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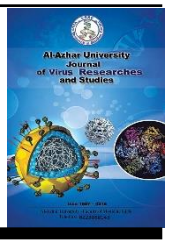

Comparative Study between Effect of Dexamethasone and Betamethasone used for Fetal Lung Maturity on Daily Fetal Movement Count and Doppler Flow Velocity Waveforms

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Abstract

Preterm birth is the costliest complication of pregnancy and the leading cause of neonatal morbidity and mortality. There are multiple strategies to minimize the risk and the impact of prematurity, such as administration of antenatal corticosteroids (ACS), in association with tocolysis, neuroprotection with magnesium sulphate, and neonatal life-saving therapies. The main objective of this paper is to compare between effect of administration of dexamethasone and betamethasone, used for lung maturity on daily fetal movement count and fetal doppler flow velocity waveforms of umbilical artery and middle cerebral artery. Patients and methods: This was a Double blinded prospective comparative trial, was carried out at the Department of Obstetrics & Gynecology at Al- Obour Hospital for health insurance in Kafr Elsheikh & at Bab AL-Sharia University Hospital, on 100 pregnant women with indication for corticosteroid according to American college of obstetrics and gynecologists (ACOG) pregnant women between 24 weeks and 33 weeks of gestation associated with fetal lung immaturity) divided into 2 groups from 1st of March 2021 till 31 August 2021. There is a significant change regarding fetal movements in Betamethasone group only. There is a significant increase regarding umbilical artery RI in both groups, the increase was higher in Dexamethasone but still in normal range. Conclusion is dexamethasone causes significant decrease in middle cerebral artery decrease after one week but still in normal range. There was a significant increase regarding umbilical artery RI but in Dexamethasone was higher however still in normal range. In our study There was a significant decrease regarding fetal movements in Betamethasone group only post treatment one day and one week.

Keywords: Betamethasone; Steroids, Intrauterine growth restriction, Fetal Doppler, fetal movements.

1. Introduction

Preterm labor is an obstetrics emergency and a threat to population health.75% of mortality among infants is related to preterm labor [1]. The etiology of preterm labor and delivery is one that is still of great research interest worldwide. It has been widely hypothesized that preterm labor and delivery is a syndrome initiated by multiple

mechanisms, from mechanical factors (such as uterine over distension), inflammation (e.g., infection), circulatory disturbances (e.g., uteroplacental ischemia) or from a combination of several factors [2]. respiratory distress syndrome is the most common cause of respiratory distress in preterm infants, as an inadequate production of pulmonary surfactant causes lung immaturity [3]. Administration of a full course of corticosteroids significantly improves neonatal outcomes (betamethasone 12 mg every 24 hours up to 2 dosages and dexamethasone 6 mg every 12 hours up to 4 dosages). Previous research showed that betamethasone has extremely fewer side effects compared to dexamethasone [4]. One of the possible theories to explain modifications in the fetal circulation associated with reduced placental resistance is based on an increased secretion of placental corticotropin releasing hormone (CRH) after exogenous administration of corticosteroids, which consecutively causes nitric oxide-mediated vasodilatation [5]. So, the aim of our study was to compare between effect of administration of dexamethasone and betamethasone, used for lung maturity on daily fetal movement count and fetal doppler flow velocity waveforms (FVWs) and resistance index (RI) of umbilical artery (UA) and middle cerebral artery (MCA).

2. Patients and Methods

This was prospective comparative trial carried out at the Department of Obstetrics & Gynecology at Al-Obour Hospital for health insurance in Kafr El-Sheikh & at Bab AL-Sharia University Hospital to 100 pregnant women divided into 2 groups: Group A: 50 pregnant women were given four intramuscular injections of 6 mg dexamethasone with 12 h apart, the daily fetal movement count and Doppler flow velocity waveforms were calculated before administration of dexamethasone, after 24 hours and one week after administration of last dose. According to the American college of obstetrics and gynecologists (ACOG), corticosteroid administration is recommended for pregnant women between 24 weeks and 33 weeks of gestation associated with fetal lung immaturity and at high risk of preterm delivery within 7 days. The Doppler examination includes the assessment of the resistance index of the umbilical artery and fetal middle cerebral artery. Group B: 50 pregnant women were given two intramuscular injections of 12 mg Betamethasone with 24 h apart Then daily fetal movement count and Doppler flow velocity waveforms were calculated before administration of betamethasone, after 24 hour and one week after administration of last dose. The Doppler examination includes the assessment of resistance index of the umbilical artery and fetal middle cerebral artery. Daily fetal movement count was calculated 3 hours daily from 7 to 8 am, from 3 to 4 pm and from 7 to 8 pm, then all fetal movement count was collected at the end of the day.

2.1 Inclusion Criteria

Singleton pregnancy, alive fetus, intact amniotic membrane, gestational age between 24 to 33 weeks and maternal age between 20 to 35 years.

2.2 Exclusion Criteria

Those with medical diseases. Twin pregnancy, patients presented with premature rupture of membranes, Foetuses with suspected structural abnormalities and women who had any contraindication to corticosteroids.

2.3. Intervention

All patients in this study were subjected to the following: History taking: Including the personal history, parity, obstetric history menstrual history and medical history.

Clinical examination: General examination and abdominal examination.

2.4 Methodology

The following technique was done: two different corticosteroid regimens were used: (1) four intramuscular injections of 6 mg dexamethasone with 12 h apart and (2) two intramuscular injections of 12 mg betamethasone with 24 h apart. Then daily fetal movement count and Doppler flow velocity waveforms were calculated. The Doppler examinations include the assessment of the resistance index (RI) of the umbilical artery and the fetal middle cerebral artery according to: RI = (PSV - EDV) / PSV Where PSV = peak systolic velocity and EDV = end-diastolic velocity. Srikumar et al., [6] demonstrated the normal values of UA and MCA RI in second and third trimesters of normal pregnancy. Daily fetal movement count was calculated 3 hours daily from 7 to 8 am, from 3 to 4 pm and from 7 to 8 pm. The values of each of the three sittings were added to give an outcome of the counts per day, with one day before the start of the course as control. Since in each of the 3 sittings a participant had a maximum of 4 counts, the maximum value per day for this category was 12. Doppler examination and daily fetal movement count will perform in all patients before start treatment and after administration of last dose of corticosteroids by 24 hours and one week later.

2.5 Statistical analysis

IBM SPSS-22 program (Inc, Chicago, IL, USA) has been used to perform statistical analysis. Data have been examined for normal distribution via the Shapiro Walk testing. Qualitative data have been presented as frequency and relative percentage. Chi square testing ($\chi 2$) has been utilized to determine change among 2 or more groups of qualitative variables. Quantitative data have been presented as mean ± SD (Standard deviation). Nondependent sample t-testing has been utilized in comparing among 2 nondependent groups of normal distribution variables (parametric data) &Mann-Whitney testing. P value < 0.05 was judged significant. ROC-curve was built to permit choice of threshold values for testing findings and comparisons of various testing approach.

3 .Results

Table.3 shows that there is no significant difference between the groups regarding maternal age, BMI, and parity. Table.4 shows there is a significant increase regarding umbilical artery RI in both groups, the increase was higher in Dexamethasone compared to Betamethasone. The most significance difference in both groups was between Pretreatment & Post-treatment 1 weeks but this increases still in normal range. Table.5 shows there was no significant decrease in MCA RI in Dexamethasone group between Pre and one day post treatment but there was a significant decrease Post treatment 1 week although this significant decrease was still in normal range. while in Betamethasone group there was no significant decrease. Table.6 shows there is a significant decrease regarding fetal movements in Betamethasone group only post treatment one day and one week. Table.7 shows there is a significant positive correlation between fetal movement with MCA RI while there is a significant negative correlation with UA RI in both groups. Table.8 shows there is no significant difference between the groups regarding neonatal outcome.

Table (1): Normal values of RI in second trimester.

Artery	Min	Max	Average
MCA	0.71	0.96	0.79
UA	0.62	0.89	0.73

Table (2): Normal values of RI in third trimester [6].

Artery	Min	Max	Average
MCA	0.72	0.83	0.78
UA	0.48	0.73	0.6

Table (3): Demographic characteristics and clinical data among the studied groups.

	Dexamethasone (n=50)	**Betamethasone** (n=50)	t	**p**
Age (years) Mean ± SD	26.9 ± 3.63	27.42 ± 2.76	.806	.422
BMI (kg/m^2) Mean ± SD	26.4 ± 4.1	27.35 ± 3.31	1.27	.205
Parity Mean ± SD	1.5 ± 1.01	1.6 ± 0.940	MU 191	.807

P1: Pretreatment & Post-treatment 1 day | P2: Pretreatment & Post-treatment 1 weeks | P3: Post-treatment 1 day & post-treatment 1 weeks.

Table (4): Umbilical artery RI of the two studied groups.

	Umbilical artery resistance index Mean ± SD					**Fr**	**P**
	Pretreatment	**Post-treatment 1 day**	**P1**	**Post-treatment 1 weeks**	**P2,3**		
Dexamethasone (n=50)	0.681 ± 0.052	0.705 ± 0.053	**0.0244**	0.732 ± 0.047	**P_2 0.0001 P_3 0.0083**	**16**	**.000**
Betamethasone (n=50)	0.664 ± 0.083	0.671 ± 0.077	**0.6629**	0.704 ± 0.089	**P_2 0.0222 P_3 0.0502**	**8**	**.009**
T	1.23	**2.57**		1.97	--		
P	.223	**.012***		0.182			

P1: Pretreatment & Post-treatment 1 day | P2: Pretreatment & Post-treatment 1 weeks | P3: Post-treatment 1 day & post-treatment 1 weeks.

Table (5): Middle cerebral artery RI of the two studied groups.

	Middle cerebral artery resistance index Mean ± SD					**Fr**	**P**
	Pretreatment	**Post-treatment 1 day**	**P_1**	**Post-treatment 1 weeks**	**$P_{2,3}$**		
Dexamethasone (n=50)	0.788 ± 0.118	0.775 ± 0.115	**0.578**	0.732 ± 0.102	**P_2 0.0127 P_3 0.0507**	**8**	**.001**
Betamethasone (n=50)	0.781 ± 0.126	0.772 ± 0.102	**0.6955**	0.738 ± 0.105	**P_2 0.0668 P_3 0.1037**	4.5	.073
T	.287	.138	--	.289	--		
P	.775	.891	--	.773			

Table (6): Fetal movements between the two studied groups.

	Fetal movements Mean ± SD			**Fr**	**P**
	Pretreatment	**Post-treatment 1 day**	**Post-treatment 1 weeks**		
Dexamethasone (n=50)	20 ± 8.76	19 ± 10.2	17 ± 9.35	1.2	.287
Betamethasone (n=50)	21 ± 8.24	12 ± 6.31	16 ± 8.57	**9**	**.001**
MU	.543	6.5	.508	--	
P	.624	**.000**	.744		

Table (7): Correlation between fetal movements with other parameters between the studied groups.

	Dexamethasone		Betamethasone	
	r	p	r	P
UA RI	**-.421**	**.009**	**-.300**	**.020**
MCA RI	**.371**	**.010**	**.315**	**.012**

Table (8): Pregnancy outcome between the two studied groups.

		Dexamethasone (n=50)	Betamethasone (n=50)	t/ χ^2	p
GA (weeks) Mean ± SD		38.4 ± 2.96	37.8 ± 1.89	1.21	0.23
Birth weight (kg) Mean ± SD		3.12 ± 0.563	2.98 ± 0.709	1.09	0.277
Mode of delivery	CS	49 (98%)	47 (94%)	1.04	0.309
	VD	1 (2%)	3 (6%)		
Apgar at 1 min Mean ± SD		7.23 ± 1.27	6.94 ± 1.86	0.911	0.365
Apgar at 5 min Mean ± SD		9.7 ± 1.09	9.51 ± 1.13	0.856	0.394
Admitted to NICU		1 (2%)	2 (4%)	0.344	0.558

4. Discussion

Respiratory distress syndrome is the most common cause of respiratory distress in preterm infants, as an inadequate production of pulmonary surfactant causes lung immaturity. Administration of a full course of corticosteroids significantly improves neonatal outcomes by improve fetal pulmonary Maturity is a well-known treatment used to reduce the risk of neonatal respiratory distress syndrome. The aim of our Study to compare the Effect of Dexamethasone and Betamethasone Used for Fetal Lung Maturity on Daily Fetal Movement Count and Doppler Flow Velocity Waveforms of umbilical artery and middle cerebral artery. There was no significant difference between the groups regarding maternal age, body mass index (BMI), parity, and gestational age. In our study there was a significant increase regarding umbilical artery RI in both groups, but the increase was higher in Dexamethasone compared to Betamethasone, although this significant increase was in normal range according to gestational age, The most significance difference in both groups was between Pretreatment & Post-treatment 1 week. These finding are in agreement with Elmorsy et al., [7] that reported there was significant increase in umbilical artery RI in both groups ($P < 0.001$). These Results were on disagreement with, the study of Ahmed et al., [8] as reported that in terms of Doppler Indices, the umbilical artery pulsatility index (PI) and resistive index showed a statistically significant reduction after Dexamethasone administration ($p <0.001$). We reported that there was significance decrease in MCA RI in Dexamethasone group between Pretreatment & Post-treatment 1 weeks but

still in normal range, our results supported by Elsnosy et al., [9] which demonstrated that maternal dexamethasone administration to pregnant women at risk of preterm labor improves the blood flow of the maternal uterine artery, fetal MCA, descending aorta and umbilical artery 24 h after its administration.

Similarly, Elmorsy et al. [7], reported a significant decrease in Middle cerebral artery RI in dexamethasone group (P<0.001).

Also ,Wahby et al., [10] they recruited 50 women who received dexamethasone with follow up of Doppler values (UA and MCA) after 60 hours from the first dose of dexamethasone and revealed no significant changes regarding UA Doppler studies with mean RI difference was 0.013 and mean PI was ~0.97 (1%). MCA Doppler values showed a significant decrease, especially in the PI, with means of ~1.96 before and ~1.72 after, and a mean difference of 0.23 (12.2%) with p<0.001. Consequently, there has been a significant change in the RI, with a mean difference of 0.02 (2%) and a p=0.002.

Furthermore, our findings supported by Shojaei & Mohammadi., [11], which reported a significant decrease in MCA RI after betamethasone Administrations. hey also reported a significant decrease in UA RI one day after betamethasone administrations then a significant increase after 4 days.

In contrary, Ali et al., [12], demonstrated that Middle cerebral artery RI among the studied cases did not significantly change after dexamethasone intake. The base line Mean± SD was 0.81±0.05 and the range was 0.70-0.94. While after 24 hours the Mean± SD was 0.80±0.06 and the range was 0.68-0.98. The change of the Mean± SD was - 0.01±0.04 and the range change was -0.07-0.08. Those results give the p=0.056. Middle cerebral artery PI among the studied cases did not significantly change after dexamethasone intake.

In the study in our hands, there was a significant change of fetal movements in Betamethasone group only. There was a significant positive correlation between fetal movements with MCA RI while there was a significant negative correlation with UA RI in both groups.

Our results were in agreement with Deren et al, [13] and Rotmensch et al., [14] which reported that, in different investigations, betamethasone administration can cause a significant but transient, suppression of fetal movements.

Contrary to our Study Wahby et al., [10], which evaluate the effect of dexamethasone on the fetal heart rate and hemodynamics and their correlation with fetal movement.

Also, in the study of Ali et al., [12], fetal movements significantly decreased at hour-24, then re-increased at hour-48 and hour-72 but still significantly lower than baseline after administration of dexamethasone.

There was a decrease in the fetal movement count on day (p∠0.001).

Our results showed that there was no significant difference between the groups regarding neonatal outcome.

This Results supported In the study of Urban et al., [15] as they reported that as regard observations regarding neonatal outcome, including: gestational age at delivery (37.7 ± 0.49 weeks versus 36.3 ± 0.66 weeks), neonatal weight (3038 ±144 g versus 3035 ± 153 g), Apgar score in 1 min (8.4 ± 0.32 versus 8.0 ± 0.45), Apgar score in 5 min (9.5 ± 0.19 versus 9.3 ± 0.3), umbilical cord artery pH (7.27 ± 0.02 versus 7.26 ± 0.02) and base deficit (-4.16 ± 0.9 versus -4.6 ± 0.8) were compared in dexamethasone and betamethasone groups, respectively. There were no statistically significant differences.

Also, Mirzamoradi et al., [16] revealed that 16 neonates (7%) suffered from one or more respiratory morbidities, and there was no significant difference between the betamethasone and control groups (six cases (6%) and 10 cases (9%), respectively, p, .299).

5. Conclusion

Based on our study, we could conclude that there was significant decrease in Fetal Movements in pregnant women administrated Betamethasone, also decrease in MCA resistance index in Dexamethasone group one week post treatment but still with in normal range and increase umbilical artery RI in both groups but also still with in normal range.

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