

Frequency of maternal and neonatal complications in pregnancies among women with type 1 diabetes

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ABSTRACT

Objective: The purpose of this study was to determine the frequency and spectrum of maternal and neonatal complications in pregnancies among women with type 1 diabetes mellitus.

Material and Methods: The study was designed as a retrospective study, and Continuous variables are expressed as mean (SD) and categorical variables as frequencies and percentages.

Results: Out of 125 identified pregnancies, 80 had complete records and were analysed. The mean age at first pregnancy was 22.96 (3.80%) years; the mean duration of diabetes before pregnancy was 6.84 (7.20%) years; the mean HbA1c at conception was 7.92 (2.11) %. Three-quarters {60 (75.0%)} of pregnancies were unplanned, and 42 (52.5%) of women had received preconception counselling on glycaemic targets. Folic acid supplementation in the first trimester was reported by 72 (90.0%). Maternal complications included hypertension {20 (25.0%)}, shock {12 (15.0%)}, acute renal failure {10 (12.5%)}, thrombotic embolism {7 (8.8%)}, and pre-eclampsia {4 (5.0%)}; 48 (60.0%) delivered by caesarean section and maternal mortality was 2 (2.5%). Neonatal complications comprised hypoglycaemia {16 (20.0%)}, preterm birth <37 weeks {59 (73.8%)}, stillbirth {10 (12.5%)}, respiratory disorders {7 (8.8%)}, low birth weight {6 (7.5%)}, hypertrophic cardiomyopathy {4 (5.0%)}, macrosomia {3 (3.8%)}, and jaundice {3 (3.8%)}.

Conclusion: This study demonstrates that pregnancies in women with type 1 diabetes are attended by high frequencies of both maternal and neonatal adverse outcomes, notably hypertensive disorders, caesarean delivery, and neonatal hypoglycaemia.

Keywords: Hypoglycaemia; Preconception Care; Pregnancy Complications; Pregnancy Outcome; Type 1 Diabetes Mellitus

This article can be cited as: Gul H, Hakim N, Jadoon S. Frequency of maternal and neonatal complications in pregnancies among women with type 1 diabetes. Pak J Pathol. 2026; 37(2): 102-107.
DOI: <https://doi.org/10.55629/pakjpathol.v37i2.1009>

INTRODUCTION

Type 1 diabetes mellitus (T1DM) is a chronic autoimmune condition that frequently manifests in childhood, adolescence, or early adulthood, thereby affecting a substantial number of women of reproductive age [1]. Globally, the incidence of T1DM is rising, and with it, the number of pregnancies complicated by pregestational diabetes has increased from approximately 1.5 to over 4 per 1,000 pregnancies in recent decades [2]. In Pakistan, the prevalence of T1DM is similarly growing, yet data on pregnancy outcomes in this population remain scarce [3].

Pregnancy in women with T1DM is inherently high-risk. Risks to the mother associated with pregnancy

may be high blood pressure, diabetic ketoacidosis, deterioration of microvascular problems, and the requirement for a surgical delivery [4,5]. Fetal or neonatal risks may involve congenital abnormalities, premature labor, macrosomia, stillbirth, respiratory difficulties, and hypoglycemia [6,7]. The seriousness of these problems correlates highly with how tightly the blood glucose level is managed at conception [8].

Although global studies have proven that a team approach to pre-conception care as well as tight glucose management prior to and during pregnancy yields positive results [9], many pregnancies occur without proper glycemic preparation. Unplanned pregnancies, as well as low rates of pre-pregnancy counselling, are prevalent worldwide and in resource-poor settings [10]. Pakistani data on maternal and neonatal complications in T1DM are extremely limited; there is a critical evidence gap regarding the burden and pattern of these complications in the local context. With this background, the present study was undertaken to determine the frequency and spectrum of maternal and neonatal complications in pregnancies among women with type 1 diabetes

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Receiving Date: 30 Apr 2026

Acceptance Date: 27 Jun 2026

Revision Date: 25 May 2026

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mellitus presenting to a tertiary care hospital in Pakistan.

MATERIAL AND METHODS

This retrospective observational study was conducted at the Department of Obstetrics and Gynaecology, Mardan Medical Complex Hospital. The study included women with type 1 diabetes mellitus (T1DM) who delivered a singleton pregnancy between January 10, 2025 and June 30, 2025. The study protocol was initiated following formal approval from the Institutional Review Committee/Ethical Review Board (IRB/ERC No. 7734-25/BKMC, dated 05-01-2025). Informed consent was confirmed to have been obtained from all patients or their legal guardians at the time of primary data entry into the clinical records.

We included all women with a confirmed diagnosis of type 1 diabetes mellitus (T1DM) prior to pregnancy who had at least one documented pregnancy and whose complete medical records were accessible via the Hospital Management System (HMS).

Patients with type 2 diabetes, gestational diabetes, or those with a new diagnosis of T1DM during the current pregnancy were excluded. Furthermore, records with missing data regarding primary maternal or neonatal outcome measures were excluded to ensure the robustness of the final analysis. Of 125 identified pregnancies, 45 were excluded due to incomplete records (n=38) or missing primary outcome data (n=7). A consecutive (non-probability) sampling technique was employed to include all eligible T1DM pregnancies identified during the study period. Of the 125 identified pregnancies, 80 (64.0%) possessed complete records and constituted the final analytic sample.

The sample size was justified post-hoc to verify statistical precision for prevalence estimation using the standard formula for 95% confidence intervals for a single proportion: margin of error = $1.96 \times \sqrt{p(1-p)/n}$. For the observed maternal hypertension rate of 25.0% (20/80), a sample of n=80 provides a margin of error of $\pm 9.5\%$, yielding a 95% CI of 15.5% to 34.5%. For neonatal hypoglycemia (20.0%, 16/80), the margin of error is $\pm 8.7\%$ (95% CI: 11.3% to 28.7%). This level of precision is appropriate for a descriptive study characterizing a specific clinical cohort in a resource-constrained tertiary care setting. Data extraction was performed using a pre-designed questionnaire tailored for the HMS. The variables extracted included maternal demographics (age at diagnosis, age at first pregnancy, gravidity), medical history (duration of diabetes), glycemic control markers (HbA1c at conception, fasting and random

blood glucose during pregnancy), pregnancy characteristics (planning status, preconception counselling, folic acid intake), mode of delivery, and a comprehensive spectrum of maternal complications (hypertension, shock, acute renal failure, thrombotic embolism, pre-eclampsia, hypoglycemia, maternal death, etc.) and neonatal complications (hypoglycaemia, preterm birth, stillbirth, respiratory disorders, low birth weight, hypertrophic cardiomyopathy, congenital abnormalities, macrosomia, jaundice). All maternal and neonatal endpoints were classified according to standardized diagnostic criteria: maternal hypertension was diagnosed based on systolic blood pressure ≥ 140 mmHg or diastolic ≥ 90 mmHg recorded twice after 20 weeks; preterm delivery was diagnosed based on delivery before 37 completed weeks; stillbirth was diagnosed based on fetal demise at ≥ 20 weeks gestation or ≥ 500 grams; neonatal hypoglycemia was diagnosed based on blood glucose concentration < 47 mg/dL (2.6 mmol/L) in the first 48 hours. Low birth weight was defined as birth weight < 2500 grams among live births; stillbirths were excluded from the low birth weight denominator. Per routine clinical practice at this facility, all participants were confirmed to have documented prescription of 5mg of oral folic acid daily throughout the first trimester in their clinical records.

The patients with pre-existing type 1 diabetes were provided comprehensive care which included input from endocrinologists and obstetricians. The diabetes care in pregnancy was managed according to guidelines with either multiple daily doses of insulin or insulin pump therapy. The glycaemic control for the pregnant women was maintained with fasting blood glucose of 3.5-5.3 mmol/L (63-95 mg/dL) and 1-hour postprandial less than 7.8 mmol/L.

All statistical analyses were performed using IBM SPSS Statistics for Windows, version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables (age at diagnosis of T1DM, age at first pregnancy, duration of diabetes before pregnancy, gestational age at delivery, HbA1c at conception, random blood glucose, and fasting blood glucose) were assessed for normality using the Shapiro-Wilk test. As the data were approximately normally distributed, these variables are presented as mean (SD). For duration of diabetes, which showed slight skewness, median (IQR) is also reported in the results. Categorical variables (pregnancy planning [planned/unplanned], preconception counselling on glycaemic targets [yes/no], folic acid intake [yes/no], gravidity [1 through 8], mode of delivery [normal vaginal/caesarean

section], and all maternal and neonatal complications [present/absent for each condition]) are presented as frequencies and percentages *n* (%). No inferential comparative tests (e.g., *t*-tests, chi-square) were performed as the primary objective was to determine the frequency and spectrum of complications in this cohort, not to compare subgroups or test associations.

RESULTS

During the study period (January 1 to June 30, 2025), 125 women with type 1 diabetes mellitus delivered at our hospital. Complete data were available for 80 women, who constituted the final study population. The mean age at diagnosis of type 1 diabetes was 16.12 (6.75%) years. The mean age at first pregnancy was 22.96 (3.80%) years, and the mean duration of diabetes before pregnancy was 6.84 (7.20) years [median: 5.40 years, IQR: 1.42-11.63]. The mean gestational age at delivery was 30.45 (10.52) weeks. The mean HbA1c at conception was 7.92 (2.11%). The mean random blood glucose and fasting blood glucose during pregnancy were 211.69 (89.64) mg/dL and 129.47 (61.63) mg/dL, respectively.

Of the 80 pregnancies, 60 (75.0%) were unplanned, while 20 (25.0%) were planned. Preconception counselling on glycaemic targets was received by 42 (52.5%) women, whereas 38 (47.5%) did not receive such counselling. Documented folic acid supplementation during the first trimester was present

in the clinical records of 72 (90.0%) participants. The distribution of gravidity is summarised in Table-I.

Maternal complications are presented in Table-II. The most frequent adverse maternal outcome was hypertension, occurring in 20 (25.0%, 95% CI: 16.0–36.0) women, followed by shock and maternal hypoglycemia, each observed in 12 (15.0%) women. Acute renal failure was documented in 10 (12.5%) women, thrombotic embolism in 7 (8.8%), thyroid dysfunction in 5 (6.3%), and pre-eclampsia in 4 (5.0%). Other less common complications included cardiac arrest in 3 (3.8%), puerperal cerebrovascular disorder in 3 (3.8%), intracranial injuries in 1 (1.3%), and urinary tract infection in 12 (15.0%). Regarding mode of delivery, 48 (60.0%) women delivered by caesarean section, while 32 (40.0%) had normal vaginal delivery. Maternal death occurred in 2 (2.5%) cases.

Neonatal complications are detailed in Table-III. The most common neonatal adverse outcome was hypoglycaemia, affecting 16 (20.0%, 95% CI: 12.0–30.0) neonates. Preterm birth (<37 weeks) occurred in 59 (73.8%, 95% CI: 62.5–82.6) cases, stillbirth in 10 (12.5%, 95% CI: 6.2–21.8), respiratory disorders in 7 (8.8%), low birth weight in 6 (7.5%), hypertrophic cardiomyopathy in 4 (5.0%), macrosomia in 3 (3.8%), and jaundice in 3 (3.8%). Congenital abnormalities were recorded in 1 (1.3%) neonate.

Table-I: Demographic and baseline characteristics of the study population (N = 80).

Characteristic	Value
Age at diagnosis of T1DM (years)	16.12 (6.75%)
Age at first pregnancy (years)	22.96 (3.80)
Duration of diabetes before pregnancy (years)	6.84 (7.20) [median: 5.40, IQR: 1.42-11.63]
Gestational age at delivery (weeks)	30.45 (10.52)
HbA1c at conception (%)	7.92 (2.11)
Random blood glucose during pregnancy (mg/dL)	211.69 (89.64)
Fasting blood glucose during pregnancy (mg/dL)	129.47 (61.63)
Pregnancy planning	
Unplanned	60 (75.0)
Planned	20 (25.0)
Preconception counselling on glycaemic targets	
No	38 (47.5)
Yes	42 (52.5)
Number of pregnancies (gravidity)	
1	10 (12.5%)
2	18 (22.5%)
3	20 (25.0%)
4	15 (18.8%)
5	9 (11.3%)
6	5 (6.3%)
7	2 (2.5)
8	1 (1.3)
Folic acid taken regularly in first trimester	
Yes	72 (90.0)
No	8 (10.0)

Footnote: Continuous variables are presented as mean (SD); categorical variables as frequency (*n*, %). T1DM = type 1 diabetes mellitus; HbA1c = glycated haemoglobin.

Table-II: Pregnancy-related maternal complications in women with type 1 diabetes (N = 80).

Maternal Complication	n (%)
Urinary tract infection	12 (15.0)
Hypertension	20 (25.0)
Thyroid dysfunction	5 (6.3)
Puerperal cerebrovascular disorder	3 (3.8)
Acute renal failure	10 (12.5)
Shock	12 (15.0)
Intracranial injuries	1 (1.3)
Cardiac arrest	3 (3.8)
Thrombotic embolism	7 (8.8)
Pre-eclampsia	4 (5.0)
Hypoglycemia (maternal)	12 (15.0)
Maternal death	2 (2.5)
Mode of delivery	
Normal vaginal delivery	32 (40.0)
Caesarean section	48 (60.0)

Footnote: Data are shown as frequency (n, %). Percentages are calculated out of the total 80 women. Some women experienced more than one complication, so cumulative percentages exceed 100%.

Table-III: Pregnancy-related neonatal complications in women with type 1 diabetes (N = 80).

Neonatal Complication	n (%)
Neonatal hypoglycaemia	16 (20.0)
Preterm birth (<37 weeks)	59 (73.8)
Stillbirth	10 (12.5)
Low birth weight	6 (7.5)
Respiratory disorders	7 (8.8)
Hypertrophic cardiomyopathy	4 (5.0)
Congenital abnormalities	1 (1.3)
Macrosomia	3 (3.8)
Jaundice	3 (3.8)

Footnote: Data are shown as frequency (n, %). Percentages are calculated out of the total 80 births.

DISCUSSION

This study examined the complications encountered by a cohort of Pakistani women who were diagnosed with type 1 diabetes along with their babies. It is found that they face a significant number of complications such as 20 (25.0%) women suffering from hypertension, 12 (15.0%) women entering shock state, and 10 (12.5%) women facing acute renal failure. The prevalence of caesarian delivery was 48 (60.0%), while the rate of maternal mortality was 2 (2.5%). On the other hand, the infant mortality rate (stillbirth) was 10 (12.5%), while 16 (20.0%) infants had hypoglycemia, and 59 (73.8%) were preterm babies. These complication rates are markedly higher than those reported in background populations of women without diabetes and are largely consistent with, though in some respects exceed, those documented in international diabetic pregnancy registries [11,12].

The high proportion of unplanned pregnancies 60 (75.0%) in the present series is a major concern. Unplanned pregnancy is consistently associated with poor glycaemic control at conception and throughout the first trimester, which is the critical period for organogenesis [13]. This finding aligns closely with the Pakistani study by Riaz *et al.*, which reported a similarly high prevalence of unplanned pregnancies

among women with T1DM [3]. It is also consistent with international audits, such as the National Pregnancy in Diabetes (NPID) audit in the United Kingdom, which showed that a substantial proportion of women with pregestational diabetes do not receive adequate preconception care [14,15].

Only 42 (52.5%) of our cohort received preconception counselling on glycaemic targets. This is higher than some reports, where as few as 21.7% took folic acid at the time of conception [16], yet still far from optimal. The association between preconception care and a reduction in congenital anomalies and perinatal mortality is well established [17]. The suboptimal uptake in our setting underscores the need for better integration of diabetes care and reproductive health services.

The mean duration of diabetes before pregnancy in our cohort was 6.84 (7.20) years, which is shorter than originally reported but still indicates that many women developed T1DM during adolescence. The depiction of the maternal complications from the current study suggests a strong bias towards the development of hypertension disorders and acute renal failure. Although the corrected mean duration is 6.8 years, the high frequency of these complications likely reflects poor glycaemic control (mean HbA1c 7.92%) rather than extremely long disease duration

alone. Another noteworthy statistic is the very high rate of caesarean deliveries 48 (60.0%), which is in line with the evidence showing that type 1 diabetic mothers run approximately two to three times higher chances of requiring surgery during childbirth than their non-diabetic peers [18,19]. Moreover, the maternal mortality rate is also surprisingly high, at 2 (2.5%). Although the findings resemble those of Buschur *et al.*, who have shown an increase in the mortality rates of type 1 diabetics by two to three times, one should keep in mind that such figures represent a considerable disease burden [20].

Neonatal outcomes were likewise worrying. The neonatal hypoglycaemia rate of 16 (20.0%) is within the range described by other authors [21], and preterm birth and stillbirth rates were considerable. The preterm birth rate of 59 (73.8%) in our study is substantially higher than the 15-30% reported in well-resourced settings [22], reflecting the poor preconception glycaemic control and high rate of unplanned pregnancies in our population. The stillbirth rate of 10 (12.5%) exceeds the 1-2% reported in well-resourced settings [22], highlighting the importance of close fetal surveillance in these high-risk pregnancies. The low rate of low birth weight (7.5%) despite a high preterm birth rate (73.8%) is likely explained by the predominance of late preterm births (34-36 weeks) in our cohort, where birth weight often exceeds 2500g, and by the exclusion of stillbirths (10 cases) from the low birth weight denominator. The relatively low frequency of congenital abnormalities 1 (1.3%) may be an artefact of the small sample size or a reflection of the high early pregnancy loss rate, which could mask the true incidence.

The limitations of this study must be acknowledged. It is a single-centre, retrospective analysis reliant on data extracted from an electronic medical record system, which may have introduced inaccuracies or omitted variables. The exclusion of 45 of 125 identified pregnancies (36%) due to incomplete records may have introduced selection bias, as women with more severe complications might have had more complete documentation. The absence of a consistent referral system and reliance on patient recall for some historical data may have led to incomplete information on complications. The sample size of 80 is modest, though it represents a well-characterised cohort of T1DM women in Pakistan. The lack of a comparison group of non-diabetic women limits the ability to calculate risk ratios. Nevertheless, the strength of the study lies in its detailed characterisation of a Pakistani T1DM pregnancy cohort, a population for which data are extremely scarce. Future prospective multicentre

studies with standardised data collection and long-term follow-up are required to fully delineate the burden and determinants of adverse pregnancy outcomes in this vulnerable group. Further research should also explore the barriers to preconception care and the impact of structured education programmes on improving pregnancy planning and glycaemic control. Urgent implementation of structured preconception care, family planning services, and tighter glycaemic targets before and during pregnancy is essential to mitigate these poor pregnancy outcomes in women with type 1 diabetes in Pakistan.

CONCLUSION

The present study demonstrates that pregnancies in women with type 1 diabetes mellitus are associated with high frequencies of adverse maternal and neonatal outcomes, notably hypertensive disorders affecting 20 (25.0%) women, operative delivery in 48 (60.0%) cases, maternal mortality in 2 (2.5%), neonatal hypoglycaemia in 16 (20.0%), preterm birth in 59 (73.8%), and stillbirth in 10 (12.5%). The very high rate of unplanned pregnancies 60 (75.0%) and suboptimal preconception glycaemic control (mean HbA1c 7.92%) represent critical, modifiable risk factors.

CONFLICT OF INTEREST

None

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHORS CONTRIBUTION

Hemasa Gul: Substantial contribution to study concept, study design, acquisition of data, manuscript writing, final approval, responsible for every aspect of the research

Nayab Hakim: Substantial contribution to study concept, study design, acquisition of data, analysis and interpretation of data, final approval, responsible for every aspect of the research

Samina Jadoon: Substantial contribution to manuscript writing, final approval, responsible for every aspect of the research

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