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Original Research Article

EVALUATING NEONATAL OUTCOMES IN PREGNANCIES COMPLICATED BY MATERNAL TYPE 2 DIABETES

ARA F[*1], QURESHI QUA[2], MANSOOR M[3], SHOAIB M[4], BIBI S[5], JAVED SQ[6]

[1]*Department of OBG Unit 1 Bolan Medical College Quetta Sandeman Provincial Hospital Quetta, Pakistan*
[2]*Department of Obstetrics and Gynecology Unit II, Liaquat University of Medical Health Sciences, Jamshoro, Sindh, Pakistan*
[3]*Department of Diagnostic Radiology Bolan Medical College Quetta, Pakistan*
[4]*Department of Gynae Unit 1 Sandeman Provincial Hospital Quetta, Pakistan*
[5]*Department of Gynae Bolan Medical College Quetta, Pakistan*
[6]*Department of Obstetrics & Gynecology Ruwaidah General Hospital Moh, KSA*
**Corresponding author`s email address:* firdousaraobg@gmail.com

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Abstract: *Maternal type 2 diabetes during pregnancy presents complex challenges that necessitate careful management due to its multifaceted impacts on both the mother and the neonate.* ***Objective:*** *The basic aim of the study is to find the neonatal outcomes in pregnancies complicated by maternal type II diabetes.* ***Methods:*** *This retrospective observational study was conducted at Sandeman Provincial Hospital from April 2022 to March 2023. Data were collected from 80 participants. Data were collected retrospectively from medical records, focusing on maternal, fetal, and neonatal parameters. Maternal records included demographic details such as age, body mass index (BMI), and parity, as well as clinical information on glycemic control measured by HbA1c levels recorded at various points throughout the pregnancy.* ***Results:*** *Data were collected from 80 patients with type 2 diabetes, with an average maternal age of 32.35 years and an average BMI of 28.5 kg/m². Primiparous women constituted 40% of the sample. The average HbA1c level was 7.5%, with 56.25% of participants achieving good glycemic control (HbA1c ≤ 7%) and 43.75% classified as having poor glycemic control (HbA1c > 7%). The results indicate that the average neonatal birth weight was 3,400 ± 500 grams. Macrosomia was observed in 31.25% of cases, with a significantly higher occurrence in the poor glycemic control group (51.4%) compared to the good glycemic control group (15.6%).* ***Conclusion:*** *It is concluded that poor glycemic control in pregnancies complicated by maternal type 2 diabetes is significantly associated with adverse neonatal outcomes, including macrosomia, neonatal hypoglycemia, congenital anomalies, and higher NICU admission rates.*

Keywords: Maternal Type 2 Diabetes, Neonatal Outcomes, Glycemic Control, Macrosomia, Neonatal Hypoglycemia, Congenital Anomalies, NICU Admissions

Introduction

Maternal type 2 diabetes during pregnancy presents complex challenges that necessitate careful management due to its multifaceted impacts on both the mother and the neonate. While pregnant women diagnosed with gestational diabetes go through the disease throughout pregnancy but typically experience improvement after delivery, it is otherwise not the same with type 2 diabetes, which often persists throughout pregnancy and beyond, calling for long-term management and planning before conception, during pregnancy, and after birth (1). This is expected because; the number of people with obesity is rising globally and young people are developing lifestyle diseases such as Type 2 diabetes and the above factors posit that the incidence of pregnancy affected by this disease will increase (2). This trend calls for the identification of the ways through which maternal type 2 diabetes affects neonatal health to guide practice changes and policy formulation (3). Maternal type 2 diabetes pregnant women put the fetuses at risk through the following ways that hinder fetal development. Some of the complications associated with elevated maternal blood glucose levels, especially in diabetic pregnancies are; fetal growth impairment and disturbances. Maternal hyperglycemia has been shown to transmit across the placenta and increase fetal insulin secretion thus increasing fetal growth rate (4). It frequently leads to macrosomia, the condition where the newborn has excessive birth weight and poses several risks to the infant such as shoulder dystocia and birth injury. Moreover, high birth weight has direct health consequences for later life, that entail a life course perspective in the form of childhood obesity, and early adulthood T2DM, thus perpetuating a cycle of impaired metabolic functioning across generations (5).

In addition to macrosomia, neonatal hypoglycemia is the other consequence of maternal type 2 diabetes. The infant may continue to secrete insulin following birth because of the high glucose levels to which it was exposed in utero the blood sugar will plunge immediately after birth once the source of glucose from the mother is severed(6). If left untreated and if the newborn is allowed to continue with hypoglycemia, then he stands the risk of having grand mal seizures, neurological dysfunction, and may also have some form of developmental retardation. Such risks explain the importance of continuous glucose tracking of neonates born to mothers with type 2 diabetes in conjunction with proper management of hypoglycemia (7). Diabetic pregnancy also results in increased congenital anomalies; these are more frequent in infants of type 2 diabetic mothers (8). Glycemic control during the first pregnancy trimester known as the period of organogenesis, maternal poor glycemic control

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contributes to an increased risk of congenital malformations in the offspring, cardiovascular, neural tube, and renal systems (9). It is reported that congenital anomalies may be 3 – 4-fold increased in pregnancies with diabetes type 2 compared to pregnancies without diabetes. These birth defects not only present initial health issues in infancy but also create lifelong health problems, requiring proper attention and demanding a special quality of life which puts considerable mental and financial pressure on families (10). Of equal importance is the management of Type 2 diabetes during Pregnancy implying that a Focused, Multidisciplinary approach to these Neonatal risks is achievable. Optimal glycemic control using pharmacologic therapies, nutrition assistance, and appropriate newborn check-ups can dramatically decrease the number of adverse neonatal effects. However, the dysfunctional hormonal changes during pregnancy complicate the goal of attaining ideal blood sugar levels for mom and baby since insulin resistance increases during pregnancy (11). Careful planning is therefore important especially through preconception control services so that maternal health may be well enhanced before conception and a good blood glycemic control set throughout gestation can be promptly achieved. In addition, systematic nursing care is preventive for neonates born to diabetic mothers, specifically maternal type 2 diabetes (12). Such attention may involve paying frequent, special concern to the possibility of hypoglycemia and also for signs of respiratory distress and or jaundice as are often seen in such newborns. NICU is well suited for handling such situations; though such an opportunity to avail NICU and care staking may differ based on the availability of healthcare in LMIC. The variation in the health care access calls for policy and healthcare reforms so that neonates who are at risk are provided the needed care regardless the social class status (13).

Methodology

This retrospective observational study was conducted at Sandeman Provincial Hospital from April 2022 to March 2023. Data were collected from 80 participants.

Pregnant women diagnosed with type 2 diabetes before pregnancy—women who received antenatal care and delivered at Sandeman Provincial Hospital between April 2022 and March 2023. Singleton pregnancies to reduce variability associated with multiple gestations.

Women with gestational diabetes mellitus (GDM), as this condition differs in onset and management. Pregnancies complicated by other maternal comorbidities, such as chronic hypertension, renal disease, or thyroid disorders, to isolate the impact of type 2 diabetes. Cases with incomplete medical records, where critical data on maternal glycemic control or neonatal outcomes was missing.

Data were collected retrospectively from medical records, focusing on maternal, fetal, and neonatal parameters. Maternal records included demographic details such as age, body mass index (BMI), and parity, as well as clinical information on glycemic control measured by HbA1c levels recorded at various points throughout the pregnancy. This glycemic data was considered highly valuable because it offered a glimpse of how much blood sugar levels were being controlled, and acted as a sign of possible neonatal complications. Neonatal data comprised of outcomes of interest such as weight at birth used to identify infants who developed macrosomia (birth weight greater than the 90th percentile for age of gestation). Thus, Apgar scores at one and five minutes were obtained to determine the neonatal condition soon after delivery. Moreover, details on congenital anomalies were recorded according to clinical assessment and any imaging done after birth particularly on heart and spinal defects commonly found in pregnancy complicated by diabetes. Birth characteristics and reasons for NICU admission such as respiratory distress or hypoglycemia were also documented. Hypoglycemia in newborns was operationally defined and noted according to standard hospital guidelines where any blood sugar level below 40 mg/dL in the first 24 hours of life was considered hypoglycemic as this is a frequent problem encountered among newborns of diabetic mothers.

Data were analyzed using SPSS v29. Descriptive statistics, including means, medians, and standard deviations, were used to summarize continuous variables such as birth weight and maternal age. Categorical variables, such as the presence of hypoglycemia and NICU admissions, were expressed as frequencies and percentages. Inferential statistics were applied to assess associations between maternal glycemic control (HbA1c levels) and neonatal outcomes.

Results

Data were collected from 80 patients with type 2 diabetes, with an average maternal age of 32.35 years and an average BMI of 28.5 kg/m². Primiparous women constituted 40% of the sample. The average HbA1c level was 7.5%, with 56.25% of participants achieving good glycemic control (HbA1c ≤ 7%) and 43.75% classified as having poor glycemic control (HbA1c > 7%).

Table 1: Demographic and Baseline Values

Characteristic	Value
Total Sample Size	80
Average Maternal Age (years)	32.35±2.01
Average BMI (kg/m²)	28.5
Percentage of Primiparous Women	40% (32)
Average HbA1c (%)	7.5
Good Glycemic Control (HbA1c ≤ 7%)	45 (56.25%)
Poor Glycemic Control (HbA1c > 7%)	35 (43.75%)

Out of the total participants, 56.25% maintained good glycemic control (HbA1c ≤ 7%), while 43.75% had poor glycemic control (HbA1c > 7%). These baseline characteristics allowed for further exploration of how glycemic control levels impacted neonatal outcomes.

Table 2: Maternal Characteristics

Characteristic	Value
Average Age (years)	32.35±2.01
Mean BMI (kg/m²)	28.5
Good Glycemic Control (HbA1c ≤ 7%)	45 (56.25%)
Poor Glycemic Control (HbA1c > 7%)	35 (43.75%)

The results indicate that the average neonatal birth weight was 3,400 ± 500 grams. Macrosomia was observed in 31.25% of cases, with a significantly higher occurrence in

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the poor glycemic control group (51.4%) compared to the good glycemic control group (15.6%). Neonatal hypoglycemia affected 37.5% of neonates, predominantly in the poor control group (73.3%). All cases of congenital anomalies (12.5%) occurred in the poor glycemic control group, while NICU admissions were also more common among neonates born to mothers with poor glycemic control (57.1% vs. 17.8%).

The data show that 68.75% of neonates had a normal birth weight, with the majority (84.4%) born to mothers with good glycemic control. In contrast, macrosomia occurred in 31.25% of cases, with a significantly higher prevalence in the poor glycemic control group (51.4%) compared to the good glycemic control group (15.6%).

Hypoglycemia management accounted for 50% of NICU admissions, with most cases (60%) from the poor glycemic control group. Respiratory distress represented 28.6% of NICU cases, with a higher occurrence in the good glycemic control group (75%). Congenital anomalies made up 21.4% of admissions, with cases nearly evenly split between the two groups.

Table 3: Neonatal Outcomes

Outcome	Total Cases	Cases in Poor Glycemic Control Group	Cases in Good Glycemic Control Group
Average Birth Weight (grams)	3,400 ± 500	-	-
Macrosomia (Birth Weight > 90th percentile)	25 (31.25%)	18 (51.4%)	7 (15.6%)
Neonatal Hypoglycemia	30 (37.5%)	22 (73.3%)	8 (26.7%)
Congenital Anomalies	10 (12.5%)	10 (100%)	0 (0%)
NICU Admissions	28 (35%)	20 (57.1%)	8 (17.8%)

Table 4: Distribution of Neonatal Birth Weight by Maternal Glycemic Control

Birth Weight Category	Total Cases	Cases in Poor Glycemic Control Group	Cases in Good Glycemic Control Group
Normal Weight	55 (68.75%)	17 (48.6%)	38 (84.4%)
Macrosomia	25 (31.25%)	18 (51.4%)	7 (15.6%)

Table 5: Reasons for NICU Admissions in Neonates by Maternal Glycemic Control

Reason for NICU Admission	Total NICU Cases	Cases in Poor Glycemic Control Group	Cases in Good Glycemic Control Group
Hypoglycemia Management	14 (50%)	12 (60%)	2 (40%)
Respiratory Distress	8 (28.6%)	5 (25%)	3 (75%)
Congenital Anomalies	6 (21.4%)	3 (15%)	3 (85%)

Discussion

This study aimed to assess the neonatal outcomes associated with pregnancies complicated by maternal type 2 diabetes at Sandeman Provincial Hospital. It has been established from the study that glycemic control of the mother is very essential with poor glycemic control of the mother constantly reflected in adverse neonatal outcomes including macrosomia, neonatal hypoglycemia, congenital anomalies, and NICU admission. These findings are consistent with earlier papers evidencing that maternal glycemia in women with type 2 diabetes before pregnancy increases neonates' adverse health outcomes; therefore, specific preventive interventions are required. The observed correlation between neonates with macrosomia and poor glycemic levels is a known complication in diabetic pregnancies. Their blood sugar level is high they get glucose in large quantities from the placenta and this makes the baby produce so much insulin and thus grow quickly (14). This condition predisposes to high birth weight and associated neonatal risks, which include the incidence of complications such as shoulder dystocia, birth trauma, and the requirement for operative delivery, particularly by cesarean section. In our study, macrosomia prevalence was also higher among the study subjects whose glycemic control was poor; therefore, there is some indication that intensive glycemic control could help reduce excessive fetal growth (15).

Poor maternal glycemic control was also reported to have been linked with neonatal hypoglycemia. Hypoglycemia in these neonates is attributed to the presence of high insulin levels in these neonates following birth, even when glucose from the mother is no longer available. Even worse, it can cause neurological complications and developmental delay if left untreated (16). Neonates of a poorly controlled diabetic mother frequently experience hypoglycemia which underpins the need to assess and manage baby glucose levels soon after birth. In addition, this observation indicates that enhanced control of maternal blood glucose during pregnancy could lessen neonatal hypoglycemia (17). Another finding regarding maternal type 2 diabetes in this study was congenital anomalies. The results portrayed that all neonates with congenital anomalies in our sample had mothers with poor glycemic control. Literature shows that uncontrolled maternal diabetes especially in the initial period of pregnancy can lead to a higher incidence of congenital anomalies especially cardiac and neurological abnormalities. This association highlights the need for preconception counseling and early pregnancy glycemic control to reduce the likelihood of such defects considering that many of the abnormalities develop during the first trimester, when some women are still ignorant of their pregnancies (18). These NICU rates are representative of the increasing number of complications that needed specific interventions, these include hypoglycemia and respiratory

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distress, among others, which are observed among neonates born to mothers with poor glycemic control. This association would suggest the considerable costs of maternal type 2 diabetes for neonatal care providers (19). Optimizing glycemic outcomes in pregnant women with diabetes may decrease NICU hospitalizations, and in turn, also overall costs and stress families. Clinically, this research re-emphasizes the need to maintain tight glycaemic control in pregnancies involving the mother with type 2 diabetes. Some of the interventions for glycemic control may comprise preconception counseling, glucose tracking, and personalized management of HbA1c goals (20). Most notably, these results further imply that women with diabetes need to have written prenatal and postnatal care plans to address complications that might affect both the woman and the unborn child. Thus, the following are the limitations of this study. First, it provides single center experience from a large volume tertiary care university hospital and it is a retrospective study and may not be representative of haulers in other facilities. Secondly, like any other retrospective research, the findings of this study are prone to bias information bias by missing and incomplete data.

Conclusion

It is concluded that poor glycemic control in pregnancies complicated by maternal type 2 diabetes is significantly associated with adverse neonatal outcomes, including macrosomia, neonatal hypoglycemia, congenital anomalies, and higher NICU admission rates. Strict glucose management and early interventions are essential to reduce these risks and improve neonatal health in this population.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval
Approved by the department concerned. (IRBEC-SPHP-32/22)
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared the absence of conflict of interest.

Author Contribution

FIRDOUS ARA (Associate Professor)
Study Design, Review of Literature.
Conception of Study, Development of Research Methodology Design.
QURAT UL AIN QURESHI (Senior Registrar)
Coordination of collaborative efforts.
MAHWASH MANSOOR (Associate Professor)
Conception of Study, Final approval of manuscript.
MARYAM SHOAIB (Associate Professor)
Manuscript revisions, critical input.
SAFIA BIBI (Associate Professor)
Data entry and Data analysis, drafting article.
SABIHA QAMAR JAVED (Consultant)
Manuscript drafting.
Coordination of collaborative efforts.

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