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Maternal Diabetes and Newborns: Unveiling Complications through a Retrospective Study in the Neonatology and Neonatal Intensive Care Unit of CHU MOHAMED VI in Oujda (Morocco)

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Abstract

Maternal diabetes during pregnancy carries potential risks for both the mother and the developing fetus. The objective of this investigation was to evaluate the morbidity and mortality outcomes among infants born to mothers with diabetes, and to determine the key maternal and neonatal risk factors associated with these outcomes. This was a retrospective, observational study designed to provide a descriptive and analytical assessment of the data, conducted over a one-year period in the Neonatology and Neonatal Intensive Care Unit of CHU MED VI in Oujda, between January 1, 2023, and December 31, 2023. The results showed a prevalence of 11.23%. The parturients had a history of abortion, preeclampsia and intra uterine fetal death. The sex ratio was 1.81, with an average weight of 3302 g. Respiratory distress was the most common complication followed by prematurity, macrosomia and congenital malformations. Uncontrolled diabetes was associated with serious neonatal complications, as well as advanced maternal age and grand multiparity. The findings underscore the necessity of providing specialized care and close monitoring for newborns born to mothers with diabetes, along with a multidisciplinary care model to address the management of any neonatal complications that may arise.

Keywords

Diabetic Mothers, Diabetes, Pregnancy, Newborn, Neonatal Complications

1. Introduction

The co-occurrence of diabetes and pregnancy poses a potential risk for both the mother and the child. Infants born to mothers with diabetes face a significantly elevated risk of perinatal morbidity and mortality [1]. In all such cases, it is a high-risk pregnancy that necessitates rigorous and comprehensive management [2]. In newborns, various complications can occur, such as congenital malformations, perinatal morbidity and mortality, prematurity, macrosomia, fetal trauma, respiratory distress, as well as metabolic disorders including hypoglycemia, hypocalcemia, and hyperbilirubinemia [3]. The prognosis of these newborns can be improved through better management, including pregnancy planning with strict glycemic control and careful monitoring through multidisciplinary collaboration. Our retrospective study examines the medical records of newborns of diabetic mothers hospitalized over one year in our neonatology department. We aim to identify the main complications and provide valuable information to guide clinical practices and research in this crucial field of neonatal health.

2. Objectives

The aim of this study was:

- To assess the incidence of neonatal complications occurring in infants born to diabetic mothers who were admitted to our neonatal intensive care unit over the course of a one-year period.
- To identify the main complications encountered in these newborns, such as hypoglycemia, macrosomia, cardiac anomalies, etc.
- To examine the demographic characteristics of newborns born to diabetic mothers (birth weight, sex, gestation, etc.) and assess their impact on neonatal outcomes.

To analyze risk factors associated with neonatal complications, including maternal glycemic control and duration of diabetes.

3. Materials and Methods

3.1. Study Type and Period

This was a retrospective study designed to provide a descriptive and analytical assessment of the data conducted over a one-year period in the Neonatology and Neonatal Intensive Care Unit of CHU MED VI in Oujda, between January 1, 2023, and December 31, 2023. All newborns of diabetic mothers who were hospitalized in the department were included.

3.2. Inclusion Criteria

We included all live neonates of diabetic mothers; hospitalized in our department for management of their disease.

3.3. Exclusion Criteria

We excluded newborns with incomplete and unexploited records.

3.4. Data Collection

The data were collected from the hospitalization records of the newborns using a standardized data collection form. The collected parameters included:

- Epidemiological data (maternal age, newborn's gender, gestational age).
- Maternal history, Type of diabetes, Data related to the course of pregnancy and delivery.
- Neonatal data (neonatal anthropometry, neonatal complications, and outcome: survival, mortality).

3.5. Limitations of the Study

The retrospective nature of our study explains the difficulties encountered in obtaining patient data and in the use of certain variables not documented in the observations.

4. Results

4.1. Maternal Data

During the study period, 552 newborns were admitted to neonatology, 62 of whom were newborns of diabetic mothers, representing a prevalence of 11.23%.

The maternal age range in this study was 20 to 42 years, with an average age of 31.6 ± 6 years.

Table 1. Gynecological and obstetric history of parturients.

Type of history	Number	Percentage
Abortion	14	22.58%
Fetal death in utero	3	4.83%
Pre-eclampsia	9	14.51%
Neonatal death	4	6.45%
Pregnancy-induced hypertension	8	12.90
No history	24	38.7%

Among the parturients, 61.3% had a specific medical history. Abortion was the most common medical history (22.58 %), followed by pre-eclampsia. They were associated in 11.29% of cases (Table 1).

The majority of patients (91%) had gestational diabetes and 22.8% were being treated with insulin. No patient was receiving oral antidiabetic treatment.

The diagnosis of gestational diabetes was made through screening by gynecologists, and no specific clinical signs were revealed, the mothers underwent a fasting blood glucose test during the first trimester, followed by an oral glucose tolerance test. HbA1c was not systematically requested.

According to the interviews with the mothers, blood glucose levels were not monitored in 91% of cases, despite high postprandial glucose readings persisting for a prolonged period during pregnancy. We do not have documents to substantiate these mothers' statements.

During pregnancy, the mothers were referred to endocrinology consultations for coordinated follow-up between the gynecologist and the endocrinologist. However, the majority of our cohort (81%) did not attend these consultations due to a lack of resources or information about the seriousness of this condition for both the mother and the fetus. After the hospitalization of their newborns in our service, advice and explanations were provided, and a follow-up assessment was suggested after three months.

21% had a family history of either type 1 or type 2 diabetes. Additionally, 35% were classified as obese prior to pregnancy and followed an unbalanced diet, while 42% came from a low socio-economic and intellectual background.

The mean parity was 3.5 with extremes of 1 and 8. 41 women (66.1%) were multiparous (4 or more deliveries).

Delivery occurred between 30 and 39 SA. The mean was 37.5 ± 2.6 SA. The route of delivery was Caesarean section for the majority of parturients (83%).

4.2. Neonatal Data

We had 40 boys and 22 girls with a sex ratio of 1.81. The mean weight was 3302 g ± 837.9 with extremes of 1200 g and 5000 g (Table 2).

Table 2. Weight of newborns.

Weights	Number	Percentage
1200 - 1499	5	8.06%
1500 - 2499	8	12.9%
2500 - 3999	32	51%
4000 - 5000	17	27.41%

Among neonatal complications (Table 3), respiratory distress was the most frequent (over 40%). Prematurity and Macrosomia were found in %30 of cases. Malformations included cyanogenic congenital heart disease (4 cases), esophageal atresia (4 cases), choanal atresia (1 case), diaphragmatic hernia (2), clubfoot (1 case). Traumatic lesions were rare in our series.

Table 3. Neonatal complications.

Neonatal complications	Number	Percentage
Respiratory distress	27	43%
Prematurity	19	30%
Macrosomia	19	30%
Malformations	12	19.35%
Neonatal Hyperbilirubinemia	5	8.06%
Hypoglycemia	12	19.35%
hypocalcemia	10	16.12%

The length of hospitalization varied from 2 to 21 days, with an average stay of 6.8 days.

Four newborns died (6.45%); all were born to mothers aged over 30, 2 mothers

had unregulated pre-gestational diabetes and the others had gestational diabetes on insulin. All presented with respiratory distress at birth with severe prematurity.

- Risk factors for congenital malformations: In our series 11 newborns had a congenital malformation (17.74%). The average age of their mothers was 36.27, uncontrolled diabetes was associated with congenital malformations in 88.8%.
- Risk factors for macrosomia: Of all the maternal factors studied, only uncontrolled diabetes and parity were significantly associated with macrosomia, while male sex was associated with macrosomia.
- Risk factors for hypoglycemia: Maternal age over 25 years and treatment with insulin, whatever the type of diabetes, were significantly associated with neonatal hypoglycemia.

5. Discussion

Diabetes represents a major global public health concern. The incidence of diabetes during pregnancy continues to rise in the current environment characterized by the ongoing obesity and type 2 diabetes epidemics [1]. It is estimated that between 3 to 10% of pregnancies are affected by some form of dysregulated glycemic control. In our series, its frequency during pregnancy (11.23%) is higher than those reported by D. Boiro in Dakar in 2017 (2.46%) [4], Firouzeh and Mahdaviani in Iran in 2004, and Kay Mcfarland and Ezzat in the United States (2.6%) [5] [6].

In pregnancies complicated by diabetes, delivery is typically scheduled around 38-39 weeks of gestation. However, many healthcare providers tend to adopt more interventionist approach when managing gestational diabetes, opting to induce delivery prematurely. This is often done with the aim of mitigating the risk of late fetal mortality or shoulder dystocia, which may occur in cases of fetal macrosomia [7]. The findings from our study align with the broader medical literature, reporting a mean gestational age at delivery of 37.5 ± 2.6 weeks.

Rates of cesarean delivery tend to be considerably higher among pregnant women with diabetes compared to the general obstetric population. While cesarean rates hover around 17% for non-diabetic pregnancies, they can exceed 60% for those complicated by diabetes. This suggests that awareness of a patient's diabetic status plays a significant role in shaping decisions regarding the mode of delivery [2].

In our study cohort, the rate of cesarean delivery was 83%. This elevated cesarean rate is consistent with findings reported by other researchers in the field. For instance, Boiro documented a cesarean rate of 87.8% [4]. Among their study population [6]. Similarly, Peace Opara et al. also observed a high incidence of cesarean births in their analysis of diabetic pregnancies [8].

One of the most common neonatal complications observed in diabetic pregnancies is macrosomia, with an elevated incidence rate of around 45% [1]. In the setting of maternal diabetes, fetal macrosomia is typically attributed to the fetus

hyperinsulinemic response to the maternal hyperglycemic environment. The anabolic effects of excessive fetal insulin production contribute to increased fetal growth and larger birth weights [9]. In addition to maternal glucose levels, other substrates like amino acids, triglycerides, and free fatty acids have also been positively correlated with neonatal birth weight in these cases [9]. The findings from our study indicate that poorly controlled maternal diabetes and multiparity are both significantly correlated with the occurrence of fetal macrosomia. Specifically, we observed that suboptimal glycemic management in diabetic pregnant women, as well as having multiple prior deliveries, were independent risk factors associated with increased rates of macrosomic infants in our patient population.

Other research, such as the study by Vambergue *et al*., has found that fetal adiposity increases with maternal parity, potentially due to the loss of brown adipose tissue over successive pregnancies [10]. Additionally, they observed that male fetuses tended to have higher birth weights compared to female fetuses. However, the underlying physiological reasons for this gender-based difference in fetal growth patterns are not yet fully understood [10].

Preterm birth is an increasingly common complication observed in pregnancies affected by diabetes, with reported rates ranging from 23% - 46% [11]. The main factors associated with this elevated preterm birth risk are poor maternal glycemic control and the development of preeclampsia [11]. For example, a study by Cordero et al. in the United States found a preterm birth rate of 14% before 34 weeks of gestation in their cohort of diabetic pregnancies [12].

Infants born to mothers with diabetes are also at higher risk of developing neonatal respiratory distress syndrome. There are a few potential contributing causes: 1) the increased incidence of preterm delivery, 2) impaired fetal surfactant maturation, and 3) the higher rates of cesarean delivery, which can delay the clearance of fetal lung fluid [1] [7].

The prevalence of congenital malformations in women with diabetes varies from 2 to 7% according to the literature [6]. A study by Cordero et al. reported a rate of 5% of malformations [12]. The risk of malformations is higher in patients with pre-existing diabetes before pregnancy, but the types of malformations observed (cardiac, skeletal, cerebral) are similar between pregestational and gestational diabetes [2] [6].

Epidemiological analyses have been established the teratogenic role of maternal diabetes. In women with diabetes before pregnancy, the risk of having a child with a malformation is multiplied by 2 to 5, potentially reaching more than 16% of births, or even 7 to 10 times for the most severe malformations. This increased risk is even more important when the diabetes is poorly controlled [13]. Our study reported a congenital malformation rate of 17%, higher than the 5.1% observed by Boiro [4]. This can be explained by the large number of mothers with poorly controlled diabetes in our series.

In terms of metabolic complications, hypoglycemia was the most prevalent finding in our study and was significantly associated with mothers under 25 years

of age and those with insulin-treated diabetes. Macrosomia was identified as a risk factor for neonatal hypoglycemia, as was poor maternal glycemic control during the peripartum period, consistent with the findings reported in the Mitanchez study [7].

The findings from our study have significant implications for clinical practice, underscoring the need for a multidisciplinary approach to the management of pregnancies in women with diabetes, and emphasizing the importance of close monitoring and specialized care for newborns of diabetic mothers after birth.

6. Conclusion

The infant born to a mother with diabetes continues to be considered a high-risk patient. Efforts must be focused on controlling maternal diabetes. This study highlights the significant impact of maternal diabetes on neonatal complications. The results underline the importance of specific care for newborns born to diabetic mothers, with careful monitoring of pregnant women and a multidisciplinary approach to the management of neonatal complications. Diabetic mothers, with careful monitoring of pregnant women and a multidisciplinary approach to reduce the risks. These findings offer valuable insights into how to improve clinical practice and guide future research in this area.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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