

Effect of Antenatal Dexamethasone on Glycemic Response in Women with and Without Gestational Diabetes Mellitus (GDM)

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ABSTRACT:

Background and objectives: The gestational diabetes mellitus (GDM) is any degree of glucose intolerance with onset or first recognition during pregnancy. Corticosteroids have a well-known effect on blood sugar levels of both the mother and the newborn. This study aimed to understand the pattern of glycemic response to dexamethasone in pregnant women with and without GDM and the rate of neonatal hypoglycemia and the relationship between maternal hyperglycemia and neonatal hypoglycemia. **Methods:** Single center, Observational, prospective, open label, double arm, non-randomized cohort study conducted at MGM Medical College and Hospital, Chhatrapati Sambhaji Nagar (Aurangabad), Maharashtra, India. Dexamethasone administration, maternal and neonatal glycemic data, demographic data were retrieved from patient records. Maternal population was divided into 2 cohorts: group A (n=70) comprised pregnant women with GDM and group B (n=70) without GDM; both received Inj. Dexamethasone. Neonatal population comprised newborns born to women included in both cohorts. **Results:** Median peak blood glucose concentration occurred approximately 7- 8 hours after the administration of first dose of injectable dexamethasone. From group A (GDM), significant hyperglycemia (120-139mg/dL) and severe hyperglycemia (140-159 mg/dL) occurred in 25.7% and 74.3% participants respectively. In group B (non-GDM), the numbers were 65.7% and 8.5% respectively for the same. Babies born to women with severe hyperglycemia were more prone to develop hypoglycemia. **Conclusion:** antenatal administration of dexamethasone resulted in hyperglycemia in both GDM and non-GDM cases. But the severity of hyperglycemia is significantly higher in women with GDM. Maternal hyperglycemia prior to birth is associated with increased risk of neonatal hypoglycemia.

Keywords: antenatal corticosteroids, Gestational Diabetes Mellitus, hyperglycemia

INTRODUCTION:

The ACOG (American Congress of Obstetricians and Gynecologists) recommends the use of antenatal steroids to patients who are in danger of delivering prematurely, as there is a known increase in risk of respiratory distress syndrome, intraventricular hemorrhage, and death of newborns^[1]. Steroids administered prior to scheduled Caesarean between 37 to 38 weeks may lead to decreased neonatal respiratory morbidity^[2]. Steroid administration in preterm birth was not associated with increased bad neonatal outcomes^[2]. Antenatal corticosteroids (ANC) improve outcomes for babies born prematurely, but cause hyperglycemia particularly in women with gestational diabetes mellitus (GDM)^[3].

The gestational diabetes mellitus (GDM) is any degree of glucose intolerance with onset or first recognition during pregnancy. For diagnosis of GDM, DIPSI (Diabetes in Pregnancy Study Group India) recommends non-fasting Oral Glucose Tolerance Test (OGTT) with 75g of glucose with a cut-off of ≥ 140 mg/dl after 2-hours, whereas WHO (1999) recommends a fasting OGTT after 75g glucose with a cut-off plasma glucose of ≥ 140 mg/dl after 2-hours^[4]. 24-28 weeks of gestation is most common period used for testing of GDM^[4].

Corticosteroids have a well-known effect on blood sugar levels. Both betamethasone and dexamethasone, the Corticosteroids used during pregnancy can lead to higher blood glucose levels by decreasing insulin production and effectiveness through antagonization as

well as the increase in gluconeogenesis^[5]. ANC can result in unintended glycemic effects for the fetus also, such as fetal hyperinsulinemia and neonatal hypoglycemia^[6]. Limited data suggest that maternal blood glucose concentration is elevated for at least 48 hours after two doses of ANC^[7, 8] although this time period is uncertain for women with GDM. The recommended optimal time for ANC administration prior to elective birth is 48 hours^[9]. As approximately 25% of all women who receive ANC give birth within 24 hours^[10], maternal hyperglycemia is likely to peak close to the time of birth for many women. Because of this, pregnant patients with diabetes are regularly monitored for abnormal fluctuations in blood sugar levels following administration of the antenatal anabolic steroids^[11].

The data on relationship between ANC administration in 48 hours after the 1st dose and maternal hyperglycemia is still limited. Approximately 50% of newborns of mothers with DIP become hypoglycemic^[11], which is associated with adverse neurodevelopmental outcomes^[12]. However, the relationship between ANC, maternal hyperglycemia and neonatal hypoglycemia remains unclear.

Given the potential for fetal compromise in the setting of maternal hyperglycemia, we studied the pattern of glycemic response to dexamethasone in pregnant women with and without diabetes^[1] and the rate of neonatal hypoglycemia and the relationship between maternal hyperglycemia and neonatal hypoglycemia.

MATERIALS AND METHODS:

This prospective observational study was conducted by department of Pharmacology, MGM medical college and hospital from May 2024 to October 2024, after obtaining the approval of Institutional Ethics Committee. Both GDM and Non-GDM prospective patients were screened for eligibility after obtaining written informed consent. The aim of this study was to evaluate the effect of antenatal dexamethasone administration on glycemic response in pregnant women with or without GDM. The primary objective was to evaluate and compare changes in levels of fasting, premeal, and 2 hr post-meal BSL levels in women with and without GDM. Secondary objectives were to evaluate increase in insulin requirement, changes in management of GDM post ANC administration, and to study the demographic profiles of these women, and effects on neonatal glycemic status was also evaluated.

Women above 18 years of age and with confirmed diagnosis of pregnancy, diagnosed to have Gestational Diabetes Mellitus according to DIPSI criteria, and received INJ Dexamethasone within 48 hours of delivery were recruited for the study. Those with pre-existing type 1 and 2 DM, who are already using medications that affect glucose metabolism, who have pre-existing adrenal or pancreatic dysfunction, have chorioamnionitis or any other maternal infection, and

who received tocolysis with beta mimetic agents were excluded.

Detailed medical and obstetric history of eligible patients was taken. General, physical and obstetric examinations were done. Patients received conventional ANC regimen (INJ Dexamethasone 12 mg 12 hourly intramuscularly, Q24 hours, 2 doses). Initiation of dexamethasone therapy was irrespective of the specific time of the day. BSL was monitored in the hospital inpatient ward. Finger prick capillary glucose was performed with Contour plus one glucometer, with measuring range of 10-600 mg/dL, after aseptic precautions. Pre-meal and post-meal at breakfast, lunch and dinner and at least 1 fasting blood glucose were performed in first 48 hours after the 1st dose of INJ dexamethasone.

Fasting BSL ≤ 95 mg/dL and 2-hr post-prandial BSL ≤ 120 mg/dL were considered as indicators of optimal glycemic control. In mother, significant fasting hyperglycemia was defined as fasting BSL ≥ 95 mg/dL; and significant and severe post-prandial hyperglycemia as ≥ 140 mg/dL and ≥ 160 mg/dL respectively. Fasting and pre-meal BSL 100 mg/dL and post-meal BSL 140 mg were considered for insulin injection. Changes in insulin requirement were noted in patients requiring insulin for the first time and those who were already on insulin.

For neonates born to these women, BSL was taken within 1st hour after birth. Neonatal hypoglycemia was defined as BSL 46 mg/dL and severe neonatal hypoglycemia 36 mg/dL, respectively.

Statistical analysis

Sample size was calculated based on the previous year's prevalence rate of GDM in Maharashtra region. Based on that, and after considering alpha margin of error 0.05 & power 0.90, the sample size required was 70 in each group i.e. GDM (Group A) and Non-GDM (Group B).

Data was collected on Microsoft Excel sheet and was analysed using SPSS V 25.0. Mean and standard deviation were calculated for quantitative variables and proportions for categorical variables. Paired 't' test was applied for within group analysis and unpaired 't' test for comparison and analysis of group A and group B.

RESULTS AND OBSERVATIONS:

Patients meeting the inclusion criteria were included in the study non-randomly. Two groups were formed: group A (GDM patients) and group B (non-GDM patients). Both groups comprised 70 patients each, who received antenatal INJ dexamethasone.

Demographic Characteristics:

The average age of participants in the GDM group (Group A) was 28.7 ± 4.08 years, while in the non-GDM group (Group B), it was 25.5 ± 4.37 years. Pre-pregnancy weight and Body mass index (BMI) was

significantly higher in Group A (61.6 ± 6.64 kg and 24.7 ± 2.5 kg/m²) compared to Group B (57.53 ± 6.35 kg and 22.6 ± 1.8 kg/m²). Average gestational weight gain was 10 ± 1.3 kg in Group A and 8.99 ± 1.23 kg in Group B

(TABLE 1)

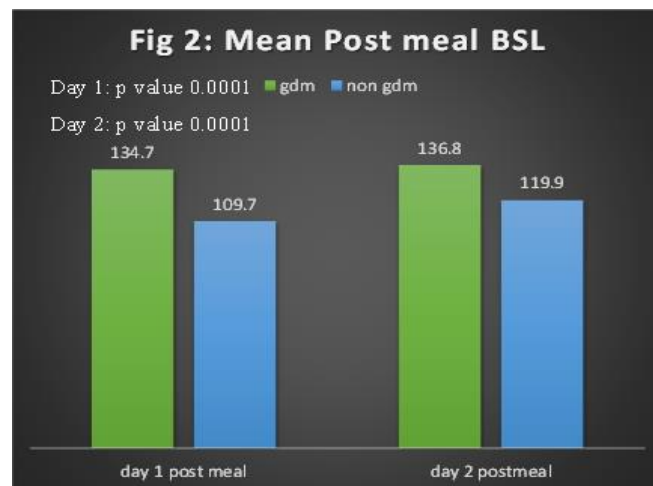
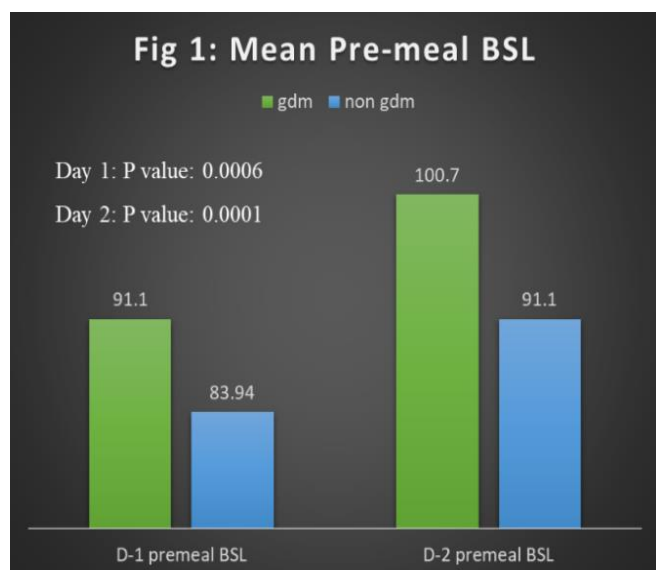
Parameters	Group A (GDM) (n=70)	Group B (non-GDM) (n=70)
Age (years)	28.7 ± 4.08	25.5 ± 4.37
Height (centimetre)	158.07 ± 6.54	159.53 ± 5.78
Weight before pregnancy (Kg)	61.6 ± 6.64	57.53 ± 6.35
BMI (Kg/m ²)	24.7 ± 2.5	22.6 ± 1.8
Weight gain during pregnancy (kg)	10 ± 1.3	8.99 ± 1.23
Multigravida	56/70 (80%)	44/70 (62.8%)
Multiple gestation	8/70 (11%)	5/70 (07%)

TABLE 1: Baseline characteristic features of study participants

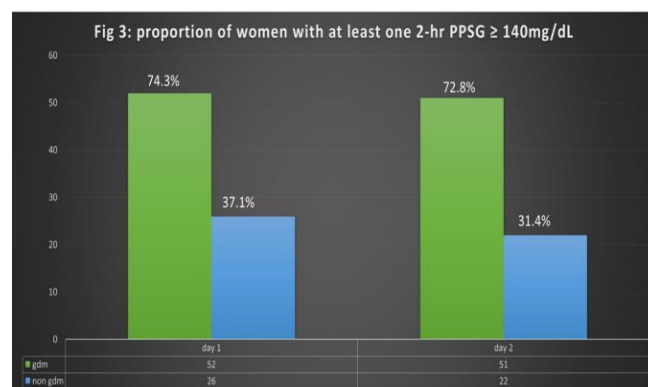
Baseline and Post-Dexamethasone Glycemic Changes:

Baseline fasting blood sugar levels (BSL) were significantly higher in the GDM group (82.9 ± 7.43 mg/dL) compared to the non-GDM group (75.4 ± 7.58 mg/dL). After dexamethasone administration, fasting BSL on Day 2 increased in both groups but was significantly higher in the GDM group (103.8 ± 9.75 mg/dL) compared to the non-GDM group (96.9 ± 7.2 mg/dL).

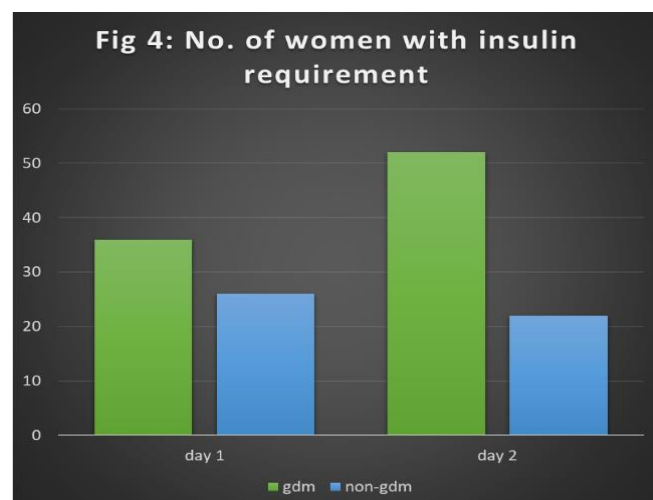
Mean pre-meal and 2-hour post-meal BSL on Day 1 and Day 2 were significantly higher in the GDM group, with a statistically significant P-value of 0.0006 (Day 1) and 0.0001 (Day 2) for pre-meal BSL and 0.0001 (Day 1 & 2) for post-meal BSL (Figures 1 and 2).



Proportion of women with at least one 2-hour postprandial sugar (PPSG) ≥ 140 mg/dL i.e. significant hyperglycemia, was 74.3% in the GDM group (Group A) and 31.4% in the non-GDM group (Group B), respectively (figure 3).

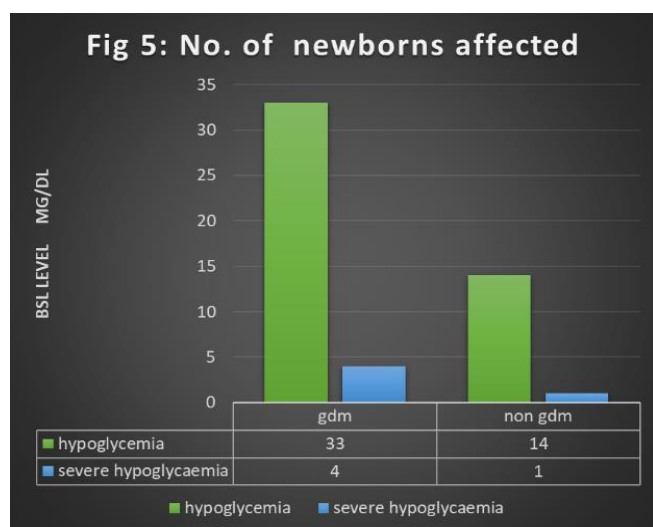


44% of women with GDM required insulin therapy after steroid administration. Before the administration of steroids, 21 GDM patients were treated with insulin, but after administration of INJ dexamethasone the number increased to 52 by day 2.



Neonatal Outcomes:

Neonatal BSL was significantly lower in the GDM group (49.1 ± 7.89 mg/dL) compared to the non-GDM group (64.47 ± 12.61 mg/dL). 47% of neonates born to GDM mothers had hypoglycemia, highlighting the need for strict monitoring post-delivery. (fig no 5)



DISCUSSION:

The rising prevalence of gestational diabetes mellitus (GDM) and its effects on both maternal and foetal health pose a significant global challenge. Managing these patients requires a multidisciplinary team, including physicians, obstetricians, endocrinologists, and paediatricians. However, the care provided is often inadequate. Current recommendations emphasize universal screening, blood glucose monitoring for those diagnosed with GDM, pharmacological treatment, and antenatal foetal status assessments. At our hospital, we adhere to universal screening for hyperglycemia and GDM in accordance with the DIPSI guidelines and GDM management is implemented through a multidisciplinary approach.

In our study, we observed that the mean age of patients in GDM group was 28.7 ± 4.08 years, whereas the mean age in non-GDM group was 25.5 ± 4.37 years, similar results were also seen in the study conducted by **A Patil et.al in 2023**^[15]. It was also found that the mean weight at the beginning of pregnancy and BMI in women of GDM group was 61.6 ± 6.64 kg and 24.7 ± 2.5 kg/m², whereas in non-GDM group was 57.53 ± 6.35 kg and 22.6 ± 1.8 kg/m². which slightly correlates with the literature by **Anil Satyaraddi et.al, 2024**.^[16]

Intragroup analysis on day 1 - day 2 of premeal BSL was not significant in GDM group ($p = 0.236$) and non-GDM group ($p = 0.462$). Similar result was seen in intragroup analysis of post-meal BSL in GDM group ($p = 0.762$) and non-GDM group ($p = 0.528$). These results were similar to literature by Patil A et.al (2023)^[15], where there was no significant ($p > 0.05$) change in the mean glucose level compared between the days 1 and 2 following ACS.

Number of women with at least one 2-hr PPSG value > 140 mg/dL was 52/70 (74.3%) on day 1 and 51/70

(72.8%) on day 2 in GDM group; whereas 26/70 (37.1%) on day 1 and 22/70 (31.4%) day 2 in non-GDM group. Which is slightly different to the literature by Beena B. et.al (2019)^[17] where 66% patients had an elevated PPSG on D2.

In our study we found that no. of pregnant women who required insulin intervention on day 1 were 36/70 (51.4%) in GDM group and 26/70 (37.1%) in non-GDM group; and on day 2 the number was 52/70 (74.3%) in GDM group and 22/70 (31.4%) in non-GDM group. Mean dose of insulin required per day was 14.36 IU on day 1 and 30.03 IU on day 2 of antenatal dexamethasone administration in GDM patients. In non-GDM patients it was about 4.2 IU required only on day 2. These findings slightly differ from the literature by Satyaraddi et.al (2024)^[16], where mean insulin required was 23.5 IU during administration of antenatal corticosteroids.

In our study, we observed that, the mean BSL of newborn in 1- hr after birth was 49.17 ± 7.89 mg/dL in GDM group and 64.47 ± 12.61 mg/dL in non-GDM group. The odds of neonatal hypoglycemia increased in babies of mothers who had significant hyperglycemia. No. of newborns born to pregnant women with GDM who had hypoglycemia (< 46 mg/dL) were 33/70 and out of them 4 had severe hypoglycemic episodes (< 36 mg/dL). No. of newborns born to pregnant women without GDM who had hypoglycemia (< 46 mg/dL) were 14/70 and out of them 1 had severe hypoglycemic episode (< 36 mg/dL). These findings co-related with the study conducted by Tuohy JF et.al (2021)^[3].

Our study has several strengths, including being one of the Indian studies to investigate the effect of antenatal dexamethasone therapy on glycemic control in pregnant women with and without GDM. The inclusion of participants with and without GDM enabled better characterization of the effect of antenatal steroid therapy on maternal glycaemia.

However, there are certain limitations to our study, such as being a single centre study, short duration of follow up with small sample size, lack of continuous glucose monitoring which could have captured outcomes related to glycemic control more comprehensively.

CONCLUSION:

GDM is a significant public health concern, especially in India, where ethnic predisposition and changing lifestyles have increased its prevalence. Its impact on both mother and neonate can be profound, with risks of macrosomia, neonatal hypoglycemia, and long-term metabolic disorders. While antenatal dexamethasone is essential for lung maturity in GDM patients, its hyperglycemic effects must be carefully managed. Antenatal use of corticosteroids is recommended to accelerate fetal lung maturity, and to reduce incidence of respiratory distress in newborns. Findings of our study indicate the need for close follow up and

intensive monitoring protocols after antenatal steroid therapy. Consideration should be given to monitoring the glycemic response in those without GDM as well. This will help in effective management of glycemic status, potentially reducing maternal and fetal complications.

India has established guidelines for screening, management, and postpartum follow-up, but challenges remain in terms of awareness, accessibility, and adherence. Improved screening strategies, better access to medications, and long-term follow-up can significantly reduce both maternal and foetal complications.

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Conflict of interest: None

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