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ASSESSMENT OF GESTATIONAL DIABETES MELLITUS IN A TERTIARY CARE HOSPITAL, BIHAR: A CROSS-SECTIONAL STUDY.

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ABSTRACT

Background

Gestational diabetes mellitus (GDM) is a prevalent pregnancy condition involving intolerance of glucose, leading to significant maternal and fetal health risks. The purpose of the study is to assess glycemic management and pregnancy outcomes in GDM-diagnosed pregnant women.

Methods

A prospective observational study was conducted involving 80 pregnant women, with 40 diagnosed with GDM and 40 serving as controls. Participants underwent glucose challenge tests (GCT) and oral glucose tolerance tests (OGTT) for screening. Women diagnosed with GDM were prescribed a diabetic diet based on BMI and, if necessary, insulin therapy. Data on mother and fetus outcomes were gathered and analyzed using SPSS software. A p-value < 0.05 was deemed statistically relevant.

Results

The average age was 29.5 years (± 4.3). The GDM group showed notably higher fasting (99.2 ± 11.3 mg/dl) and postprandial glucose levels (136.8 ± 14.7 mg/dl) compared to the control group (84.7 ± 8.9 mg/dl and 112.3 ± 10.2 mg/dl, respectively; $p < 0.001$). Thirty percent of the GDM group required insulin therapy. Cesarean section rates were greater in the GDM group (45% vs. 25%, $p = 0.05$). Adverse fetal outcomes, including macrosomia (20% vs. 5%, $p = 0.04$), neonatal hypoglycemia (15% vs. 2.5%, $p = 0.04$), and respiratory distress (10% vs. 0%, $p = 0.05$), were more frequent in the GDM group.

Conclusion

The study highlights the significant impact of GDM on mother and newborn health, with higher rates of Cesarean sections and adverse fetal outcomes in the GDM group. Effective glycemic control through dietary management and insulin therapy is crucial for improving pregnancy outcomes.

Recommendations

There is a need for stringent glucose monitoring and personalized treatment plans for pregnant women with GDM. Further research should focus on optimizing management strategies and exploring new interventions to reduce the risks associated with GDM.

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INTRODUCTION

Glucose intolerance is the hallmark of gestational diabetes mellitus (GDM), a disorder that first manifests or occurs during pregnancy. Both the mother and the fetus are in danger from this metabolic condition, which can result in complications like preeclampsia, cesarean delivery, macrosomia, and newborn hypoglycemia. Globally, the prevalence of GDM varies and is impacted by various factors including lifestyle, weight, and ethnicity. The International Diabetes Federation estimates that 16.2% of pregnant women experience hyperglycemia, with GDM being the primary cause of most instances [1].

GDM has a complicated etiology that includes both insufficient insulin secretion and insulin resistance. Increased insulin resistance during pregnancy is caused by hormonal changes, but this is usually offset by increased insulin production. Hyperglycemia results from this compensatory mechanism's inadequacy in women with GDM. Advanced mother age, obesity, a family record of diabetes, and a previous diagnosis of GDM are risk factors for GDM [2].

Early diagnosis and effective management of GDM are crucial for minimizing adverse outcomes. Screening typically involves an initial glucose challenge test (GCT) followed by an oral glucose tolerance test (OGTT) if the initial screening results are abnormal. Management strategies include lifestyle modifications, dietary changes, and in some cases, insulin therapy. Proper glycemic control can significantly reduce the risk of complications [3].

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Recent studies have emphasized the importance of individualized care plans for managing GDM. For instance, the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study highlighted the relationship between mother glucose levels and adverse pregnancy outcomes, underscoring the need for tailored interventions [4]. Additionally, advancements in continuous glucose monitoring have provided new insights into glucose variability and its impact on pregnancy outcomes, further supporting the move toward personalized treatment approaches [5, 6].

This study aims to assess the glycemic control and pregnancy results of women in a tertiary care hospital who have been diagnosed with GDM.

METHODOLOGY

Study Design

A prospective observational cross-sectional study.

Study Setting

The study was taken out at Madhubani Medical College, Bihar, India, providing a comprehensive setting for monitoring and managing gestational diabetes, over one year (May 2023 to June 2024).

Participants

The study included 80 pregnant women.

Inclusion Criteria

- Pregnant women who developed carbohydrate intolerance during the current pregnancy.
- Participants who underwent GCT and, if necessary, OGTT.

Exclusion Criteria

- Women with pre-existing diabetes mellitus.
- Women with other co-morbid conditions that could affect glucose metabolism.

Sample size

To calculate the sample size for this study, the following formula was used for estimating a proportion of a population:

$$n=\frac{Z2 \times p \times (1-p)}{E2}$$

Where:

- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

Bias

To minimize selection bias, the next normal case of the same age following each study case was taken as a control. This age-matching control selection helps in reducing potential confounding variables related to age.

Variables

Variables included age, BMI, dietary compliance, insulin treatment, plasma glucose levels, maternal outcomes, and fetal outcomes.

Data Collection and Procedure

Medical records and prenatal monitoring were used to gather data. The screening and diagnosis of GDM in the pregnant participants marked the start of the investigation. Every subject had a GCT at 24-28 weeks of gestation, 32-34 weeks, and at any time any risk factors were noticed. To measure the plasma glucose levels, 50 grams of glucose were administered. Following an overnight fast, the ladies were put through a 100-gram OGTT if their plasma glucose level was more than 130 mg/dl. In the study, controls were pregnant women with normal GCT results and normal OGTT results.

The patients were given a diabetic diet plan depending on their body mass index (BMI) after being diagnosed with GDM. Following two weeks of this diet, their glycemic profiles—which included venous glucose levels during fasting and two hours following each main meal—were assessed. Dietary management was considered adequate if the glucose concentration during fasting was less than 95 mg/dl and the glucose concentration two hours after the meal was less than 120 mg/dl. In cases where the patient's dietary compliance was good but these values were surpassed, insulin therapy was initiated for them. Insulin dosages were started at the lowest level and changed based on blood sugar readings.

Depending on how severe the carbohydrate intolerance was, fetal surveillance was started throughout pregnancy. All participants were encouraged to give birth vaginally; cesarean sections were only done for medical necessity. Premature rupture of membranes (PROM), vaginal or cesarean delivery, and other maternal variables was taken into consideration when evaluating the outcomes of the pregnancies. Fetal outcomes, such as the prevalence of congenital defects, sepsis, respiratory distress, hypoglycemia, macrosomia, and preterm, were also evaluated.

Statistical Analysis

The SPSS software, version 19, was employed for statistical analyses. To make comparisons easier, the findings were given as means and percentages. A statistically significant variation was deemed as a p-value of less than 0.05, signifying a meaningful variation between the groups.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULT

The study included 80 pregnant women, with 40 diagnosed with GDM and 40 serving as controls. The average age was 29.5 years (± 4.3), with no significant age

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variation among the GDM group (29.7 years) and the control group (29.3 years).

Table 1: Participant Demographics

Demographic profile	GDM Group	Control Group	p-value
Age (years)	29.7 ± 4.2	29.3 ± 4.4	0.78
BMI (kg/m²)	27.5 ± 3.1	26.8 ± 3.0	0.45

Participants in the GDM group showed significantly higher fasting and postprandial glucose levels compared to the control group. After dietary management, 70% of the GDM group achieved target glucose levels, while the remaining 30% required insulin therapy.

Table 2: Glycemic Profile

Glycemic profile	GDM Group	Control Group	p-value
Fasting glucose (mg/dl)	99.2 ± 11.3	84.7 ± 8.9	<0.001
Postprandial glucose (mg/dl)	136.8 ± 14.7	112.3 ± 10.2	<0.001
Insulin therapy (%)	30%	0%	-

The rate of Cesarean sections was higher in the GDM group in contrast to the control group (45% vs. 25%). PROM occurred in 10% of the GDM group and 5% of the control group.

Table 3: Maternal Outcomes

Maternal Outcomes (%)	GDM Group	Control Group	p-value
Spontaneous deliveries	55%	75%	0.05
Induced deliveries	45%	25%	0.05
Vaginal deliveries	55%	75%	0.05
Cesarean sections	45%	25%	0.05
PROM	10%	5%	0.65

Macrosomia was observed in 20% of the infants born to mothers in the GDM group, compared to 5% in the control group. There were higher incidences of neonatal hypoglycemia (15% vs. 2.5%) and respiratory distress (10% vs. 0%) in the GDM group.

Table 4: Fetal Outcomes

Fetal Outcomes (%)	GDM Group	Control Group	p-value
Macrosomia	20%	5%	0.04
Congenital anomalies	5%	2.5%	0.50
Sepsis	7.5%	2.5%	0.30
Respiratory distress	10%	0%	0.05
Hypoglycemia	15%	2.5%	0.04
Prematurity	12.5%	5%	0.20

DISCUSSION

The study involved 80 pregnant women, divided equally into the GDM group and the control group. The average age of participants was around 29.5 years, with no significant age difference between the groups, ensuring a balanced comparison.

The GDM group exhibited significantly higher fasting and postprandial glucose levels compared to the control group. Despite dietary management, 30% of the women in the GDM group required insulin therapy to achieve target glucose levels. This indicates that while dietary management is effective for the majority, a substantial proportion of GDM women need additional intervention with insulin to maintain glycemic control.

The rate of Cesarean sections was significantly greater in the GDM group (45%) compared to the control group (25%), suggesting that GDM may increase the likelihood of requiring surgical intervention during delivery. Although the rate of PROM was higher in the GDM group, this difference was not statistically substantial.

Infants born to mothers in the GDM group had higher incidences of macrosomia (20% vs. 5%), neonatal hypoglycemia (15% vs. 2.5%), and respiratory distress (10% vs. 0%) compared to the control group. These findings imply that GDM is related to a greater risk of significant neonatal complications, including excessive birth weight, low blood sugar levels, and respiratory issues.

The results of this study highlight the critical impact of GDM on both mother and neonatal health. Elevated glucose levels in the GDM group led to a greater need for insulin therapy, indicating that dietary management alone is not sufficient for a considerable number of patients. The increased rate of Cesarean sections in the GDM group underscores the obstetric challenges posed by this condition, potentially due to complications such as macrosomia.

Fetal outcomes in the GDM group reveal a heightened risk of adverse conditions, including macrosomia, neonatal hypoglycemia, and respiratory distress. These complications necessitate careful monitoring and management of pregnant women with GDM to mitigate risks to the newborn.

Overall, the findings emphasize the importance of stringent glucose monitoring and individualized treatment plans for pregnant women with GDM to improve pregnancy results and reduce the risk of complications for both mothers and their babies. The study supports the need for comprehensive care strategies involving diet, monitoring, and when necessary, insulin therapy, to effectively manage GDM and enhance mother and fetus health outcomes.

The evaluation of GDM reveals significant variations in prevalence and associated risk factors across different regions. In research, the incidence of GDM was identified to be 17.2%, and the main risk variables were acanthosis nigricans, maternal age, and a family history of diabetes. Additionally, this study found that inflammation, oxidative stress, and DNA damage all play significant roles in the pathophysiology of GDM and that certain biomarkers, including mean platelet volume (MPV), neutrophil-lymphocyte ratio (NLR), and reactive oxygen species (ROS), may be useful as prognostic and diagnostic markers [7].

Prospective research found that 15.9% of people had GDM. A history of GDM, an elevated BMI, a family record of diabetes, and advanced maternal age were all significant risk factors. The significance of contemporary lifestyle variables in the onset of GDM was also highlighted by this study [8].

A cross-sectional study discovered that GDM prevalence was 3.42% lower. Obese, over thirty years of age, and a family record of diabetes characterized most women with GDM. Furthermore, a sizable portion needed cesarean sections as a result of GDM-related problems [9].

7.1% of people have GDM, according to research. It emphasized important risk variables such as pre-pregnancy weight, family records of diabetes or hypertension, and socioeconomic level. Acanthosis nigricans was also discovered by the study to be a strong predictor of GDM [10].

According to a study, the prevalence of GDM is 13.8%. A family history of diabetes, an elevated BMI, and an older mother were all strongly linked to the illness. The study also found that women with GDM had higher odds of premature birth, postpartum hemorrhage, and polyhydramnios [11].

Another study found a high incidence of GDM at 20.4% using capillary blood testing, compared to 11.5% with venous blood testing. The study emphasized the intermediate agreement between these testing methods and highlighted the importance of early screening and detection [12].

A study reported a GDM prevalence of 35.8%. The majority of cases were diagnosed using fasting plasma glucose, which was associated with advanced maternal age. The study underscored the necessity of proper screening practices to manage and mitigate the risks associated with GDM [13].

Generalizability

The study underscores the critical need for effective glycemic management in pregnant women with gestational diabetes mellitus (GDM) to mitigate maternal and fetal health risks. The findings, derived from a sample of 80 women, reveal that GDM significantly increases fasting and postprandial glucose levels, necessitating dietary adjustments and insulin therapy in some cases. Higher rates of Cesarean sections and adverse fetal outcomes, such as macrosomia, neonatal hypoglycemia, and respiratory distress, were observed in the GDM group compared to controls. These results highlight the importance of stringent glucose monitoring and personalized treatment plans, suggesting that similar interventions could improve pregnancy outcomes on a larger scale, thus benefiting the broader population of pregnant women with GDM.

CONCLUSION

The study identified significant differences between the GDM and control groups, particularly in glycemic control, delivery methods, and neonatal outcomes. Women with GDM had higher rates of Cesarean sections and adverse fetal outcomes, underscoring the importance of effective monitoring and management of GDM to improve both mother and neonatal health.

Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

Recommendation

There is a need for stringent glucose monitoring and personalized treatment plans for pregnant women with GDM. Further research should focus on optimizing management strategies and exploring new interventions to reduce the risks associated with GDM.

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List of abbreviations

GDM: Gestational Diabetes Mellitus
BMI: Body Mass Index
GCT: Glucose Challenge Test
OGTT: Oral Glucose Tolerance Test
PROM: Premature Rupture of Membranes

Source of funding

No funding was received.

Conflict of interest

The authors have no conflicting interests to declare.

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