Effects of Dexamethasone on Fetal Doppler Indices

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Abstract

Objective: To assess the impacts of dexamethasone given to the mother on fetal Doppler flow velocity waveforms of both umbilical and fetal middle cerebral arteries in pregnancies with normal fetoplacental vascular resistance.

Study Design: Prospective Study.

Patients and Methods: Pregnant women between 28 weeks and 34 weeks gestation at risk of preterm labour, Preterm birth was anticipated on the basis of: History of previous preterm birth, dilating cervix, antepartum hemorrhage, Preterm premature rupture of the membranes, increased amniotic fluid volume, Patients with possible need for early termination of pregnancy including those with history of previous uterine rupture and hysterotomy.

Intramuscular dexamethasone was given as 4 doses dexamethasone (6mg/12 hours for 48 hrs), Doppler ultrasound assessment of umbilical artery (UA), middle cerebral artery (MCA) both resistive index (RI) and pulsatility index (PI) were done as baseline, day 2 and day 4.

Results: There was no significant variation noted in UA or MCA PI or RI throughout dexamethasone therapy.

Conclusion: Dexamethasone treatment was not associated with significant changes in the mean values of the pulsatility, resistive indices in umbilical artery and fetal middle cerebral artery. Awareness of this drug-induced effect might prevent unnecessary iatrogenic delivery of preterm fetuses.

Key Words: Dexamethasone – Preterm birth – Umbilical artery Doppler – Middle cerebral artery Doppler (MCA).

Introduction

WORLDWIDE, prematurity accounts for 10% of neonatal mortality, or around 500,000 deaths per year, prematurity is the leading cause of neonatal mortality at 25% [1].

Prematurity can be reduced to a small extent by using drugs to accelerate maturation of the fetus and to a greater extent by preventing preterm birth [2].

Preterm infants are at risk for specific diseases such as respiratory distress syndrome, intraventricular hemorrhage, broncho-pulmonary dysplasia, patent ductus arteriosus, necrotizing enterocolitis, sepsis, apnea and retinopathy [3].

Early detection of fetal risk is one of the main issues in today obstetrics. Ultrasound diagnosis plays a significant role, as the introduction of Doppler imaging method in the evaluation of blood flow has enabled non-invasive assessment of uteroplacental circulation [4].

Doppler velocimetry does not only facilitate judgment in diagnosis and monitoring of fetal wellbeing during pregnancy and labour but also has a role in the early detection of fetal hypoxia [5].

Knowledge of fetal haemodynamic effects after exogenous corticosteroids is limited [6].

Doppler studies have the potential to differentiate the steroid-induced changes in the fetal biophysical profile from those due to fetal compromise.

Patients and Methods

This study was carried out at Kasr Al-Aini University Hospital from March 2012 to March 2013 on eighty (80) pregnant women at risk for preterm labor (History of previous preterm birth, dilating cervix, antepartum hemorrhage, Preterm premature rupture of the membranes, increased amniotic fluid volume, Patients with possible need for early termination of pregnancy including those
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with history of previous uterine rupture and hysterotomy). Who presented at a gestational age of 28 to 34 weeks. All patients gave an informed consent and the study was approved by ethics committee, at the time of initial scanning, all pregnancies had normal umbilical artery flow velocity waveforms values.

Pregnancies with infants with major structural malformations, who had spontaneous delivery prior to completion of all examinations, those with reversed or absent End Diastolic Flow, Women on corticosteroids treatment for another disease, or those with any associated medical problem with pregnancy Gestational Diabetes, Hypertension, Cardiac, Hepatic, Thyroid diseases, RH negative mothers with history of sensitization or positive Coomb’s test or other cases of documented fetal anemia, and patients who refused and fall out were excluded from analysis.

Intramuscular dexamethasone was given as 4 doses dexamethasone (6mg/12 hours for 48 hrs), Doppler ultrasound assessment of umbilical artery (UA), middle cerebral artery (MCA) both resistive index (RI) and pulsatility index (PI) were done as baseline, day 2 and day 4.

Statistical presentation and analysis of the present study was conducted, using the mean, standard error paired t-test and chi-square tests. The level of significance was taken at p-value <0.050 is significant, otherwise is non-significant. The p-value is a statistical measure for the probability that the results observed in a study could have occurred by chance.

Results

80 patients received 6mg of dexamethasone (Epidrone, Epico Egypt) intramuscularly every 12 hours for 48 hours.

The patient’s mean age was 24.71 ± SD of 3.21 with age ranging from 19-32 years old.

Table (1): Impact of dexamethasone on resistive index (RI) of umbilical artery.

<table>
<thead>
<tr>
<th>Range</th>
<th>Mean±SD</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.6-0.8</td>
<td>0.69±0.05</td>
<td>0&amp;2</td>
</tr>
<tr>
<td>Day two</td>
<td>0.6-0.8</td>
<td>0.68±0.04</td>
<td>0&amp;4</td>
</tr>
<tr>
<td>Day four</td>
<td>0.6-0.8</td>
<td>0.68±0.04</td>
<td>2&amp;4</td>
</tr>
</tbody>
</table>

UA RI: Umbilical Artery Resistive Index.

Table (2): Impact of dexamethasone on pulsatility index (PI) of umbilical artery.

<table>
<thead>
<tr>
<th>Range</th>
<th>Mean±SD</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.9-1.3</td>
<td>1.14±0.12</td>
<td>0&amp;2</td>
</tr>
<tr>
<td>Day two</td>
<td>0.9-1.3</td>
<td>1.12±0.12</td>
<td>0&amp;4</td>
</tr>
<tr>
<td>Day four</td>
<td>0.9-1.3</td>
<td>1.11±0.13</td>
<td>2&amp;4</td>
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</tbody>
</table>

UA PI: Umbilical Artery Pulsatility Index.

Table (3): Impact of dexamethasone on pulsatility index (PI) of middle cerebral artery.

<table>
<thead>
<tr>
<th>Range</th>
<th>Mean±SD</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>1.9-2.3</td>
<td>2.07±0.1</td>
<td>0&amp;2</td>
</tr>
<tr>
<td>Day two</td>
<td>1.7-2.1</td>
<td>1.94±0.08</td>
<td>0&amp;4</td>
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<tr>
<td>Day four</td>
<td>1.5-2.3</td>
<td>2.0±0.4</td>
<td>2&amp;4</td>
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</table>

MCA PI: Middle Cerebral Artery Pulsatility Index.

Table (4): Impact of dexamethasone on resistive index (RI) of middle cerebral artery.

<table>
<thead>
<tr>
<th>Range</th>
<th>Mean±SD</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.7-0.9</td>
<td>0.79±0.04</td>
<td>0&amp;2</td>
</tr>
<tr>
<td>Day two</td>
<td>0.7-0.9</td>
<td>0.77±0.04</td>
<td>0&amp;4</td>
</tr>
<tr>
<td>Day four</td>
<td>0.7-0.9</td>
<td>0.78±0.04</td>
<td>2&amp;4</td>
</tr>
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</table>

MCA RI: Middle Cerebral Artery Resistive Index.

Discussion

Synthetic corticosteroids have been successfully employed for more than 20 years to enhance fetal lung maturity in saturations where preterm delivery is anticipated [7]. Early detection of fetal risk is one of the main issues in today obstetrics. Ultrasound diagnosis plays a significant role, as the introduction of Doppler imaging method in the evaluation of blood flow has enabled non-invasive assessment of uteroplacental circulation [4].

Doppler studies have the potential to differentiate the steroid-induced changes in the fetal biophysical profile from those due to fetal compromise [6].

The aim of the current study was to evaluate the effects of maternal dexamethasone administration on Doppler flow velocity waveforms of both umbilical and fetal middle cerebral arteries in pregnancies with normal fetoplacental vascular resistance and at high risk for preterm delivery.
Eighty women with singleton pregnancies at risk for preterm delivery were subjected to standard dose of dexamethasone, followed by Doppler studies for both umbilical artery and fetal middle cerebral artery on baseline, day 2 and day 4.

In this study, it was observed that administering dexamethasone for the mother was not associated with significant changes in the mean values of the pulsatility, resistive indices or maximum velocity of flow in umbilical artery and fetal middle cerebral artery.

Yalti [8] stated that Umbilical velocimetry, is a test of placental function that does not always directly reflect fetal status.

Piazze [5] and Urban [9] added that there was no significant change observed in UA PI through administration of corticosteroids whether dexamethasone or betamethasone therapy. That is in accordance with the current study where no significant change was detected.

Controversies were reported about impact of either dexamethasone or betamethasone on MCA PI, where some reported significant transient drop starting from 48 hours post injection followed by normalization in the next 96 hours after injection [5,6].

Conclusion:
Dexamethasone treatment was not associated with significant changes in the mean values of the pulsatility, resistive indices or maximum velocity of flow in umbilical artery and fetal middle cerebral artery. Awareness of this drug-induced effect might prevent unnecessary iatrogenic delivery of preterm fetuses.

References