Original Research Article

Effect of Antenatal Corticosteroid on Cardiotocographic Parameters in Pregnant Women

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Abstract

Objective: To evaluate the effect of dexamethasone administration on cardiotocographic parameters.

Material & Methods: A prospective cohort study was carried out in the department of Obstetrics and Gynaecology in collaboration with Department of physiology, Jawaharlal Nehru Medical College & Hospital. Total 100 pregnant women between gestational age of 28 weeks to 38 weeks were enrolled in the study. They underwent cardiotocography on day 0 i.e. before administration of injection dexamethasone, on day 2 (after 48 hours of first dose) and on day 4-7. Patients received injection dexamethasone 6 mg i.m. 4 doses at an interval of 12 hours for various indications like preterm labor (PTL), preterm prelabor rupture of membrane (PPROM), placenta previa and previous CS. Outcome measures were changes in Baseline FHR(Fetal Heart Rate), Baseline variability, Acceleration and DFMC before and after dexamethasone administration.

Results: All parameters including Baseline FHR, Accelerations, baseline variability and daily fetal movement counts were significantly reduced on day 2 of injection dexamethasone administration and returned to baseline values after 4 to 7 days of receiving dexamethasone.

Conclusions: Dexamethasone administration resulted in transient reduction in baseline FHR, acceleration, variability and DFMC that mimic fetal compromise, hence clinicians should be aware of this phenomena to avoid iatrogenic preterm delivery of the fetus.

Keywords: Cardiotocography (CTG), Antenatal corticosteroids

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Introduction

Antenatal fetal assessment has a novel role and its significance is emerging in modern obstetrics. Cardiotocography in the form of non-stress test (NST) is the commonest primary testing method of fetal surveillance. Fetal well-being can be assessed by techniques based upon the fetal biophysical activity (Biophysical Profile BPP) that includes NST, fetal tone, movement, breathing and amniotic fluid index (AFI). Modified biophysical profile includes only two parameters that are NST and AFI. Electronic fetal monitoring (eCTG) has now become the standard tool for fetal surveillance. The basis of CTG is the occurrence of acceleration in fetal heart rate in response to fetal movement which indicates healthy fetus. The baseline fetal heart rate in third trimester ranges between 110 to 160 beats per minute(bpm) while FHR(Fetal Heart Rate) variability is 5 to 25 bpm in a 20 minutes observation on CTG.

Antenatal corticosteroid therapy for maturation of fetal lungs is the most common therapy to minimize complications of preterm birth like respiratory distress syndrome (RDS), necrotising enterocolitis (NES), intraventricular hemorrhage (IVH) and periventricular leukomalacia (PVL).[1] The National Institute of Health (NIH) consensus Development conference(1995) recommends either 2 doses of 12 mg of betamethasone given i.m. 24 hours apart or 4 doses of 6 mg of dexamethasone given i.m. 12 hours apart between 24 and 34 weeks of gestation in pregnancies at risk of preterm delivery.[2] Corticosteroids therapy may be given between 34 0/7weeks and 36 6/7 weeks to pregnant women at risk of preterm birth within 7 days, and who have not received a previous course of antenatal corticosteroid (ACOG 2017) [3].

Fetal heart rate monitoring during pregnancy is cornerstone of fetal surveillance therefore pharmacological influence of corticosteroids on CTG parameters is important to clinical scenario. Many studies like Rotmensch et al [4] (1999), Mulder et al [5] (2012), Elimian A et al [6] (2007) and Noben L et al (2019)[7] reported change in the parameters of CTG after dexamethasone therapy. The purpose of present study was to evaluate the effect of dexamethasone administration on cardiotocographic parameters.

Material and Methods

A prospective cohort study carried out in the Department of Obstetrics and Gynaecology, Jawaharlal Nehru Medical College and hospital. Informed consent was taken prior to inclusion in the study. Ethical approval was taken from institutional Ethical committee of J.N.Medical College, AMU,Aligarh. 100 antenatal women who were admitted for premature uterine contractions (Preterm labor), anemia, placenta previa, PPROM (Preterm prelabor rupture of membrane) and planned for caesarean section between 28 weeks to 38 weeks of gestation were given 4 intramuscular injections of 6 mg dexamethasone 12 hours apart [2]. Women receiving medical therapy like antihypertensive drugs or benzodiazepines were excluded. All women had cardiotocogram (CTG) records before administration of dexamethasone, 48 hours after and then on 4^{th} to 7^{th} day after the first dose of corticosteroids. CTG recordings were taken in standardized conditions. Observations were recorded in an average duration of 20 minutes, 2 to 3 hours after a meal and preferably between 11:00 am to 1:00 pm to avoid diurnal variations of fetal behavior.

Cardiotocography machine Avalon Fetal Monitor FM 20/30, FM 30/40 was used which runs at the speed of 1 cm per minute and 10 beats per minute per vertical cm and range is between 50 to 200 bpm.

Study Procedure and Data collection Protocol-Cardiotocography was done on Day 0 i.e. before receiving dexamethasone, on Day 2 i.e. after the completion of steroid course and in between Day 4 to 7 to see when effect of steroid had gone. All data were presented as means and standard deviation. Statistical analysis was done using Student t-test.

Results

The women recruited in the study had Mean age of **26.10±4.53** in years. Mean Gestational age at dexamethasone administration in weeks were **34.16±2.34**. Among 100 antenatal women **37**% were nullipara and **63**%were multiparous**.**

Injection dexamethasone was administered in the following group of patients:PPROM **(26 %),** placenta previa **(16%),** previous history of Preterm labor **(38%),** and others admitted for mild anemia treatment or elective cesarean as shown in **Table [1].**

The study concluded the following results as shown in **Table [2].**

The mean Baseline FHR before administration of injection dexamethasone was 144.30 ±10.49 then after 48 hours of first dose Baseline FHR decreased to 142.14±9.63 and the percentage change in FHR was 1.5%. The p-value was calculated which came out <0.05 suggesting that after 48 hours of injection dexamethasone baseline FHR decreased.

The mean baseline Variability before administration of dexamethasone was 13.73±3.07 which then decreased to 11.28±2.57 after 48 hours of first dose and decrease in variability in terms of percentage was 12%. The p-value came out to be <0.05 suggesting that injection dexamethasone is responsible for the decrease in variability of FHR with maximal effect after 48 hours of first dose. The mean accelerations before administration of dexamethasone were 3.84±1.11 which then became 3.17±0.92 after 48 hours of first dose but the change in acceleration was not significant(p>0.05).

Cardiotocographic parameters were again studied after 4 to 7 days of dexamethasone administration to see when these changes wean off. Baseline FHR returned to its baseline values (144.42±9.48) after 4- 7 days of first dose of injection dexamethasone as shown in Table [3]. Also FHR Variability returned to 14.11±2.25 after 4-7 days of first dose.

Since the p-values of Baseline FHR, variabllity and acceleration after 4-7 days of first dose came out to be >0.05, suggesting that there is no change in cardiotocographic parameters after 4-7 days of dexamethasone, hence effect weans off in 4-7 days.

Table [1] Descriptive data of the study group

Descriptive Variables	N=100
Age(years)	26.10±4.53
Gestational age at dexamethsone administration	34.16±2.34
Parity-	
Primigravida	37%
Multigravida	63%
Indications of injection dexamethasone	
PPROM	26%
PTL	38%
Placenta previa	16%
Others(previous c/s, mild anemia)	20%

Table [2] Comparison of CTG parameters before and after 48 hours of dexamethasone administration

	Day 0	Day 2	P value	SD	Std error
Baseline FHR	144.30	142.14	<0.05	5.34	.534
Variability	13.73	11.28	<0.05	3.00	.300.
Acceleration	3.84	3.17	<0.05	1.28	.129

Table [3] Comparison of CTG parameters before and after 4 to 7 days of dexamethasone administration

	Day 0	Day 4-7	P value	SD	Std error
Baseline FHR	144.30	144.42	>0.05	4.73	0.474
Variability	13.73	14.11	>0.05	2.40	0.240
Acceleration	3.84	3.61	>0.05	1.15	0.115

Discussion

The present prospective cohort study was carried out in the department of Obstetrics and Gynaecology in collaboration with Department of physiology on 100 pregnant women between gestational age of 28 weeks to 38 weeks. Cardiotocography was performed on day 0, day 2 and day 4 to 7 of dexamethasone administration which revealed that the mean Baseline FHR decreased by 1.5% which was statistically significant (p-value <0.05). Percentage change in mean baseline Variability was 12% on day 2. The p-value came out to be <0.05 suggesting that injection dexamethasone is responsible for the decrease in variability of FHR with maximal effect after 48 hours of first dose. While there were no change in FHR accelerations. Change in CTG parameters was returned back within 4-7 days.

Researchers had observed CTG changes with both dexamethasone and betamethasone (corticosteroids) . The results of our study are consistent with that observed by Mulder and Graatsma(2012). **Mulder et al [5]** (2012) described that baseline FHR diminished after 24 hours in more than half fetuses after 2 doses of dexamethasone while **Graatsma et al [8] (2012)** observed decrease in baseline FHR after 48 hours of dexamethasone. However **Rotmensch et al [4] (1999)** used betamethasone and observed significant increase in baseline FHR on Day 1 and Day 2 in comparison to initial FHR which is contradictory to the results of our study where we used dexamethasone. **Elimian A et al [6]** (2007) used both dexamethasone and betamethasone and found that basal FHR enhanced with betamethasone while diminished with dexamethasone which favours our study.

As for as FHR variability concern, **Frusca et al [9] (2001)** found profound decrease in FHR variability on day 3 after giving betamethasone. **Rotmensch et al [10] (2005)** found a decrease in fetal heart rate variability 48 hours after first dose. **Derks et al [11] (1994)** showed decrease in FHR variability after 48 hours of dexamethasone administration. **Noben et al[7] (2019)** concluded that FHR Variability decreases on day 2 after betamethasone administration. Our results were in accordance with the results as obtained by Noben et al [7] (2019) , Frusca et al [9] (2001), Rotmensch et al [10] (2005) and Derks et al [11] (1994). In a recent study performed by **Ahmed AA, Sayed Ahmed WA et al [12](2019)** on the effect of dexamethsone on antepartum cardiotocography, they concluded that dexamethasone causes transient reduction of short term variability after 48 hours of giving dexamethasone.

On the contrary, **Magee et al [13] (1997)** combined two steroids dexamethasone and betamethasone into one group and found a significant increase of FHR short term variability. **Mulder et al [5] (2004)** studied both dexamethasone and betamethasone and observed a rise in short term variability only in the dexamethasone group, but with a corresponding non significant decrease in the betamethasone group.

Among CTG parameters FHR accelerations were only studied by **Subtil et al [14] (2003)** and **Rotmensch et al [10](2005)** who depicted significant reduction in the number of accelerations on the second day. In our study change in CTG parameters on day 2 of dexamethasone administration returned to baseline values after 4-7 days which follows the results of **Rotmensch et al [4] (1999)** and **Graatsma et al [8] (2012).**

Conclusion

Cardiotocography plays a pivotal role in monitoring fetal well being in both antepartum and intrapartum peroid. It is extensively used because of its low cost, non-invasiveness and high sensitivity. At the same time CTG is influenced by various maternal as well as fetal factors and injection dexamethasone is one of the major pharmacological factor influencing CTG parameters. The aim of this study was to evaluate the degree of change in CTG parameters due to dexamethasone while interpretation in high risk fetuses. This study have demonstrated effect of injection dexamethasone on CTG parameters after exclusion of confounding factors such as fetal affection due to IUGR, oligohydramnios, IHCP, anomalous baby etc. and diurnal variations and with the standard drug regimen. The Present study revealed that fetal exposure to dexamethasone results in transient reductions in FHR variability, fetal body movements and baseline FHR. Although these changes are little but significant hence clinicians should be aware of pharmacologic side effect of this widely used drug, since unwarranted premature delivery of healthy fetuses could be prompted by this misleading finding. CTG interpretation purely based on "pattern recognition" are misleading as the False Positive Rate of CTG is 60%, hence CTG alone should not be used as the only tool for assessment of fetal well being. Although these changes are little but significant hence during fetal surveillance obstetrician should know the pharmacological side effect of dexamethasone to prevent premature birth of healthy fetuses. It is therefore, suggested that to minimize iatrogenic preterm birth, fetal surveillance should be done using Doppler studies and biophysical profile in high risk pregnancy who have given corticosteroid therapy.

Ethics Committee Approval- The study protocol was approved from Institutional Ethical Committee, Faculty of Medicine, AMU, Aligarh. (D.No- 2114/ FM,Dated 11.05.2019)

Informed Consent- Informed consent was taken from all the participants before enrollment in the study.

Conflict of Interest- No conflict of interest was declared by the authors

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