Middle Cerebral Artery Doppler and Amniotic Fluid Index in Predicting Perinatal Outcome in Post Dated Pregnancies

Thesis

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Mohamed Adel Ali

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- **AEDV** : Absence of end-diastolic flow velocity.
- **AFI** : Amniotic fluid index.
- **BPS** : Bio physical score.
- **CST** : Contraction stress test.
- **DFM** : Decreased fetal movement.
- **DFMC** : Decreased fetal movement count.
- **EDD** : Expected day of delivery.
- **FMs** : Fetal movements.
- **IUGR** : Intra uterine growth restriction.
- **LMP** : Last menstrual period.
- **M.C.A.** : Middle cerebral artery.
- **MBPP** : Modified bio physical profile.
- **MSAF** : Meconium stained amniotic fluid.
- **NST** : Non stress tests.
- **P.I.** : Pulsatility index.
- **PMR** : Perinatal mortality rate.
- **R.I.** : Resistance index.
- **REDV** : Reversal of end-diastolic flow velocity.
- **SGA** : Small for gestational age.
- **U.A** : Umbilical artery.
- **VAS** : Vibro acoustic stimulation.

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Introduction

Postdated pregnancies account for about 5–10% of the deliveries and are known to be associated with increased risk for many perinatal complications. The mechanism of fetal complication associated with postdated pregnancy has been attributed to progressive placental insufficiency, particularly in the presence of decreased amniotic fluid *(Lam et al., 2005).*

The adjectives postterm, prolonged, postdates, and postmature are often loosely used interchangeably to describe pregnancies that have exceeded a duration considered to be the upper limit of normal *(Cunningham et al., 2010).*

As a result, ultrasound monitoring has become an important component in the antepartum surveillance of post dated pregnancy *(Johnson et al., 1986).*

Postterm pregnancy is one of the commonest obstetric conditions. Pregnancy is called term when it lies between 37 completed weeks to 40 completed weeks (259 to 294 days) from the last menstrual period, if the pregnancy exceeds this period (above 40 completed weeks) it is classified as postterm pregnancy. The overall incidence of postterm pregnancy is 10.0% of all pregnancies. This incidence varies depending on whether the calculation is based on the history and clinical examination alone, or whether early pregnancy ultrasound examination is used to estimate gestational age *(Marahatta et al., 2009).*

Maternal and fetal risks increase with increase gestational age, but the management of otherwise low-risk prolonged pregnancies is controversial. Antenatal surveillance with fetal kick counts, non-stress testing, amniotic fluid index measurement, and biophysical profiles is used, although no satisfactory data show that monitoring improves outcomes. Studies show a reduction in the rate of cesarean deliveries and

possibly in neonatal mortality with a policy of routine labor induction at 41 weeks gestation *(Briscoe et al., 2005)*.

Postterm pregnancy is associated with longer labor and operative delivery (forceps or vacuum-assisted birth). Mothers are at increased risk for vaginal trauma due to a large baby. Cesarean delivery is twice as likely in postterm pregnancy because of the size of the baby. Mothers are also at risk for infection and wound complications, and postpartum hemorrhage. There are also risk for the fetus and newborn in a postterm pregnancy. Toward the end of pregnancy, the placenta, which supplies the fetus with the nutrients and oxygen from the mother's circulation, begins to age and may not function as efficiently as before. Amniotic fluid volume may decrease and the fetus may stop gaining weight, or may even lose weight. Babies born after 42 weeks may be at risk for meconium aspiration, when a baby breathes in fluid containing the first stool *(Caughey et al., 2006)*.

These problems can be decreased by routine ante partum fetal surveillance prior to onset of spontaneous labor. The current methods of fetal surveillance are Non stress test (NST), Amniotic fluid index (AFI),Biophysical score (BPS),Umbilical artery (UA) Systole/Diastole ratio and middle cerebral artery (MCA) pulsatility index (PI) *(Hollis B. Prolonged Pregnancy, 2002)*.

The intrapartum management of prolonged pregnancies is a unique challenge to the obstetrician, as the perinatal outcome is adverse after 40 completed weeks. In such cases, intrapartum asphyxia and meconium aspiration are associated with almost three fourths of all perinatal deaths *(Dasari et al., 2007)*.

Various studies have investigated MCA in post-term pregnancies with high risk complicating factors like chronic hypertension; pregnancy induced hypertension (PIH) and diabetes, and found it too accurately predicts fetal compromise. These conditions however, are known to affect

the vascular bed and placental circulation, and hence the blood flows to the fetus *(Gramellini et al., 1992 and Arias, 2004).*

Very few studies have been done to evaluate MCA Doppler and AFI in determining the perinatal outcome in low risk postdate pregnancies. Hence this study was designed to study the Doppler waveforms in MCA, and AFI in Uncomplicated postdate pregnancies, and to correlate these findings with the perinatal outcome.

Sarno et al (1990) found that intrapartum oligohydramnios was associated with increased risk of caesarean section for fetal distress. But *Chauhan et al (2006)* did not find an increased risk of caesarean section for fetal distress. So Oligohydramnios is not considered the optimal choice for use in prediction of increased fetal risk *(Voxman et al., 2002).*

There was a risk of fetal distress in pregnancies of 40 weeks or longer with amniotic fluid index 8 cm or less and with maximal vertical pocket 2 cm or less. In such cases, intrapartum monitoring should be performed to prevent fetal jeopardy *(Dasari et al., 2007).*

Oligohydramnios in postdated pregnancies is associated with arterial redistribution of fetal blood flow typifying the brain sparing effect and with decreased resistance in the middle cerebral artery "MCA" *(Selam et al., 2000).*

A few studies had studied the Doppler 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 is thought to result in oligohydramnios. However; others reported in significant difference in Doppler indices for postdated pregnancies with and without oligohydramnios *(Adhikari et al., 2008).*

This prospective study will be performed to examine the centile distribution of fetal MCA Doppler indices and amniotic fluid index "AFI" in uncomplicated postdated pregnancies at 40 weeks or more and the correlation between these parameters with respect to manifestation of intrapartum fetal distress:

1. Thick meconium (this is a heavy suspension of meconium, either undiluted or with reasonable amount of liquor), similar to grade 2 or 3 as defined by ***O'Driscoll and Meagher (1980).***

2. Abnormal fetal heart rate pattern: persistent moderate or severe variable decelerations or prolonged deceleration.

3. Abnormality of the fetal heart rate tracing that prompted the obstetrician to terminate labor by caesarean section, vacuum extraction or low forceps delivery ***(Lam et al., 2005).***

Aim of the work

To study the correlation between Doppler study of fetal middle cerebral artery and amniotic fluid index in uncomplicated postterm pregnancies at gestational age more than 40 weeks as a predictor of perinatal outcome in post term pregnant women.

Postdate

The adjectives post term, prolonged, postdates, and post mature are often loosely used interchangeably to describe pregnancies that have exceeded a duration considered to be the upper limit of normal *(Cunningham et al., 2010).*

The World Health Organization defines a post-term pregnancy as one that has extended to or beyond 42weeks (294 days) of gestation *(WHO, 2006).*

In 1997, the society of obsteatritions and gynecologists of Canada (SOGC) published clinical practice guidelines recommending that women with an uncomplicated pregnancy who reach 41 to42 weeks gestation should be offered elective delivery *(Hannah et al., 1997).*

Concern about increased risk to the post-term $\geq$ 42 weeks fetus has existed since the early to mid 1900s *(McClure, 1963).*

The mechanism of fetal complication associated with postdated pregnancy has been attributed to progressive placental insufficiency, particularly in the presence of decreased amniotic fluid *(Lam et al., 2005).*

The overall incidence of postterm pregnancy is 10.0% of all pregnancies. This incidence varies depending on whether the calculation is based on the history and clinical examination alone, or whether early pregnancy ultrasound examination is used to estimate gestational age *(Marahatta et al., 2009).*

The most frequent cause of an apparently prolonged gestation is an error in dating *(Crowley, 2004).*

When postterm pregnancy truly exists, the cause usually is unknown; Primiparity and prior postterm pregnancy are the

most common identifiable risk factors for prolongation of pregnancy *(Mogren et al., 1999).*

Rarely, postterm pregnancy may be associated with placental sulfatase deficiency, this enzyme plays a critical role in the synthesis of placental estrogen that is necessary for the development of gap junctions and increased expression of oxytocin and prostaglandin receptors in the myometrial cells (*Fernando Arias et al., 2010).*

Fetal anencephaly due to the lack of development of fetal hypothalamus negates the production of corticotrophin-releasing hormone and the stimulation of the pituitary-adrenal –placental axis necessary for the initiation of parturition (*Fernando Arias et al., 2010).*

Male sex also has been associated with prolongation of pregnancy *(Divon et al., 2002).*

Genetic predisposition may play a role in prolonging pregnancy (*Olesen et al., 2003).*

Fourty weeks of gestation and beyond Postterm pregnancy are associated with significant risks to the fetus. The perinatal mortality rate (stillbirths plus early neonatal deaths) at greater than 42 weeks of gestation is twice that at term (4–7 deaths versus 2–3 deaths per 1,000 deliveries) and increases 6-fold and higher at 43 weeks *(Smith, 2001).(Fig 1).*

Uteroplacental insufficiency, meconium aspiration, and intrauterine infection contribute to the increased rate of perinatal deaths (*Hannah, 2003).*

Postterm pregnancy also is an independent risk factor for low umbilical artery pH levels at delivery and low 5-minute Apgar scores (*Kitlinski et al., 2003).*

Postterm infants are larger than term infants and have a

higher incidence of fetal macrosomia (2.5–10% versus 0.8–1%) *(Rosen and Dickinson, 1992).*

Complications associated with fetal macrosomia include prolonged labor, cephalopelvic disproportion, and shoulder dystocia with resultant risks of orthopedic or neurologic injury *(ACOG practice bulletin guideline no55., 2004).*

Approximately 20% of postterm fetuses have dysmaturity syndrome, which refers to infants with characteristics resembling chronic intrauterine growth restriction from uteroplacental insufficiency *(Mannino, 2008).*

These pregnancies are at increased risk of umbilical cord compression from oligohydramnios, meconium aspiration, and short-term neonatal complications (such as hypoglycemia, seizures, and respiratory insufficiency) and have an increased incidence of non reassuring fetal testing, both antepartum and intrapartum *(Knox et al., 1979).*

Fetuses born postterm also are at increased risk of death within the first year of life Although some of these infant deaths clearly result from peripartum complications (such as meconium aspiration syndrome which is a severe complication the problem occurs more frequently when thick meconium,fetal tachycardia,and absence of fetal heart rate accelerations are present not only thick meconium is of concern but also patients with thin mecounium at the the beginning of labor may have thick mecouniun and aspiration at birth *(Fernando Arias et al., 2010),* most have no known cause *(Rand et al., 2000).*

Kitlinski et al. collected data on singleton pregnancies planned for vaginal delivery after 37 completed weeks. They defined acidemia as a pH < 7.10 and a gestational age-dependent acidemia as a pH < mean-2 SDs. Their data showed that the mean umbilical cord arterial blood pH at birth decreases linearly with gestational age. The odds ratio trend curve for low pH according

to the gestational age-dependent definition of < mean-2 SDs showed no linear association with gestational age but a significant increase after 42 weeks (OR1.24; 95% CI 1.05–1.47). The odds ratio for pH < 7.10 among infants born after 41 weeks 3 days was also significant at 1.48 (95% CI 1.26–1.72) *(Kitlinski et al., 2003).*
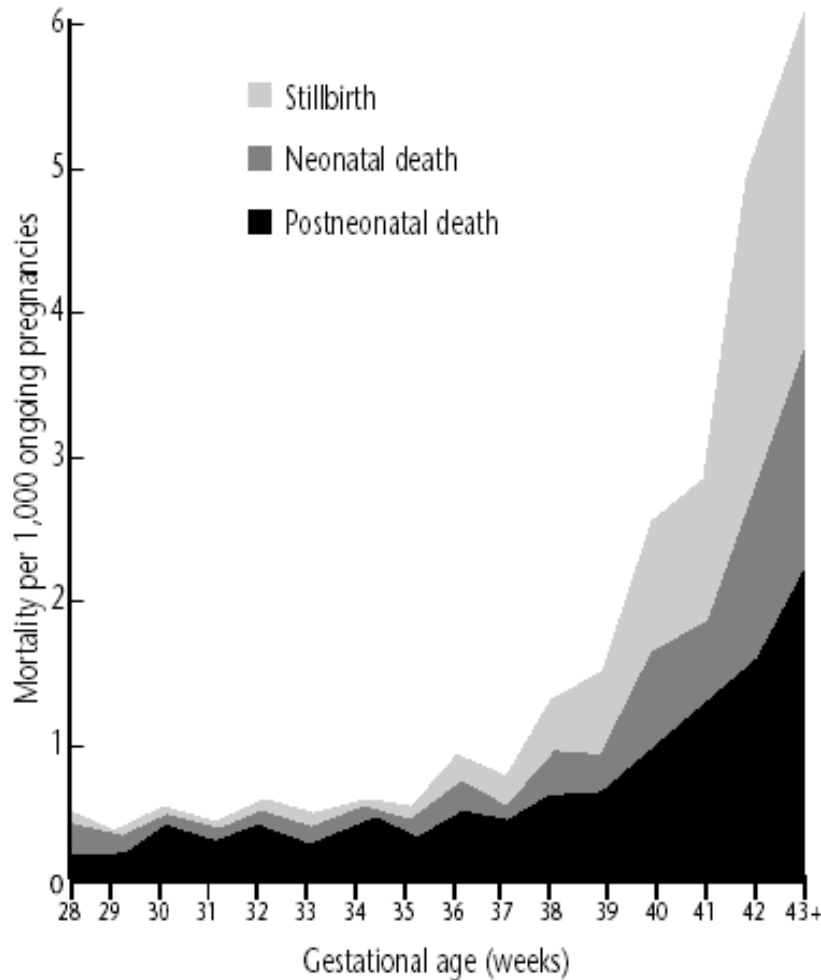

Fig. (1): Perinatal mortality per 1.000 ongoing pregnancies *Hilder et al., 1998)*

Postterm pregnancy also is associated with significant risks to the pregnant woman, including an increase in labor dystocia (9–12% versus 2–7% at term), an increase in severe perineal injury related to macrosomia (3.3% versus 2.6% at term), and a doubling