective of the rate of change provided that the final value remains >5.0 cm. A significant association with FHR decelerations and presence of meconium is proved to exist when AFI is <5.0 cm. **Conclusion:** The addition of cerebral/umbilical ratios to antenatal surveillance protocols is expected to improve the perinatal outcome. It should be tried in the various high risk pregnancies whenever uteroplacental insufficiency is suspected.

Keywords: Doppler ultrasound; Post-term; Pregnancy; Perinatal outcome

INTRODUCTION

The terms post-term, prolonged, postdates and post mature are often loosely used interchangeably to signify pregnancies that have exceeded a duration considered to be the upper limit of normal ***(Cunningham et al., 2017).***

The standard internationally recommended definition of prolonged pregnancy accepted by both the World Health Organization (WHO) and the International Federation of Gynecology and Obstetrics (FIGO) is 42 completed weeks (294 days) or more from the first day of the last menstrual period (LMP), assuming valid dates and a regular 28 day cycle ***(Luckas et al., 2004).*** This definition was endorsed by the American College of Obstetricians and Gynecologists (1997) ***(Cunningham et al., 2015).***

Postdate pregnancies account about 5 – 10 % of the deliveries and are known to be associated with increased risk for perinatal complications ***(Lam et al., 2005a).***

Incidence of subsequent post term birth increases from 10 to 27% if first birth was post term up to 39% if there had been two previous successive post term deliveries ***(Bakketeig et al., 2000).***

The mechanism of fetal complications associated with postdate pregnancy has attributed to progressive placental

insufficiency, particularly in the presence of decreased amniotic fluid ***(Lam et al., 2005a).***

Placental dysfunction is considered to be the pathophysiologic event leading to intrapartum asphyxia and meconium aspiration. However, the principal mechanism leading to intrapartum fetal distress is umbilical cord compression due to oligohydramnios ***(Dasari et al., 2007).***

Prepartum meconium aspiration is the potential danger in postdate pregnancy. Meconium staining of amniotic fluid serves as a primary ingredient in the lower APGAR scores and higher incidence of meconium aspiration syndrome and fetal distress encountered in the postdate group ***(Boisselier et al., 2001).***

Postdate infants, particularly those with macrosomia and post maturity, are at increased risk for hypoglycemia because post mature infants has decreased storage of glycogen and subcutaneous fat and also possibly an increased metabolic rate. It is important that postdate infants with macrosomia or signs of post maturity have glucose evaluations especially during the first 12 hours ***(Sims et al., 2001)***.

Postdate pregnancies are also associated with maternal risks namely discomfort, anxiety and increased cesarean delivery due to cephalopelvic disproportion. Also, there is a risk for cervical tears due to the fetal macrosomia ***(Olesen et al., 2003)***.

Ultrasound examination plays a very important role in the diagnosis of postdate pregnancies which is used for assessment of both gestational age and amniotic fluid volume. The amniotic fluid index (AFI) and biophysical profile (BPP) have both been used to assess fetal well-being ***(Magann et al., 2004).***

Doppler information may play a role in the surveillance of uncomplicated prolonged pregnancies. Data from reliable, well- constructed normal curves during this gestational age are lacking ***(Palacio et al., 2004).***

A few studies had looked into the Doppler blood flow changes in postdated pregnancies and came up with varying results. Some demonstrated redistribution of blood flow in the fetal cerebral circulation in postdated pregnancies with adverse perinatal outcome, and such brain- sparing phenomenon is thought to result in oligohydramnios ***(Selam et al., 2000).***

However, others reported insignificant difference in Doppler indices for postdated pregnancies with and without oligohydramnios ***(Lam et al., 2005a)***.

Evaluation of the cerebral blood flow in the fetus has become an integrated part of the assessment of high-risk pregnancies. The middle cerebral artery (MCA) has been studied extensively, and its Doppler recordings are incorporated regularly into the management of fetuses at risk of developing placental compromise and fetal anemia ***(Ebbing et al., 2007).***

Combining the Doppler waveform analysis of the middle cerebral artery (MCA) with that of the umbilical artery (UA) by a common cerebro-placental ratio, i.e. the ratio of their pulsatility indices has been suggested as a useful clinical simplification ***(Ebbing et al., 2007).***

A low cerebroplacental ratio reflects redistribution of the cardiac output to the cerebral circulation and has been shown to improve accuracy in predicting adverse outcome compared with MCA or UA Doppler alone ***(Vergani et al., 2005).***

AIM OF THE WORK

The aim of this study is to determine the role of Doppler velocimetry of the umbilical and middle cerebral arteries, represented by the cerebroplacental ratio, and amniotic fluid volume in the prediction of adverse fetal outcome in post-term pregnancies.

Chapter 1

EPIDEMIOLOGY OF POST TERM PREGNANCY

Definition

The expression of post-term, postdate and post mature are often loosely used interchangeably to signify pregnancies that have exceeded a duration considered to be the upper limit of normal ***(Cunningham et al., 2017).***

The standard internationally recommended definition of prolonged pregnancy accepted by both the World Health Organization (WHO) and the International Federation of Gynecology and Obstetrics (FIGO) is 42 completed weeks (294 days) or more from the first day of the last menstrual period (LMP), assuming valid dates and a regular 28 day cycle ***(Luckas et al., 2004).*** This definition was endorsed by the American College of Obstetricians and Gynecologists (1997) ***(Cunningham et al., 2015).***

Epidemiological studies have shown that after 41 weeks, the rate of fetal, maternal and neonatal complications increase. As such, management of this condition remains a matter of concern for most clinicians. Many national scientific societies have produced guidelines that are likely to be influenced by the characteristics of the local health systems ***(Giampaolo et al., 2010).***