

The effect of betamethasone on fetal movement, biophysical profile and fetal circulation in preterm fetusesSoghra Khazardoost, MD¹, Parichehr Pooransari MD², Masoome Mirzamoradi MD³

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Running Title: Betamethasone and Biophysical Profile in Preterm Fetuses

Abstract: Objective: Evaluating the effect of antenatal betamethasone on the biophysical profile and Doppler indices of umbilical and middle cerebral arteries. Materials and Methods: Twenty-five preterm labor singleton pregnancies (gestational age, 26-34 weeks) were studied prospectively. These patients received two consecutive doses of betamethasone 24 hours apart to accelerate pulmonary maturation. Fetal biophysical profile (BPP) and Doppler assessment were performed twice, on admission and 48 hours after administration of the first dose. The mother recorded fetal movement before, during and after the study periods. Comparison was made between biophysical profile score, fetal movement and Doppler indices of the umbilical and middle cerebral artery before and after betamethasone administration. Continuous data were compared by paired t test and dichotomous data were compared by McNemar test between pre and post treatment evaluations. The statistical significance was set at 0.05 levels. Results: Twenty-five women—median age, 26 (19-42) years; median of gestational age, 32 (26-34) weeks—which were referred to Imam Sajjad hospital, Yasuj from August 2010 to December 2011 were enrolled into the study. There was significant different in fetal movement before and after betamethasone administration ($p=0.004$). The frequency of BPP scores ≤ 8 increased from 13 to 21 subjects ($p=0.039$) at post treatment evaluation which was significant statistically. There was statistically significant difference in the reduction of umbilical artery PI (0.10) (95%CI: 0.01-0.19) and RI (0.07) (95%CI: 0.08-0.06), but these changes were not important clinically. The mean changes of MCA PI and RI were 0.01 (95% CI:-0.16-0.19) and -0.01 (95% CI:-0.08-0.06), respectively. Conclusion: After betamethasone administration, fetal movement, BPP scores and umbilical artery indices were decreased, while MCA Doppler indices were not affected.

[Soghra Khazardoost, Parichehr Pooransari, Masoome Mirzamoradi. **The effect of betamethasone on fetal movement, biophysical profile and fetal circulation in preterm fetuses.** *Life Sci J* 9(4):1990-1992]. (ISSN: 1097-8135). <http://www.lifesciencesite.com>. 298

Keywords: Betamethasone, Biophysical profile, Doppler indices, Fetal movement

1. Introduction

Preterm birth is associated with significant prenatal morbidity and mortality rates. The overall preterm delivery (PTD) rate is 8.1% (1). The use of prophylactic maternal corticosteroids to enhance fetal lung maturity in women at risk of PTD has currently been carried out (2). Biophysical assay is a useful tool for the assessment of the fetal well being. Previous studies have shown that antenatal steroid administration may suppress fetal activity and change the biophysical score (3). Sometimes this transient changes may result to an warranted iatrogenic delivery. Doppler velocimetry of the brain circulation and umbilical for evaluation of the well being of the fetus in the uterus has been used (4, 5). We have also been want that used this technique in healthy preterm fetus, because that can differentiate between fetal distress and suppression of biophysical profile due to steroid effect. Therefore we studied onset and duration of betamethasone administration on biophysical profile and Doppler indices of healthy fetus. These information can decrease management

errors due to misinterpretations of biophysical profile data.

2. Materials and Methods

Thirty one single fetus pregnancies at high risk for preterm delivery who were admitted to the obstetrics unit of Imam Sajjad hospital, Yasuj from August 2010 to December 2011 with 26-34 weeks gestation were enrolled into the study. Six of these patients were excluded from the analysis due to spontaneous delivery prior to completion of all the examinations or incomplete data. The median age was 19-42 years. The main indication for hospital admission and steroid use was third trimester vaginal bleeding, previous preterm delivery, uterine anomaly and false labor due to other risk factors of preterm labor. Usually, any patient who was admitted to the hospital with a gestational age of less than 34 weeks received steroids. Informed written consent was obtained from all patients. Before baseline examination, an ultrasonography examination was performed for the biometry and estimated fetal weight. All of the examinations were done after

breakfast at 8-12 midday to control the fetal circadian rhythm. The gestational age was calculated based on the last menstrual period (LMP) which agreed with the second trimester ultrasonography examination.

Some of the patients who had received medication such as magnesium sulfate and narcotic were excluded from the study because it might interfere with the biophysical profile and Doppler studies. One person carried out all the examinations). Sampling of both arteries was performed at the lowest practical incident angle.

The patients who were included in the study received two doses of 12 mg betamethasone, 24 hours apart). BPP scores and Doppler flow velocimetry wave forma of umbilical and middle cerebral artery were performed at 0 and 48 hours after the first dose of betamethasone administration. If the initial biophysical profile scores were equal or higher than 8, the fetuses were included.

Each component of the biophysical profile, including fetal movement, fetal tone, fetal breathing, amniotic fluid volume and fetal heart rate tracing (non stress test) was given a score of 0 or 2 points. The fetal heart rate tracing was obtained before the biophysical profile and interpreted as reassuring or nonreassuring.

Instantly after scoring of the biophysical profile, Doppler studies were carried out. Certain indices such as the peak systolic velocity, pulsatility index (PI), resistance index (RI), S/D ratios were achieved for the middle cerebral artery and the umbilical artery.

The data were analyzed using SPSS version 11.5, continuous data were compared by paired t test and dichotomous data were compared by MCNemar test between pre and post treatment evaluation. The statistical significance was set at 0.05 level.

3. Results

Twenty five women with the median (range) age of 26 (19-42) years were enrolled into the study. The median (range) of gestational weeks at delivery was 32 (26-34) weeks.

The mean reduction of umbilical artery PI was 0.10 (95% CI: 0.01-0.19) and of the umbilical artery RI was 0.07 (95% CI: 0.01-0.12). The mean changes of MCA PI and RI were 0.01 (95% CI: -0.16-0.19) and 0.01 (95% CI: -0.08-0.06), respectively (Table 1).

In nine (36%) subjects, fetal movement decreased 48 hours after steroid treatment ($P = 0.004$).

The frequency of a higher or equal to 6 BPP score increased from 2 to 3 subjects ($P=1.0$) and the frequency of a higher or equal to 8 BPP score

increased from 13 to 21 subjects ($P = 0.039$) at post treatment evaluation.

Table 1. The mean changes of MCA PI and RI

	Pre treatment	Post treatment	PV*
	N = 25		
UA PI	1.09 (± 0.32)	0.99 (± 0.34)	0.025
UA RI	0.62 (± 0.11)	0.55 (± 0.16)	0.019
MCA PI	1.99 (± 0.61)	1.98 (± 0.72)	0.875
MCA RI	0.84 (± 0.13)	0.85 (± 0.19)	0.823

* paired t test

MCA: Median Cerebral Artery; UA: Umbilical Artery; PI: Pulsatility Index; RI: Resistance Index

4. Discussion

In this study, it was observed that administrating betamethasone for the mother may lead to a significant but temporary decrease of biophysical profile scores in healthy preterm fetuses. In a study performed by Rotmensch et al., a profound suppression was observed on the biophysical profile scores at 48 hr of steroid use (5) which was consistent with our findings Synthetic glucocorticoid has a suppressive activity on the neural system which has been documented previously. Diffuse expression of glucocorticoid receptors in different parts of the brain such as the cerebral cortical part and the mid brain may explain this suppression (6); furthermore, glucocorticoid receptors are widely expressed in cerebral cortical tissues, mid brain and subcortical nuclei which may partly explain the suppression. Jackson et al. also reported the same result. They showed that the administration of betamethasone decreases fetal movement and breathing and as a result the biophysical profile scores may be decreased. In their study, amniotic fluid was also decreased, but this result was not obtained in our study (7).

In the at risk fetus, it has been shown that bio physical monitoring using biophysical indices may decrease mortality and morbidity. Biophysical profile is the most commonly used tool in at risk fetuses and also in the high-risk pregnancy monitoring (8). (The changes due to antenatal steroid consumption effect the biophysical parameters which may lead to misinterpretation (9). Another modality for evaluation of the fetal status is Doppler velocimetry of the umbilical and fetal cerebral circulation (10). In a previous study carried out by Cohlen et al., corticosteroids had no effect on Doppler indices obtained from fetal, placental or uterine arteries (11). This finding has been subsequently confirmed by others (12, 13). In our study, the middle cerebral and the umbilical artery Doppler indices decreased, although not clinically significant. The above-mentioned points highlight the reliability of this method for the evaluation of

antenatal steroid-exposed fetuses. In the fetal biophysical profile, Doppler studies are capable of differentiating steroid-induced changes from alterations due to fetal compromise (14). The fact that antenatal steroid usage is rising, subsequently leading to an increase in the rate of abnormal biophysical profile highlights this matter as a notable clinical consideration (15). Until new monitoring tools or algorithms are added, the decision regarding the delivery of preterm fetuses exposed to antenatal steroids should be cautiously made.

5. Conclusion

We demonstrated that betamethasone administration can cause a remarkable, but impermanent reduction in fetal body movement. This result is particularly outstanding for the biophysical profile score obtained after 48 hr of steroid administration. Confusional results due to the effect of steroid on biophysical profile parameters as an evidence of fetal distress could lead to unapproved intervention and consequently the delivery of a preterm fetus, but Doppler studies of the MCA and UA can differentiate between the compromised and non compromised fetus groups.

Acknowledgement

None declared.

Conflict of Interest

None declared.

6. References

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10/12/2012