ORIGINAL ARTICLE

Impact of Standardized Gestational Diabetes Screening on Maternal and Neonatal Health

TAHIR ANGEZ KHAN¹, ZUL-E-HUMA², MUHAMMAD USMAN³, MUMTAZ ALI LAKHO⁴, ROBINA QADEER⁵, NAUREEN GHANI⁶ ¹District Medical Specialist, DHQ Hospital, Haripur

²Assistant Professor, Department of Gynae & Obs, Gajju Khan Medical College, Swabi

³Senior Registrar, Department of Medicine, Fauji Foundation Hospital, Rawalpindi

⁴Associate Professor, Department of Medicine, LUMHS Jamshoro

⁵Senior Registrar, Department of Gynae & Obs, Kwait Teaching Hospital, Peshawar.

⁶Gynaecologist, PNS Hafeez Hospital, Islamabad Correspondence to: Zul-e-Huma, Email: zulehuma865@gmail.com

ABSTRACT

Background: To evaluate the effect of standardized gestational diabetes mellitus (GDM) screening on maternal and neonatal health outcomes among pregnant women receiving antenatal care at public sector hospitals.

Methods: This cross-sectional study was conducted at DHQ Hospital Haripur and Bacha Khan Medical Complex, Swabi during the first half of 2023, from January to June. For the purpose of this study, 101 pregnant women in the 24 to 28 weeks of 'gestation period were screened for GDM using either one step or two step oral glucose tolerance tests (OGTT)'. Information regarding the demographics and clinical details of the mother, along with the outcome of the pregnancy and the child, were gathered and analyzed. The significance of the results was assessed by means of a chi-square or t-test, considering p-values under 0.05 as statistically significant.

Results: There is an increase in the prevalence of gestational hypertension, preeclampsia and cesarean deliveries in women with GDM. Infants with GDM mothers have increased risk of macrosomia, neonatal hypoglycemia and NICU admissions. Implementation of GDM-specific screening algorithms facilitated early diagnosis and treatment of GDM and enabled better maternal glucose levels thus decreasing the detrimental outcomes.

Conclusion: The implementation of organized antenatal care has been associated with a decrease in the frequency of negative maternal and neonatal pregnancy outcomes. In order to mitigate the risks associated with pregnancy, early detection, accurate diagnosis, and timely intervention is paramount for enhanced nursing outcomes.

Keywords: Gestational diabetes mellitus, standardized screening, maternal outcomes, neonatal complications, macrosomia, NICU admission, cesarean section

INTRODUCTION

'Gestational diabetes mellitus (GDM) is a relatively common medical complication during pregnancy owing to its impact on glucose metabolism, it poses certain risks to the mother and the fetus'^{1, 2}. It is defined as glucose intolerance that is diagnosed (or commences) during pregnancy, frequently in the second or third trimester. Due to increasing globalization, GDM is on the rise is a growing concern for healthcare systems because of the aging obese population³.

Timely detection and proper management of GDM can help prevent several short- and long-term complications. Alongside uncontrolled blood glucose levels during pregnancy leading to the development of hypertensive disorders, it has also been associated with increased chances of 'cesarean section and type 2 diabetes later in life for the mother'^{4, 5}. For the unborn child, GDM significantly increases the chances of macrosomia, birth injuries, neonatal hypoglycemia, respiratory distress, ICU admission, and more. These risks highlight the need for appropriate screening methodologies to help women early on in their pregnancy who are potentially suffering from such conditions⁶.

Multiple protocols advocate for the use of uniform methodologies such as the one-step or two-step OGTT for the diagnosis of GDM^{7, 8}. While adequate tools for screening are available, practices often differ from institution to institution and GDM is still either drastically underdiagnosed or handled far too late in some environments, which results in avoidable complications^{7, 8}.

This study was aim to determine the effects of standardized GDM screening on pregnancy outcomes. The study seeks to illustrate how an early diagnosis and management of GDM improves health outcomes by assessing both the maternal and neonatal implications and ultimately, informs the focus of future antenatal care plans.

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METHODOLOGY

This was an analytical cross-sectional study aimed at assessing the effects of systematic screening for gestational diabetes on the health outcomes of mothers and neonates. The study was carried out at two public sector healthcare institutions which included the Department of Obstetrics and Gynaecology, District Headquarters (DHQ) Hospital Haripur and Bacha Khan Medical Complex, Swabi. The research was conducted from January to June 2023 after receiving ethical clearance from various institutional review boards.

The participants were enrolled using a consecutive nonprobability sampling approach. Screening for inclusion was done amongst all eligible pregnant women attending antenatal care visits during the study period. Enrollment was preceded by each participant providing informed verbal and written consent.

The criteria for inclusion comprised of women aged between 18 to 45 years, along with singleton pregnancies within the gestational age of 24-28 weeks. Only individuals diagnosed with diabetes mellitus after the inclusion period were selected. Other exclusion criteria were multiple gestations, Type 1 or Type 2 Diabetes, chronic hypertension, renal disease, thyroid issues and those unwilling to participate in the study.

The study included 101 pregnant women. The sample size was guided by prior research in conjunction with practicality in order to evaluate relationships between gestational diabetes and significant maternal-neonatal outcomes within the limits of resources and time.

Each participant was screened for gestational diabetes using hospital protocols which included either a one-step or two-step approach. 'The one-step method consisted of a 75-gram OGTT with blood glucose measurements taken at fasting, one hour, and two hours'. 'The two-step approach started with a 50-gram Glucose Challenge Test (GCT), and if positive, a subsequent 100gram OGTT was performed'. Diagnostic criteria were adhered to globally accepted standards.

Maternal demographic details such as age, body mass index (BMI), gravidity, parity, educational status, occupation, socioeconomic background, and family history of diabetes were recorded. Clinical data included gestational age at screening, type

of screening method used, blood glucose and HbA1c levels, requirement for insulin or dietary management, and compliance with treatment. Maternal outcomes included gestational hypertension, preeclampsia, preterm labor, mode of delivery, postpartum hemorrhage, and infections. Postpartum glycemic status was assessed six weeks after delivery.

Neonatal outcomes included birth weight, APGAR scores, neonatal hypoglycemia, macrosomia, preterm birth, NICU admission, respiratory distress, jaundice requiring phototherapy, congenital anomalies, and perinatal mortality.

Standardized equipment and calibrated laboratory methods were used to ensure accurate blood glucose measurement. Data collection tools were pre-tested in a pilot group before implementation. All clinical assessments were performed by qualified obstetricians and pediatricians to maintain consistency in evaluation and diagnosis.

Collected data were entered and analyzed using SPSS version 25. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means with standard deviations. The chi-square test and independent t-test were applied to evaluate associations between gestational diabetes and outcome variables. A p-value of less than 0.05 was considered statistically significant.

RESULT

The study included 101 pregnant women, with a mean maternal age of approximately 29.6 years. Most participants had a normal to slightly elevated pre-pregnancy BMI, with a statistically significant difference observed in \overrightarrow{BMI} (p = 0.045), indicating a possible link between maternal weight and the development of gestational diabetes. A considerable proportion of women were multigravida and multiparous, though these were not significantly associated with screening outcomes. Educational attainment was moderate, with nearly 40% having tertiary education, but it showed no significant relationship. The majority of participants were housewives residing in urban areas, and although not statistically significant, these trends may reflect population characteristics. Notably, family history of diabetes and previous history of gestational diabetes were significantly associated with positive screening results (p = 0.022 and p = 0.008, respectively), suggesting their potential role as predictive factors.

Table 1: Demographic Characteristics of Study Participants (n = 101)
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Variable	Frequency (%) or	p-value
	Mean ± SD	
Maternal age (years)	29.6 ± 4.8	0.212
Pre-pregnancy BMI (kg/m ²)	27.1 ± 3.9	0.045*
Gravida (≥2)	63 (62.4%)	0.331
Parity (≥1)	58 (57.4%)	0.490
Education (Tertiary)	40 (39.6%)	0.081
Employment status (Housewives)	71 (70.3%)	0.104
Residence (Urban)	68 (67.3%)	0.053
Socioeconomic status (Middle)	55 (54.5%)	0.372
Family history of diabetes	38 (37.6%)	0.022*
History of GDM (Yes)	17 (16.8%)	0.008*
*Significant at $n < 0.05$		

Significant at p < 0.05

The average gestational age at the time of screening was 24.3 weeks, aligning with standard clinical guidelines. The onestep OGTT method was more commonly used and significantly associated with identifying gestational diabetes (p = 0.023). Fasting glucose levels, 2-hour OGTT values, and HbA1c levels at diagnosis all demonstrated significant associations (p-values < 0.01), underlining their diagnostic importance. Around a quarter of the women required insulin therapy, and this group showed statistically significant outcomes (p = 0.037). The majority, however, were managed with dietary adjustments alone, which also correlated significantly with screening results (p = 0.041). Treatment compliance was generally good, though this did not reach statistical significance. These findings suggest that timely

screening and individualized management play a key role in controlling maternal glycemic status.

Fable 2: Clinical and Screening Characteristic
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Variable	Frequency (%) or	p-value	
	Mean ± SD		
Gestational age at screening (weeks)	24.3 ± 2.1	0.186	
Screening method (OGTT one-step)	64 (63.4%)	0.023*	
Fasting blood glucose (mg/dL)	98.5 ± 12.3	0.001*	
2-hour OGTT result (mg/dL)	145.6 ± 18.4	0.002*	
HbA1c at diagnosis (%)	5.9 ± 0.6	0.009*	
Insulin therapy required	26 (25.7%)	0.037*	
Dietary management only	75 (74.3%)	0.041*	
Treatment compliance (Good)	66 (65.3%)	0.051	

Women diagnosed with gestational diabetes were more likely to develop hypertensive disorders, including gestational hypertension and preeclampsia, both of which showed statistically significant associations (p = 0.019 and p = 0.028, respectively). Preterm labor was also more frequent in this group (p = 0.044), indicating an increased risk for obstetric complications. Cesarean delivery was notably higher among women with gestational diabetes, with a significant association (p = 0.031), which may reflect clinical decisions to prevent labor-related complications. Although postpartum hemorrhage and infections did occur, their associations were not significant. Interestingly, glycemic status post-delivery revealed that a small percentage of women progressed to type 2 diabetes (7.9%), with significant associations found for impaired fasting glucose and diabetes development (pvalues = 0.038 and 0.046), reinforcing the need for postpartum follow-up and long-term monitoring.

Table 3⁻ Maternal Outcomes

Variable	Frequency (%) or	p-value
	Mean ± SD	
Gestational hypertension	19 (18.8%)	0.019*
Preeclampsia	12 (11.9%)	0.028*
Preterm labor (<37 weeks)	15 (14.9%)	0.044*
Mode of delivery (Cesarean)	53 (52.5%)	0.031*
Postpartum hemorrhage	9 (8.9%)	0.290
Maternal weight gain (kg)	11.3 ± 3.2	0.212
Maternal infection	7 (6.9%)	0.489
Postpartum glycemic status		
- Normal	72 (71.3%)	—
- Impaired fasting glucose	21 (20.8%)	0.038*
- Type 2 diabetes	8 (7.9%)	0.046*

Table 4: Neonatal Outcomes

Variable	Frequency (%) or	p-value
	Mean ± SD	
Birth weight (grams)	3165 ± 402.7	0.029*
APGAR score at 1 minute < 7	9 (8.9%)	0.071
APGAR score at 5 minutes < 7	4 (4.0%)	0.082
Neonatal hypoglycemia	14 (13.9%)	0.017*
Macrosomia (>4000g)	11 (10.9%)	0.011*
Preterm birth (<37 weeks)	16 (15.8%)	0.040*
NICU admission	19 (18.8%)	0.025*
Respiratory distress syndrome (RDS)	10 (9.9%)	0.035*
Jaundice needing phototherapy	22 (21.8%)	0.148
Congenital anomalies	3 (3.0%)	0.291
Stillbirth/neonatal death	2 (2.0%)	0.330

Neonatal outcomes varied notably between groups. The mean birth weight was significantly higher in babies born to mothers with gestational diabetes (p = 0.029), and the occurrence of macrosomia was also statistically significant (p = 0.011), supporting existing evidence that hyperglycemia in pregnancy influences fetal growth. Neonatal hypoglycemia was reported in nearly 14% of the newborns, which was significantly associated with maternal glycemic status (p = 0.017). NICU admissions were relatively common (18.8%) and also significantly associated with maternal diabetes (p = 0.025), often due to complications like respiratory distress or hypoglycemia. Preterm birth was reported in

about 16% of cases, showing a significant association (p = 0.040). While some newborns experienced jaundice and low APGAR scores, these did not show statistically significant differences. Congenital anomalies and perinatal deaths were rare and not significantly linked to gestational diabetes in this sample.



Figure 1: The graph highlights key maternal and neonatal outcomes associated with gestational diabetes. Cesarean delivery was most common, followed by gestational hypertension and NICU admissions. Macrosomia was observed to occur in lower proportions, whereas preterm birth and neonatal hypoglycemia were moderately prevalent. These findings highlight the clinical consequences of gestational diabetes and underline the importance of prompt screening and intervention.

DISCUSSION

This investigation evaluated the effects of systematized GDM screening on 101 maternal and neonatal patients at DHQ Hospital Haripur and Bacha Khan Medical Complex, Swabi, from January to June 2023. The results highlight the importance of early detection and intervention of GDM in preventing negative health implications for both mothers and children.

The increased prevalence of gestational hypertension and preeclampsia in women with GDM was particularly noteworthy. This is in accordance with the literature which suggests that hyperglycemia in pregnancy increases the chance of hypertensive complications. Studies documented a greater prevalence of gestational hypertension among women with GDM compared to those without GDM [9-11]. Moreover, the high rate of cesarean sections performed in our cohort is consistent with findings from other studies showing that GDM is associated with operative deliveries because of the concern regarding macrosomia and complications in labor [12-14].

The infants delivered to mothers with GDM were noted to have greater birth weights along with an increased frequency of macrosomia [15, 16]. These results are in parallel with the outcomes of the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study which showed increased birth weight in relation to increased maternal glucose level [17-19]. Additionally, the increased frequency of hypoglycemia and the greater number of NICU admissions among infants of diabetic mothers indeed support the notion that children exposed to maternal hyperglycemia suffer the consequences of metabolic derangements after delivery.

The need for standardized GDM screening protocols has been emphasized in the study. As suggested by several authors, early diagnosis through one-step OGTT allows timely and effective interventions that mitigate negative consequences [20, 21]. Evidence stresses the importance of managing GDM even when diagnosed during the first trimester, underlining the significance of timely and efficient action on management frameworks aiming for improved perinatal outcomes.

Limitations: This study is limited by its smaller sample size and focus on two healthcare facilities, which may limit the broader applicability of the findings. Furthermore, the lack of in-depth

analysis of some important underpinning factors, such as maternal BMI and lifestyle choices, may affect the outcomes of the study.

CONCLUSION

The results support the importance of implementing the standardized screening for GDM to enhance maternal and neonatal health outcomes. GDM diagnosis and appropriate interventions help mitigate risks of hypertensive disorders, cesarean deliveries, macrosomia, and neonatal metabolic complications. Continued research is needed with larger, more heterogeneous populations to further clarify these relationships and adapt clinical recommendations.

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