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" Factors associated with neonatal respiratory distress syndrome among infants of diabetic mothers "

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ABSTRACT:

Objective: The objective of this study is to assess the variables linked to the occurrence of newborn respiratory distress syndrome in babies born to mothers with diabetes.

Methods: This cross-sectional was conducted at the obstetrics and gynecology department of PortSaid Maternity hospital from February 2022 to March 2023. We recruited diabetic mothers according to predetermined inclusion and exclusion criteria. Eligible women were subjected to proper history and examination and obstetric ultrasound for fetal scan. After birth, the evaluation of each newborn included the need for neonatal intensive care unit (NICU) admissions, the Apgar score and the incidence of respiratory distress syndrome.

Results: The current study recruited 103 diabetic women who gave birth at our institute. The mean age of the studied population was 25.9 ± 4.5 years. The mean gestational age at birth was 36.8 ± 1.3 weeks. Cesarean section was performed for a proportion of the participants 51/103 (49.5%). Neonatal respiratory distress syndrome (RDS) and NICU admission occurred in 43/103 (41.7%) neonates. Using regression analysis, increased parity, fetal weight, and Apgar score were significant factors predicting the occurrence of RDS (p-value 0.011, 0.006, and 0.0001, respectively).

Conclusion: The occurrence of neonatal RDS is common in infants born to mothers with diabetes. The variables of parity, fetal weight, and Apgar score demonstrated a substantial association with the occurrence of newborn respiratory distress syndrome.

Keywords: diabetes; pregnancy, respiratory distress prediction.

Introduction:

More than 300 million people all over the world have diabetes. This number is expected to be doubled by 2030 (1). This is correlated with a concomitant elevate in the incidence of gestational diabetes (2). Diabetes has a significant impact on maternal and fetal outcomes. It was linked with an elevated risk of preeclampsia, polyhydramnios, fetal death, increased cesarean delivery, fetal congenital anomalies, and fetal macrosomia. It also elevates the risk of developing type 2 diabetes in the baby and mother (3). Maternal hyperglycemia leads to fetal hyperglycemia and hyperinsulinemia. This results in accelerated fetal growth, predisposing the fetus to many drawbacks such as birth injuries and increased need for instrumental delivery (4). For babies of diabetes mothers, neonatal respiratory distress syndrome (RDS), earlier known as hyaline membrane disease (5), is a frequent postpartum consequence. It is caused by delayed surfactant production due to hyperinsulinemia and iatrogenic preterm birth (6). Its risk is increased by 5.6 times in diabetic mothers than in ordinary women after controlling for other confounders (7). The main factor affecting the severity of neonatal RDS was high maternal blood glucose levels (8). Another study reported that the type of diabetes did not influence the rate of neonatal RDS (9). The purpose of this research was to investigate the risk variables for newborn RDS in children whose mothers had diabetes.

Materials and Methods:

From February 2021 to December 2021, a cross-sectional study was carried out in the Department of Obstetrics and Gynecology at PortSaid Maternity Hospital. We recruited diabetic mothers (pregestational or gestational) regarding to predetermined exclusion and inclusion criteria. Inclusion criteria: a) maternal age 18- 45 years, b) singleton pregnancy, c) viable fetus, d) intact membranes, and d) gestational age ≥ 34 weeks. The exclusion criteria were Exclusion criteria: a) women with unsure dates; b) known fetal anomalies, even if diagnosed after delivery; c) fetal growth restriction; d) other medical disorders with pregnancy; e) fetal congenital heart anomalies, even if diagnosed after delivery, f) antepartum hemorrhage, g) pregnancies complicated with polyhydramnios or oligohydramnios, and h) women refusing to participate in the study.

Eligible women were subjected to:

- Complete history taking, including age, parity, gestational age, residence, occupation, history of any chronic illness, and complete obstetric history.
- Obstetric ultrasound was done using a 3 to 5 MHz convex probe of Toshiba Aplio 500 (S/N 28184086, made in Japan) for measurement of fetal biometry: biparietal diameter, head circumference, abdominal and chest circumference, and femur length, then expected fetal weight, placental site and amniotic fluid volume and amniotic fluid index were calculated.

- Each infant was evaluated after delivery to determine the incidence of RDS, the necessity for NICU hospitalizations, and the Apgar score at 1 and 5 minutes. Neonatal respiratory RDS is diagnosed by pediatricians based on the infant's clinical history, clinical examination results showing respiratory compromise or not, increased oxygen use, responsiveness to surfactant treatment, and chest radiograph indications of hyaline membrane disease.

We recruited all eligible women throughout the study.

Statistical analysis:

The statistical software SPSS version 25.0 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. The Kolmogorov-Smirnov test was used to evaluate a normal distribution of variables. When applicable, frequencies (number of instances), percentages, and mean and standard deviation were used to statistically characterize the data. The variables that contribute to newborn RDS were identified using linear regression. The probability (P value), where $p > 0.05$ denotes a non-significant result and $p < 0.05$ is deemed significant for all the tests listed above.

Results:

The current study recruited 103 diabetic women who gave birth at our institute. The mean age of the studied population was 25.9 ± 4.5 years. The mean GA at birth was 36.8 ± 1.3 weeks. Almost half were nulliparous 52/103 (50.5%) **(Table 1).**

Table 1: The table is shown basic patient features of the studied population

Age (years) (mean ± sd)		25.9 ± 4.5
GA (weeks) (mean ± sd)		36.8 ± 1.3
Parity	**Nullipara**	52 (50.5%)
	Para 1	36 (35%)
N (%)	**>para 1**	15 (14.6%)
BMI (wt/ht^2) (mean ± sd)		26.7 ± 3.4

GA: gestational age, BMI: body mass index

Regarding the obstetric outcomes, CS was performed for a significant proportion of the participants, 51/103 (49.5%). Neonatal RDS and NICU admission occurred in 43/103 (41.7%) neonates. Female gender was predominant 60/103 (58.3%). The mean fetal weight was 2563.8 ± 822.6 grams **(Table 2).**

Table 2: Obstetric outcomes of the studied population

Preterm or term birth	**Term**	53 (51.5%)
	Preterm	50 (48.5%)
Mode of delivery	**NVD**	52 (50.5%)
N (%)	**CS**	51 (49.5%)
Fetal gender	**Male**	43 (41.7%)
N (%)	**Female**	60 (58.3%)
RDS	**Yes**	43 (41.7%)
N (%)	**No**	60 (58.3%)
Fetal weight (gram) (mean ± sd)		2563.8 ± 822.6
Apgar score (mean ± sd)		7.4 ± 1.7
NICU admission	**Yes**	43 (41.7%)
N (%)	**No**	60 (58.3%)

NVD: normal vaginal delivery, CS: cesarean delivery, RDS: respiratory distress syndrome, NICU: neonatal intensive care unit

Using regression analysis, increased parity, fetal weight, and Apgar score were significant factors predicting the occurrence of neonatal RDS (p-value 0.011, 0.006, and 0.0001, respectively) **(Table 3).**

Table 3: Regression analysis for the factors associated with neonatal RDS

Factor	**β**	**P value**	**95% CI**
Age	0.011	0.051	0.000- 0.023
GA	0.026	0.264	-0.020- 0.071
Fetal gender	-0.009	0.817	-0.091- 0.072
Parity	0.085	0.011	0.020- 0.150
BMI	-0.008	0.266	-0.023- 0.006
Mode of delivery	-0.010	0.811	-0.090- 0.071
Fetal weight	0.000	0.006	0.000-0.000
Apgar score	-0.231	0.0001	-0.262- -0.199

GA: gestational age, BMI: body mass index

Discussion:

Cesarean delivery was required in 49.5% of participants. An earlier study reported CS delivery among 57.8% of the studied population (10). A greater rate was reported in Saudi Arabia (68.7%) (11). This was explained by increased fear of birth injuries associated with fetal macrosomia. Also, the lack of experience in instrumental delivery in the current institute rendered physicians to perform CS rather than attempting instrumental delivery.

Preterm birth occurred in 48.5% of the studied population. Lower estimates were reported by a study conducted in Ethiopia (17.6%) (10). Additionally, a study conducted in Qatar reported decreased preterm rates (12). This discrepancy would be related to the difference in the quality of care provided to mothers among nations.

The incidence of neonatal RDS was 49.5%. Another study reported a lower incidence (22/168, 13.1%) of neonatal RDS among diabetic mothers (13). An earlier one mentioned that 12.1% of infants born to diabetic mothers needed respiratory support in the first 72 hours (14). This discrepancy would be attributed to different sample sizes between studies and the recruitment of women with gestational diabetes only (14). Another one reported an incidence of 15.1%; however, this study compared the effect of antenatal steroids given to diabetic mothers, which was not precisely evaluated in the current study (15). Also, an increased rate of preterm birth would be a contributing factor.

All neonates with RDS were admitted to the NICU. Another study reported an increased rate of NICU admission (65%) despite a low rate of neonatal RDS (9.2%) (10). Other nations reported different rates of NICU admission (11, 16). This would be related to different neonatal management protocols in each country.

Increased parity, fetal weight, and Apgar score were significant factors predicting the occurrence of neonatal RDS. Another study reported that preterm delivery was a significant factor associated with adverse perinatal outcomes (10). This was related to the increased susceptibility of preterm infants of diabetic mothers to perinatal complications. An earlier study reported a strong association between parity and the development of gestational DM (17), which might explain the effect of increased parity on the development of RDS. Another study reported that predictors of neonatal RDS were preterm birth, cesarean delivery, and nulliparity (18), contradicting our results. Nulliparity as a predicting factor for RDS was rendered to the increased rate of preterm birth among nulliparous women (18). Contradicting results were related to different ethnicity among studies, different sample sizes, and different study methodologies.

Strength and limitations: This study recruited diabetic mothers only with no control group. The presence of a control group would be more informative. We evaluated neonatal outcomes with particular attention to neonatal RDS. The sample size is a limitation.

Conclusion: Neonatal RDS commonly occurs in infants of diabetic mothers. Increased parity, fetal weight, and Apgar score significantly predicted neonatal RDS.

Conflict of interest: None

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