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Original Research Article

Examination of gestational diabetes mellitus at a tertiary care hospital

Gunjan[1]*, Indu Khare[1], Ashutosh Kumar[2], Anjana Sinha[1]

[1]Department of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna, Bihar, India
[2]Department of ENT, Jawahar Lal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

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***Correspondence:**
Dr. Gunjan Sinha,
E-mail: dr.gunjan24@gmail.com

ABSTRACT

Background: Globally, 14% of pregnancies are complicated by gestational diabetes mellitus (GDM). This can induce type 2 diabetes and metabolic problems in mothers and children. Dietary and lifestyle adjustments are the basic GDM treatments, but optimal euglycemia treatments are being researched. The study examined GDM prevalence and implications in pregnant women and compared mother and foetal outcomes in GDM patients and controls.
Methods: The study involved 200 pregnant females, with 100 diagnosed with GDM and 100 as controls. Data were gathered through glucose challenge tests (GCT) and oral glucose tolerance tests (OGTT) at specified intervals. Mother and fetal outcomes were compared between the groups with a p value of <0.05 regard as significant.
Results: Women with GDM had a significantly higher body mass index (27.8±3.1 kg/m²) compared to the control group (25.4±2.9 kg/m², p<0.001). They also had a higher incidence of cesarean sections (35% versus 20%, p=0.03) and premature rupture of membranes (PROM) (18% versus 8%, p=0.04). Infants of GDM mothers had higher birth weights (3500±500 g versus 3200±450 g, p<0.001) and higher rates of macrosomia (22% versus 8%, p=0.01), neonatal hypoglycemia (15% versus 5%, p=0.01), and respiratory distress (12% versus 4%, p=0.02).
Conclusions: GDM increases the risk of PROM, caesarean birth, respiratory distress, hypoglycemia, and macrosomia for the infant and harms the mother and foetus. These findings emphasise early detection and effective GDM therapy.

Keywords: Gestational diabetes mellitus, Maternal outcomes, Fetal outcomes, Glycemic control, Pregnancy complications

INTRODUCTION

One of the most prevalent pregnancy problems, gestational diabetes mellitus (GDM) affects about 14% of pregnancies worldwide.[1] This metabolic disease presents serious dangers to the mother and the foetus and is characterised by glucose intolerance that was initially identified during pregnancy.[2]

Because of probable epigenetic alterations brought on by the intrauterine environment, women with GDM have a greater chance of acquiring type 2 diabetes mellitus (T2DM) later in life, and their progeny are more likely to be obese, have T2DM, and have metabolic syndrome.[3]

The treatment and management of GDM primarily involve medical nutrition therapy, which includes dietary modifications, weight management, and physical activity. Effective management aims to achieve euglycemia, thereby minimizing the risk of adverse mother and neonatal outcomes.[4] Although dietary interventions are often recommended, there is no agreement on the ideal diet for reaching and sustaining maternal euglycemia. Numerous dietary approaches, including as calorie restriction, low glycemic index (GI) diets, and changes in the macronutrient composition of diets, have been investigated with varying degrees of success.[5]

Recent research has highlighted the rising incidence of GDM, correlating with the raising rates of maternal

obesity.[6] The complexity of GDM's etiology involves both genetic and environmental factors, which contribute to its pathogenesis and impact. For instance, review by the American Diabetes Association (ADA) found that modified dietary interventions, compared to control diets, were associated with improved glycemic control and reduced rates of macrosomia in neonates. This suggests that tailored nutritional strategies can significantly influence pregnancy outcomes.[7]

This study seeks to contribute to the understanding of GDM's impact on maternal and fetal health outcomes. By comparing the clinical characteristics and pregnancy results between the GDM and control groups, the research aims to provide insights into effective management strategies and the potential benefits of early detection and intervention.

The study aimed to analyze the prevalence and implications of GDM among pregnant women.

METHODS

Study design

The study was a case-control study.

Study setting

The study took place at Patna Medical College and Hospital, spanning from April 2023 to May 2024.

Participants

A total of 200 pregnant women comprised in the study. Women who initially experienced carbohydrate intolerance during their current pregnancy, regardless of severity, made up the study group.

Inclusion criteria

Women who showed carbohydrate intolerance onset or first detected during the current pregnancy, antenatal women supervised with glucose challenge test (GCT) at 24–28 and 32–34 weeks, or upon development of any risk factors during pregnancy, and GDM cases were selected based on ADA and National Diabetes Data Group (NDDG) were included.

Exclusion criteria

Women with pre-existing diabetes mellitus or other significant health issues that could interfere with the study were excluded.

Sample size

To calculate the sample size for this study, the following formula was used for estimating a proportion in a population, where n=sample size, Z=Z-score corresponding to the desired level of confidence, p=estimated proportion in the population, and E=margin of error.

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Bias

To minimize bias, the next normal pregnant woman of the same age, following the identification of a study case, was taken as a control. This matching aimed to ensure comparability between the study and control groups.

Variables

Plasma glucose levels after a 50 g GCT and a 100 g oral glucose tolerance test (OGTT) were among the main variables examined. Other maternal outcomes included type of delivery (induced, vaginal, or caesarean section), premature rupture of membranes (PROM), and foetal outcomes included congenital anomalies, macrosomia, respiratory distress, sepsis, hypoglycemia, and prematurity.

Procedure

Antenatal women underwent GCT at 24 to 28 and 32 to 34 weeks or whenever a risk factor grown during pregnancy. Those with plasma glucose values exceeding 130 mg/dl were given a 100 g OGTT after overnight fasting. The glycemic profile was measured after prescribing a diabetic diet based on BMI and subsequent adjustments were made according to fasting and postprandial glucose levels. Insulin treatment was initiated if dietary measures failed to control glucose levels adequately. Antenatal fetal surveillance and delivery methods were recorded.

Statistical analysis

Statistical package for the social sciences (SPSS) version 21 was utilized for the data analysis. The strength of relationship was determined by calculating odds ratios. If the p value was <0.05, it was deemed statistically significant. In order to arrive at significant findings, data were compared using means and percentages.

Ethical considerations

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

RESULTS

The study analyzed maternal characteristics and outcomes among 100 women diagnosed with GDM and 100 control participants. The average age in the GDM group was 29.4±4.2 years, slightly higher than the control group at 28.9±3.8 years, though this variation was not statistically

relevant (p=0.45). However, the mean body mass index (BMI) was considerably greater in the GDM group (27.8±3.1 kg/m²) in contrast to the control group (25.4±2.9 kg/m²), with a p value of <0.001.

Additionally, a family history of diabetes was more prevalent among the GDM group (45%) in contrast to the control group (20%), with a statistically relevant p value of less than 0.001. Regarding delivery methods, 35% of the GDM group underwent cesarean sections, in contrast to 20% in the control group (p=0.03). The incidence of premature rupture of membranes (PROM) was also greater in the GDM group (18%) versus the control group (8%), with a significant p value of 0.04.

Table 1: Maternal characteristics and outcomes.

Characteristics	GDM group (n=100)	Control group (n=100)	P value
Age (years)	29.4±4.2	28.9±3.8	0.45
BMI (kg/m²)	27.8±3.1	25.4±2.9	<0.001*
Family history of diabetes	45	20	<0.001*
Mode of delivery			
Vaginal	65	880	0.03*
Cesarean section	35	20	0.03*
PROM	18	8	0.04*

*Statistically significant.

There were notable variations among the GDM group as well as the control group based on the foetal outcomes. With a p value of less than 0.001, the average birth weight in the GDM group was greater (3500±500 g) than in the control group (3200±450 g). With a significant p-value of 0.01 for macrosomia (birth weight over 4000 g), the GDM group had a significantly greater incidence of this condition (22%) than the control group (8%).

15% of newborns born to females in the GDM group and 5% of babies born to mothers in the control group had neonatal hypoglycemia (p=0.01). Furthermore, with a p value of 0.02 there was a greater frequency of respiratory distress in infants in the GDM group (12%) as opposed to the control group (4%). Sepsis, preterm, and congenital abnormalities were among the other outcomes that did not significantly differ between the two groups.

Among the 100 women in the GDM group, the initial fasting glucose levels averaged 110±12 mg/dl, and postprandial glucose levels averaged 145±15 mg/dl. Sixty women managed their condition with dietary modifications alone, while 40 required insulin therapy. The average insulin dose administered was 24±8 IU/day. Glycemic control was considered adequate in 80% of the women following these interventions.

The statistical analysis confirmed that several maternal and fetal outcomes were significantly associated with GDM, emphasizing the importance of monitoring and managing gestational diabetes effectively.

Table 2: Fetal outcomes.

Characteristics	GDM group	Control group	P value
Birth weight (g)	3500±500	3200±450	<0.001*
Macrosomia (birth weight >4000 g)	22	8	0.01*
Congenital anomalies	5	2	0.24
Neonatal hypoglycemia	15	5	0.01*
Respiratory distress	12	4	0.02*
Prematurity	10	6	0.29
Sepsis	4	2	0.41

*Statistically significant.

Table 3: Glycemic control and treatment in GDM group.

Variables	Values
Initial fasting glucose (mg/dl)	110±12
Postprandial glucose (mg/dl)	145±15
Patients on diet alone	60
Patients on insulin	40
Average insulin dose (IU/day)	24±8
Adequate glycemic control achieved	80

Table 4: Statistical analysis of maternal and fetal outcomes.

Outcomes	Odds ratio	95% CI
Family history of diabetes	3.38	1.79–6.36
Mode of delivery		
Vaginal	0.50	0.27–0.92
Cesarean section	2.33	1.15–4.73
PROM	2.52	1.05–6.06
Fetal outcomes		
Macrosomia (birth weight >4000 g)	3.16	1.32–7.55
Congenital anomalies	2.57	0.48–13.85
Neonatal hypoglycemia	3.44	1.21–9.76
Respiratory distress	3.29	1.03–10.48
Prematurity	1.74	0.61–4.93
Sepsis	2.04	0.37–11.24

DISCUSSION

The study included 200 pregnant women, with 100 diagnosed with GDM and 100 serving as controls. The results indicated considerable variation in several maternal and fetal outcomes between the two groups. Maternal characteristics showed that women in the GDM group had

a notably higher BMI in contrast to the control group (27.8±3.1 kg/m² versus 25.4±2.9 kg/m², p<0.001). A higher proportion of women in the GDM group had a family history of diabetes (45% versus 20%, p<0.001), suggesting a genetic predisposition to developing GDM.

The mode of delivery also differed significantly between the groups. Females with GDM were more likely to undergo cesarean section (35% versus 20%, p=0.03) and had a higher prevalence of premature rupture of membranes (PROM) (18% versus 8%, p=0.04). These findings highlight the increased obstetric risks associated with GDM, necessitating careful monitoring and intervention during pregnancy and delivery.

The foetal results showed that babies born to GDM mothers had a greater frequency of macrosomia (22% versus 8%, p=0.01) and a larger average birth weight (3500±500 g versus 3200±450 g, p<0.001). This shows that GDM is linked to hypertrophic foetal development, which may result in difficult deliveries and a higher chance of obesity and metabolic diseases in later life. Neonatal complications were more general in the GDM group, with greater rates of neonatal hypoglycemia (15% versus 5%, p=0.01) and respiratory distress (12% versus 4%, p=0.02). These conditions require immediate medical attention and may result in prolonged hospital stays and increased healthcare costs.

Among the women with GDM, 60% managed their condition through diet alone, while 40% required insulin therapy. Adequate glycemic control was achieved in 80% of the women after intervention, indicating the effectiveness of the management protocols used in the study. However, the need for insulin in a significant portion of the women underscores the importance of personalized treatment plans to achieve optimal outcomes.

In tertiary care settings, recent research has examined a number of GDM-related topics, such as prevalence, risk factors, diagnostic techniques, and outcomes for mothers and newborns. In 735 pregnant women, a tertiary care hospital in Kolkata conducted a research that found a 17.2% prevalence of GDM. Mother's age, diabetes in the family history, and the existence of acanthosis nigricans were significant risk factors. The study emphasised how inflammatory indicators, DNA damage, and oxidative stress contribute to the pathophysiology of GDM.[8]

The incidence of GDM was determined to be 3.42% in a descriptive cross-sectional research conducted among 3034 pregnant patients in a tertiary care hospital. The majority of GDM-afflicted women were over 30, and many of them had a history of diabetes in their families. Among GDM patients, the study also found that polyhydramnios and caesarean sections were common.[9]

A research that used various glucose tolerance tests looked at 77,227 pregnant women. With the two-step screening procedure, the prevalence of GDM was 6.07%, whereas with the one-step screening method, it was 21%. Due to inappropriate fasting practices, the study highlighted the difficulties in performing plasma glucose testing when fasting.[10] 13.8% of people in Bhubaneswar had GDM, according to a research. Advanced maternal age, a higher BMI, and a family history of diabetes were important risk factors. Preterm delivery, polyhydramnios, and postpartum haemorrhage have all been linked to increased risks in GDM.[11] 11.5% of people in Tamil Nadu have GDM, according to a retrospective research. High fasting blood glucose, high random blood glucose, and a history of GDM in prior pregnancies were significant risk factors.[12]

The incidence of GDM increased by 74% upon the implementation of revised diagnostic criteria, however primary health outcomes did not improve overall. The expense of healthcare increased significantly as a result of this adjustment.[13] Poor glycemic control was seen in 38.5% of GDM-afflicted women, with multigravidas and those receiving medication being more at risk. Better awareness and management techniques are required, according to the study.[14] Predictive models for GDM have been created by several research using laboratory data and maternal factors. Significant predictors were a familial history of dyslipidemia, high HbA1c levels, and a history of GDM.[15]

Limitations

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

CONCLUSION

The findings of this study underscore the significant impact of GDM on both mother and fetal outcomes. Women with GDM are at higher risk of complications such as cesarean delivery and PROM, while their infants face increased risks of macrosomia, neonatal hypoglycemia, and respiratory distress. These results highlight the importance of early detection, continuous monitoring, and appropriate management of GDM to improve pregnancy outcomes and reduce associated risks. Effective treatment protocols, including dietary interventions and insulin therapy when necessary, are crucial for achieving good glycemic control and mitigating adverse effects of GDM.

Recommendations

Enhanced screening protocols and individualized dietary and lifestyle interventions are recommended to improve glycemic control and reduce the associated risks of GDM.

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REFERENCES

1. International Diabetes Federation. Idf diabetes atlas. 2013. 2019. Available at: https://diabetesatlas.org/. Accessed on 05 May 2024.
2. Metzger BE, Lowe LP, Dyer AR, Trimble ER. Chaovari U, Cousta DR, et al. The HAPO Study Cooperative Research Group. Hyperglycemia and adverse pregnancy outcomes. N Engl J Med. 2008;358(19):1991-2002.
3. Campbell T. Stigmatization as a Barrier to Treatment Adherence in Women with Gestational Diabetes (Doctoral dissertation, Kansas City University). 2022. Available at: https://digitalcommons. kansascity.edu/psyd/4/. Accessed on 05 May 2024.
4. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin. Clinical management guidelines for obstetrician-gynecologists. Obstet Gynecol. 2018;131(2):e49-64.
5. Simmons D, Rowan JA, Campbell N, McIntyre HD. Hyperglycaemia in early pregnancy: the Treatment of Booking Gestational Diabetes Mellitus (TOBOGM) study. A randomized controlled trial. Med J Aust. 2018;209(9):405.
6. American Diabetes Association. Gestational diabetes mellitus and diet: A systematic review and meta-analysis of randomized controlled trials examining the impact of modified dietary interventions on maternal glucose control and neonatal birth weight. Diabetes Care. 2018;41(8):1540-8.
7. Hannah W, Hunter D, Dinsdale S. Global burden of early pregnancy gestational diabetes mellitus (eGDM): a systematic review. Acta Diabetol. 2022;59(3):403-27.
8. Basu J, Datta C, Chowdhury S, Mandal D, Mondal NK, Ghosh A. Gestational Diabetes Mellitus in a Tertiary Care Hospital of Kolkata, India: Prevalence, Pathogenesis and Potential Disease Biomarkers. Exp Clin Endocrinol Diabetes. 2020;128(4):216-23.
9. Singh S, Yadav M. Gestational Diabetes Mellitus among Pregnant Women Delivering in a Tertiary Care Hospital: A Descriptive Cross-sectional Study. JNMA J Nepal Med Assoc. 2022;60:229-33.
10. Ozgu-Erdinc A, Sert UY, Buyuk GN, Engin-Ustun Y. Prevalence of gestational diabetes mellitus and results of the screening tests at a tertiary referral center: A cross-sectional study. Diabetes Metab Syndr. 2019;13(1):74-7.
11. Panigrahi A, Mallicka, Panda J. Gestational diabetes mellitus, its associated factors, and the pregnancy outcomes among pregnant women attending tertiary care hospitals of Bhubaneswar, India. Int J Diabetes Dev Ctries. 2020;40:371-8.
12. Kumar CN, Manova V, Maniyarasi R, Paveena V, Vanitha K. Prevalance and Risk Factors of Gestational Diabetes Mellitus: A Retrospective Study. Med Leg Updat. 2020;20:397-400.
13. Cade TJ, Polyakov A, Brennecke S. Implications of the introduction of new criteria for the diagnosis of gestational diabetes: a health outcome and cost of care analysis. BMJ Open. 2019;9:e023293.
14. Meena G, Venkatachalam J, Chinnakali P, Olickal JJ, Kumar KV, Subramanian S, et al. Glycemic control and its associated factors among women with gestational diabetes mellitus in a tertiary care Centre, Puducherry, South India. J Family Med Prim Care. 2021;10:491-5.
15. Lappharat S, Rothmanee P, Jandee K, Suksai M, Liabsuetrakul T. A model for predicting gestational diabetes mellitus in early pregnancy: a prospective study in Thailand. Obstet Gynecol Sci. 2022;65:156-65.

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