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Neonatal complications of diabetes in pregnancy: Study of 393 cases

Abstract

Diabetes in pregnant women is a high-risk situation for both mother and fetus. Despite improved management, neonatal morbidity remains very high. We conducted a retrospective descriptive study during 8 months (January- August 2020) in the maternity center of Bizerta in Tunisia, including newborns from diabetic pregnancies (pre-gestational or gestational diabetes). The main objective was to focus on the incidence of complications during diabetes-associated pregnancies. In this study, 393 newborns and 388 diabetic mothers were included. The prevalence of diabetes during pregnancy was 19.06%. Gestational diabetes was the most common type, representing 16.81% of births, and it was timely diagnosed in 67.3% of cases. Obstetrical ultrasound abnormalities were found in 10.3% of pregnancies. Vaginal infections and urinary tract infections were prevalent in diabetic mothers, at 19.8% and 9.1%, respectively. Most pregnancies reached full term, with a 9.4% prevalence of prematurity. Newborns of diabetic mothers had an average weight of 3386.84 g, with 19% being hypertrophic and 4.83% hypotrophic. Common morbidities in these newborns included transient respiratory distress (52.6%) and early neonatal bacterial infection (42.1%). Congenital malformations were present in 7.6% of cases. Obstetric trauma occurred in 10.9% of cases. Newborn's hospitalization was needed for 33.3%, mainly due to neonatal respiratory distress. The average hospital stay was 4 days, and there was one recorded death in the study population.

Diabetes during pregnancy increases the risk of various neonatal problems, including respiratory distress, congenital issues, and trauma during childbirth, and metabolic disorders. To minimize these risks, improved pregnancy management, effective screening, and proper gestational diabetes management are crucial for reducing neonatal morbidity.

Keywords: newborn, diabetes, gestational diabetes, morbidity, mortality

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Abbreviations: MCB, maternity center of the Habib Bougatfa University Hospital in Bizerte; NBDM, new born of diabetic mother

Introduction

The International Diabetes Federation (IDF) estimates that 21.8% of women aged between 20 and 49 in the MENA (Middle East and North Africa) region have hyperglycemia during pregnancy.[1]

The incidence of fetal and neonatal morbidity and mortality increases in the presence of diabetes during pregnancy.[2] These complications are variously described within literature. Nevertheless, in Tunisia, limited studies have been conducted to elucidating these particular complications.

The aim of our study was to precise the incidence of neonatal morbidity and mortality during diabetes-associated pregnancies in the maternity center of the Habib Bougatfa University Hospital in Bizerte (MCB), Tunisia.

Methodology

A retrospective study over 8 months (January -August 2020) at MCB, which was type 2A maternity at the time of the study. We included newborns of diabetic mothers, born at MCB or transferred from another medical center during the first 48 hours of life. Diabetic mothers were women with pre gestational or gestational diabetes. We have adopted the criteria of the International Association of Diabetes and Pregnancy Study Group (IADPSG)[3] and the American Diabetes Association 2021 (ADA)[4] to diagnose gestational diabetes.

We did not include the babies whose mothers had, in addition to diabetes, other chronic diseases that could have an impact on the pregnancy and fetus, such as arterial hypertension, hypothyroidism, severe heart disease, progressive renal or hepatic disease, psychiatric or neurological pathology, or a progressive inflammatory or infectious disease. Data were collected from post-partum charts and newborn hospitalization records.

Results

A total of 393 newborns and 388 diabetic mothers were included in the study. The prevalence of diabetes during pregnancy was 19.06 %. The mean age of the mothers was 31 years and 7 months (extremes 20-48 years). Gestational diabetes was the most frequent type of diabetes. It represented 16.81% of the total number of women who have given birth during the study period, and 96% of diabetic ones. Gestational diabetes was diagnosed on time according to ADA recommendations in 67.3% of cases (252 mothers). For the remaining cases (122 mothers), it was diagnosed late by fasting blood glucose tests. When gestational diabetes was diagnosed during the second trimester of pregnancy, 95.63% of the mothers were put only on dietary measures. The association with insulin was necessary in 4,36% of cases. No preconception programming was carried out for mothers known to be diabetic prior to pregnancy. Obstetrical ultrasound abnormalities were found in 10.3% of cases. Morphological ultrasound was performed in 36.59% of pregnancies. It was pathological in 8.45% women. The antenatal malformations diagnosed were congenital malformations were pyelocaval dilatation in 2.8% of cases and esophageal atresia in one case.

The prevalence of vaginal infection and urinary tract infection among diabetic mothers was 19.8% and 9.1% respectively.

The majority of pregnancies were carried to term, and the prevalence of prematurity was 9.4%. The mean term of delivery was 39 weeks of amenorrhea. The upper delivery route was the most frequent (57%). Instrumental vaginal delivery was indicated in 2% of cases. Indications for cesarean delivery are displayed in Table 1.

Table 1 The different indications for cesarean delivery

Indication	Number	Percentage
Acute fetal distress	101	45,3%
Biscarred uterus	63	28,3%
Seat presentation	19	8,5%
Transverse presentation	8	3,6%
Macrosomia	14	6,3%
Preeclampsia	8	3,6%
Failure to engage	5	2,2%
Placenta previa	3	1,3%
High myopia	1	0,4%
Elderly primipara who refuses vaginal delivery	1	0,4%
Total	223	100%

Poor adaptation to extrauterine life was noted in 1.28% of cases. The mean weight of newborns of diabetic mothers (NBDM) was 3386.84 g. NBDM were hypertrophic compared to their birth term in 19% of cases, and hypo trophic in 4.83%. The other morbidities diagnosed are shown in Table 2. Transient respiratory distress (52.6%) and early neonatal bacterial infection (42.1%) were the most common causes of respiratory distress in NBDM. At birth, a congenital malformation was found in 7.6% of cases. The different types of congenital malformations in our population are summarized in Table 3. Obstetric trauma (10.9%) was severe in 3.1% of cases. Hospitalization was indicated in 33.3% of cases. The main cause for hospitalization was neonatal respiratory distress. The remaining causes are summarized in Table 4. The average length of hospital stay was 4 days. Only one death was recorded in our study population.

Table 2 The different morbid states in newborns of diabetic mothers

Morbid state	Diabetic mothers' newborns
Neonatal respiratory distress	76(19,30%)
Neonatal jaundice	53(13,50%)
Polyglobulia	79(20,10%)
Congenital malformation	30(7,60%)
Obstetrical trauma	43(10,90%)
Early-onset neonatal bacterial infection	57(14,50%)
Hypoglycemia	35(8,90%)
Hypocalcemia	12(3,10%)
Hypotonia	4(1%)
Convulsion	1(0,30%)

Table 3 Frequency and type of congenital malformations in newborns of diabetic mothers

Malformation type	Frequency and percentage	Clinical signs
Urogenital	10(2,54%)	- Hypospadias (6 newborns) -Bent penis (1 newborn) -Pyloric ectasia (3 newborns)
Musculoskeletal	7(1,78%)	- Clubfoot (4 newborns) - Craniostenosis (1 newborn) -Tongue lock (2 newborns)
Cardiac	4(1,02%)	-Ventricular septal defect (4 newborns)
Vascular	4(1,02%)	- Angioma (4 newborns)
Poly malformative syndrome and chromosomal abnormalities	4(1,02%)	-Goldenhar syndrome + ventricular septal defect (1 newborn) -Holt-Oram syndrome + pyelocalic dilatation (1 newborn) -Pyelocalic dilatation + bilateral hexadactyly + angioma (1 newborn) -Trisomy 21 (1 newborn)
Digestive	1(0,25%)	Esophageal atresia (1 newborn)

Table 4 Frequency and pourcentage of the hospitalization causes in newborns of diabetic mothers

The hospitalization cause	Frequency	Pourcentage
Neonatal respiratory distress	76	58%
Heel blood glucose monitoring	29	22,1%
Neonatal jaundice	18	13,7%
Hypoglycemia	5	3,8%
Prematurity	3	2,3%
Total	131	100%

Discussion

Diabetes during pregnancy is a real public health problem. Its incidence is significantly increasing these days due to obesity and type 2 diabetes. Nearly 3 to 10% of pregnancies are complicated by a glycemic regulation disorder.[4] In our series, its frequency during pregnancy was estimated at 19.06 % which is much higher than those reported in the study of Firouzeh and Mahdaviani[5] in Iran in 2004, and KayMcfarland and Ezzat[6] in the United States in 1985 (2.6%).

For diabetic pregnancies, the mothers' most common obstetrical antecedents are macrosomia, spontaneous miscarriage and prematurity, which were evaluated respectively at 25.7%, 23% and 8.1% in a study conducted in Bamako,[7] 42%, 24% and 8% in a study conducted in Marrakech[8] and 22.7%, 22.7% and 14.9% in our study.

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The simultaneous presence of diabetes and pre-eclampsia during pregnancy increases the risk of maternal-fetal complications and requires adequate management.[9] In our study, the coexistence of toxemia gravidarum with diabetes during pregnancy was found in 17% of cases. This rate was high compared to 6.2% at the Mayotte hospital,[10] 7.4% in Bamako[11] and 12.8% in Tunisia,[12] but lower than the 23.76% rate in Tlemcen.[13]

The main embryonic anomalies detected on antenatal ultrasound are: macrosomia, hydramnios, abortion, in utero fetal death and congenital malformations, with variable prevalence in the literature.[11,12,14]

According to the literature, the main risk factors for gestational diabetes are: overweight, maternal age greater than or equal to 35 at the time of pregnancy, first-degree family history of type 2 diabetes, personal history of gestational diabetes and personal history of fetal macrosomia.[15–18]

First treatment of gestational diabetes is dietary therapy. Insulin was the preferred hypoglycemic treatment in cases of poor control by dietary therapies.[16,19] In our study, glycemic control in gestational diabetes was achieved by dietary measures in 95,63% of cases. For pregestational diabetes, oral antidiabetics do not have marketing authorization during pregnancy.[20]

In cases of diabetes associated with pregnancy, the high route is the preferred method of delivery, with an estimated frequency of 56.7% in our study, 68% in the Dhouibi series[12] and 78.9% in the Ashour et al. series.[21]

The lower prevalence of vaginal deliveries in diabetes can be explained by the interventionist attitude of obstetricians, the high frequency of previous caesarean deliveries and the high frequency of fetal macrosomia.[22,23] Macrosomia is one of the most frequent complications of diabetes in pregnancy.[24]

Maternal hyperglycemia during pregnancy causes fetal hyperglycemia, resulting in hyperinsulinemia. This extra glucose in the fetus is stored as body fat.[25]

A study of 17,094 mothers and infants in 15 centers in 9 countries conducted by Metzger et al. showed a linear correlation between maternal blood glucose levels, fetal hyperinsulinism, and birth weight above the 90th percentile.[26] Moreover, lipid concentrations in pregnant diabetic mothers (especially triglycerides) were found to be strongly correlated with fetal growth.[27]

The prevalence of macrosomia in our study was higher than the prevalence reported by Dhouibi et al (15.5%),[8] Moumen et al (14%)[16] and Christophe Olivesi (5.2%),[17] but lower than Boiro et al. (29.29%)[2] and Drabo et al (48.4%).[7]

Newborns of diabetic mothers are generally more likely to develop neonatal respiratory distress due to premature birth, surfactant maturation abnormalities and caesarean section births, which increase the risk of respiratory distress through delayed resorption of pulmonary fluid.[24,28,29]

As for metabolic complications, the high frequency of hypoglycemia in NBDM is explained by transient hyperinsulinism that hinders the adaptive mechanisms initiated at birth to regulate blood sugar according to the prandial state.[30]

Its prevalence in our study (8.9%) was lower compared to the prevalence reported in the study of Al-Nemri et al (11.8%),[31] but higher compared to the prevalence reported by Drabo et al (6.1%).[7]

The mechanism of hypocalcemia in the NBDM is not completely clarified and appears to be related to functional hypoparathyroidism.[32]

In our study, hypocalcemia was found in 3.10% of NBDMs. Our results were similar to those of Moumhil et al,[8]

Boiro et al.,[2] and Tshiala Fany,[33] with a prevalence of 2.32%, 3.03% and 2.86% respectively.

According to the literature, both pre-gestational and gestational diabetes increase the risk of congenital anomalies.[34–36]

Fetal exposure to hyperglycemia in early pregnancy may contribute to increased oxidative stress. This leads to high levels of fetal cells apoptosis, increasing the risk of malformation. In addition, deficient activity of the transcription factor involved in defense mechanisms against oxidative stress (ALX3) may increase the risk of congenital anomalies due to maternal hyperglycemia.[37]

Obstetric trauma is generally attributed to macrosomia, notably shoulder dystocia.[24,35] Its incidence varies from 0.2% to 2.8% in the general population. It can even reach a rate of 9% in diabetic pregnancies. The risk increases with the child's weight; however, for the same weight, the frequency of shoulder dystocia is multiplied by 2 in macrosomia born to diabetic mothers, due to the increase in thoracic volume and bi-acromial diameter, explaining the high frequency of brachial plexus elongation.[38]

Conclusion

Diabetes during pregnancy is a high-risk situation for the newborn. Respiratory distress, congenital malformations, obstetric trauma, metabolic and hematological disorders are the main neonatal morbidities associated with this pregnancy. Great efforts are needed to better conduct pregnancy programming in diabetic mothers, screening and management of gestational diabetes during pregnancy to reduce the risk of neonatal morbidity.

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Conflicts of interest

No conflict of interest to declare.

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