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Neonatal Morbidity Among Infants of Diabetic Mothers in Fayoum.

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Abstract

Introduction: Diabetes mellitus is one of the most common disorders that affects pregnant women and infants. Complications of diabetes in pregnant women, including increased perinatal morbidity, congenital anomalies, fetal growth restriction, preterm birth, cesarean section, and macrosomia, are well known.

Aim of the study: evaluation of morbidities and complications among infants of diabetic mothers outcomes in Fayoum.

Patients and Methods: All participants underwent history taking, clinical examination, laboratory investigations (blood glucose level, investigations of complications, e.g., serum blood sugar, serum blood calcium, serum bilirubin, complete blood picture), and radiological investigations (chest X-ray, echocardiography).

Results: The mean gestational age among the study group was 37.8 ± 1.6, with 16% preterm and 84% full-term. In 72% of cases, their mothers showed gestational diabetes, versus 28% who were diabetic before pregnancy. 76% of cases showed abnormal ECHO findings. The cases had a treatment for hypoglycemia (26%), hypocalcemia (16%), jaundice (40%), oxygen therapy (82%), and CPAP (26%); finally, 16% needed mechanical ventilation.

Conclusion: there is a high occurrence of complications in neonates born to diabetic mothers. Respiratory distress, cardiac abnormalities and hypoglycemia were the most frequent complications, so they should be carefully examined and have follow-up visits.

Keywords: Neonatal; Morbidity; Infants; Diabetic Mothers.

1. Introduction

Gestational diabetes mellitus (GDM), characterized by glucose intolerance that arises or is first identified during pregnancy, is a prevalent metabolic consequence of gestation. **[1].**

Insulin resistance and β-cell dysfunction are the primary pathophysiological characteristics of GDM. Insulin sensitivity markedly fluctuates during pregnancy, continuously adjusting to the energy requirements of both the mother as well as the fetus. The synthesis of estrogens and progesterone steadily escalates, along with other placental-derived chemicals, including human placental lactogen in addition to human placental growth hormone, which contribute to the gradual decline in insulin sensitivity **[2].**

Maternal diabetes correlates with pregnancy difficulties and heightened incidences of negative maternal and newborn outcomes. Short-term complications encompass macrosomia, respiratory distress syndrome, pre-eclampsia, cesarean section (C/S), large for gestational age, neonatal intensive care unit admission, neonatal hypoglycemia, congenital anomalies, preterm birth, intrauterine growth restriction, and preterm birth. In the long term, both mothers and their infants face an elevated risk of metabolic disease **[3].**

2. Patients and methods

2.1. Patients

Fifty infants of diabetic mothers who were admitted to the neonatal critical care unit at University Hospital and Fayoum General Hospital were the subjects of this prospective cross-sectional study.

Inclusion criteria:

- Infants of diabetic mothers
- Both sexes

Exclusion criteria:

- Severe hypoxia.
- Severe Sepsis

2.2. Study Design

3. Laboratory tests (serum glucose level, investigations to monitor complications , such as serum glucose, calcium, bilirubin level , and complete blood count), radiological tests as chest X-ray and echocardiography were performed in all patients.

3.1. Statistical Analysis

Data was gathered, coded to make data manipulation easier, double-entered into Microsoft Access, and analyzed using SPSS version 22. Standard deviations are a measure of the dispersion of quantitative parametric data, arithmetic means are a way to measure central tendency, and simple descriptive analysis is expressed as numbers and percentages of qualitative data. Each research group's quantitative data was initially examined for normalcy using the One-Sample Kolmogorov-Smirnov test, after which inferential statistical tests were chosen. Quantitative measures between two independent groups were compared using the independent samples t test. Two independent groups are compared using the Mann-Whitney test. When comparing two or more qualitative groups, the chi square test is utilized. A P-value of less than 0.05 was deemed statistically significant.

3. Results

Table (1): frequency of preterm and full-term among study group

	Frequency	
	Number	**(%)**
Preterm (< 37 w)	8	16%
Full-term (≥ 37w)	42	84%

Table (1) Most of studied patients were full-term (84%).

Table (2): Description of neonatal anthropometric measurements

Variables	Mean ± SD	Range
Weight (kg)	3.2±0.67	2-5
Length (cm)	49.9±0.58	47.9-51.2
HC (cm)	34.9±0.32	34-35.6

Table (2) showed that the study group's average weight was 3.2±0.67 kg, their average length was 49.9±0.58 cm, and their average HC was 34.9±0.32 cm.

Table (3): Neonatal systemic examination of the studied group

Variables (n=50)	Frequency	
	Number	**%**
Chest		
Normal rate	5	10%
Respiratory distress grade 1	22	44%
Respiratory distress grade 2	13	26%
Respiratory distress grade 3	3	6%
Respiratory distress grade 4	7	14%
Heart		
Normal heart auscultation	37	74%
Presence of Murmur	13	26%
Abdominal		
Normal	49	98%
Distended lax	1	2%
CNS		
Normal	48	96%
Abnormal	2	4%

Table (3) illustrated that 90% of cases were distressed, (26%)had murmur in cardiac examination and (4%) showed abnormalities in CNS examination.

Table (4): Neonatal congenital anomalies among the study group

Variables (n=50)	Frequency	
	Number	**%**
Head & neck		
No	50	100%
Yes	0	0%
Limbs		
No	50	100%
Yes	0	0%
Back		
No	50	100%
Yes	0	0%
Genetalia		
No	49	98%
Hydrocele	1	2%

Table (4) illustrated that all cases show no congenital anomalies in head and neck, limbs, or back. But only 2% of neonate show hydrocele.

Table (5): Abnormal echocardiographic findings among the study group

Variables (n=50)	Frequency	
	Number	%
Abnormal finding (CHD&LVH)		
No	12	24%
Yes	38	76%
Echo finding		
PFO	11	22%
PFO&PDA	1	2%
VSD	2	4%
ASD	1	2%
Coarctation of aorta	1	2%
Left pulmonary stenosis	4	8%
Impaired systolic function (patient had sepsis)	1	2%
Left ventricular hypertrophy with outflow obstruction	4	8%
left ventricular hypertrophy without outflow obstruction	22	44%
Fallot	1	2%
VSD&MR	1	2%
VSD&left ventricular hypertrophy without outflow obstruction	1	2%

*PFO :Patent Foramen Ovale
* VSD: Ventricular Septal Defect
* ASD: Atrial Septal Defect
* PDA: Patent Dutus Arteriosus
* MR: Mitral Regurge
*PFO & tiny PDA not considered congenital anomaly.

Table (5) illustrated that 76% of cases show Abnormal finding (congenital heart disease, left ventricular hypertrophy) versus 24% with normal results. 11% of cases show PFO (normal finding), 44% show left ventricular hypertrophy without outflow obstruction&2%were fallot tetralogy.

Table (6): Frequency of neonatal treatment among study group

Variables (n=50)	Needed		Not needed	
	No.	%	No.	%
Hypoglycemia	13	26%	37	74%
Hypocalcemia	8	16%	42	96%
Jaundice	20	40%	30	60%
Oxygen	41	82%	9	18%
CPAP	13	26%	37	74%
MV	8	16%	42	96%

Table (6) illustrated that26% of cases need treatment for hypoglycemia, 16% treated for hypocalcemia, 40% for jaundice. 82% of cases need oxygen therapy, and 26% need CPAP, finally 16% need mechanical ventilation.

Table (7): Comparisons of hospital stay in different neonatal surviving outcomes

Variables	Hospital stay duration (days)	
	Mean	SD
Survived	4.4	2.8
Not Survived	8.7	1.7

Table (7) illustrated that there was a statistical significant longer duration of hospital stay among none surviving cases with p-value 0.003.

4. Discussion

With an estimated 300 million diabetics worldwide by 2030, diabetes mellitus is a serious public health concern [4].

Pregnant women with various forms of diabetes face a heightened risk of obstetric difficulties, and their offspring are also predisposed to perinatal and neonatal adverse outcomes **[5].**

50 IDM patients who arrived in the NICU of those hospitals were included in our study, which was carried out to determine the prevalence of new born problems among IDMs admitted to Fayoum University Paediatrics Hospital & Fayoum General Hospital. The infants in the study group had an average gestational age of 37.8 ±1.6 weeks, with 16 percent of them being preterm and 84% full-term. This result was consistent with a study by Devi Meenakshi et al. [6] that found that out of 174 baby cases, 87.9% of the babies were term and 24 (12.1%) were preterm.

By taking the medical history of the study group patients, it is clear that 72% of mothers showed gestational diabetes, versus 28% who were diabetic before pregnancy. 76% of them were controlled versus 24% that were uncontrolled. 92% of mothers deliver by caesarean section. which was similar to the study by **Anjum and Yashodha [7]**, GDM was found in 86% and pregestational diabetes in 14% of cases.

Gestational diabetes is associated with an increased risk of complications for both the mother and the foetus. The perinatal outcome correlates with the onset, duration of glucose intolerance, and the severity of the condition [8].
The results aligned with those of Kheir et al. [9], who noted that a substantial 84% of mothers had caesarean deliveries, with the majority being planned elective caesarean sections (60%). This contrasts with the research undertaken in Nigeria by Opara et al. [10], which disclosed that most caesarean sections were conducted as emergency procedures. Opara et al. [10]findings were similar to a study in Sri Lanka by Senanayake and Gunawardene [11], which indicated that rates of elective caesarean sections far exceeded those of emergency ones. Sri Lanka holds a unique status in South Asia as a leading lesser-developed nation providing universal healthcare. The heightened frequency of surgical deliveries is linked to the increased occurrence of macrosomia in IDMS. Our findings revealed that 90% of cases presented with RD, corroborated by Al-Awqati et al. [12], whose study indicated respiratory distress was a prevalent issue among infants of diabetic mothers. Furthermore, our study found the average weight in the group to be (3.2±0.67) kg, with 18% classified as macrosomia. This contrasts with Hussain et al. [13], who reported that 40.4% had macrosomia primarily due to poor glycemic management during the pregnancy period. Hyperbilirubinemia is a recognized challenge in infants of diabetic mothers and is shown to be more prevalent in macrosomic babies born to these mothers [14].
Our aforementioned findings (12% icteric cases) align with Kheir et al. [9], who cited neonatal jaundice occurring less commonly in infants of diabetic mothers (20%), particularly in those born to mothers with pregestational diabetes. However, this differs from the observations of Opara et al. [10], who reported that 63.8% of infants of diabetic mothers experienced hyperbilirubinemia.
Regarding neonatal congenital anomalies, our results indicated no congenital issues in the head, neck, limbs, and back. Only 2% of neonates exhibited hydrocele. This outcome is consistent with Thomas et al. [15], who found congenital anomalies in

only 5.4%. Similar findings emerged from Almhanna et al. [16], who indicated that congenital abnormalities affect approximately 4–12% of infants born to type 1 diabetic mothers. As for our results on neonatal congenital heart disease, they indicated that 76% of cases displayed abnormal ECHO findings (congenital heart disease & LVH), while 24% showed normal results, with 57% exhibiting LV hypertrophy and 62% revealing pulmonary hypertension.

Additionally, Codazzi et al. [17] discovered that hypertrophic cardiomyopathy in foetuses subjected to hyperglycemic and hyperinsulinemic conditions during diabetic pregnancies predominantly impacts the interventricular septum due to the high concentration of insulin receptors in that area of the heart, although it may extend to the myocardium in more severe instances. Septal hypertrophy is detectable through echocardiography in 30% of all IDMs.

In the investigation by Bogo et al. [18], during the neonatal phase, 14 occurrences, equating to 29 percent of foetuses, displayed an increase in the interventricular septum thickness among the echocardiographic parameters. Upon postnatal evaluation, only 3 patients were diagnosed with hypertrophic cardiomyopathy, which translates to an incidence rate of 6% ($p = 0.006$). In the study conducted by Kozák-Bárány et al. [19], it is possible that the management of gestational diabetes mellitus and effective control led to a reduction in cases of HOCM during the postpartum period. Our findings suggested that employing neonatal laboratory tests and radiological assessments, such as chest X-rays, highlighted that the mean of various lab investigations within 24 hours of birth is crucial for diagnosing any abnormalities in the vital signs of new born infants. This aligns with the outcomes reported by Reuter et al. [20], who noted that physical examinations, comprehensive medical histories, along with radiographic and laboratory data, contribute to the differential diagnosis. Concerning treatment in the study cohort, 26% of cases required intervention for hypoglycemia, 16% for hypocalcemia, and 40% for jaundice. Additionally, 82% needed oxygen therapy, 26% required CPAP, and finally, 16% needed mechanical ventilation. These figures surpassed the results from the study by Thomas et al. [15], which indicated that hypoglycemia occurred in 9.3%, polycythemia in 2.3%, hypocalcemia in 0.5%, and probable sepsis in 2.5% of infants. Our analysis regarding the mean length of hospital stay in the study group was (4.7±2.9) days, ranging from (1 to 13) days, with a survival rate of 92%. This is consistent with findings from Capobianco et al. [21], who reported that the average hospitalization duration for babies in the control group was 3 days, while the GDM group averaged 4 days (p-value < 0.0001), and the DM1/2 group averaged 10 days (p-value < 0.0001). Our study indicated that 92% of the infants survived, while 8% did not, suggesting that advancements in foetal monitoring, perinatal care, and high-level neonatal treatment have enhanced the morbidity and mortality rates for foetuses and infants among IDMs. Significant birth defects were observed in 4-10% of pregnancies complicated by poorly managed type 1 diabetes, alongside a 15-20% incidence of spontaneous abortion in pregnancies where diabetes was a factor [22].

5. Conclusion

Infants of diabetic mothers have a high incidence of respiratory distress, mainly grade 2, as a result of preterm labor with immature lungs and caesarean sections, and most of them were vitally stable on admission to the NICU. Jaundice, hypoglycemia and hypocalcemia were the main complications among our cases. Most of the distressed cases needed oxygen therapy, others needed CPAP and a few

needed mechanical ventilation. Cardiac abnormalities like LVH, PHT, HCM, and VSD are common among IDMs, so they needed postnatal echocardiography and follow-up. No significant difference in complications among IDMs with PGDM.

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Ethical approval and consent to participate:

Approved by the scientific researcher Ethics Committee No. (104) on 12/03/2023 at the Faculty of Medicine University (M 652)

The Faculty of Medicine Research Ethical Committee reviewed this study. The study's goals, the examination, and the inquiry were explained to the participants by the researcher. Additionally, they have the opportunity to decline participation in the study and the confidentiality of their information.

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Authors' contributions:

GSA: protocol/data collection& management manuscript (writing / editing). **SEA:** protocol management/ data analysis review & editing manuscript

MME: protocol management/ review & approval data & manuscript.

All authors have read and approved the manuscript

AI declaration: Not applicable.

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