

Research Article

Macrosomic Infants of Diabetic and Non-diabetic Pregnant Women

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Abstract

Background: Macrosomia is defined as a birth weight above the 90th percentile for gestational age. Macrosomic infants associated with neonatal morbidities and admissions to the neonatal intensive care unit, also is associated with maternal complications such as cesarean delivery, postpartum hemorrhage and trauma.

Objective: The aim of the study was to assess the neonatal outcomes of macrosomic babies for both pregnant women with gestational diabetes mellitus and without the disease.

Methods: This retrospective cohort study was conducted

at the Duhok Obstetrics and Gynecology Teaching Hospital, Hive Pediatrics Teaching Hospital, and Kurdistan Private Hospital in Iraqi Kurdistan between March 2017 and March 2021. The study included hundred pregnant women, they were divided into two groups; first group (Diabetic mothers) included pregnant women who had gestational diabetes mellitus, second group (Non- Diabetic mothers) included pregnant women who had not the disease. Both groups were included their macrocosmic babies. Both groups were compared regarding a baseline characteristics and neonatal outcomes. The data were statistically analyzed using a software package, current versions IBM (SPSS) Statistic.

Results: During the study period, from March 2017 to March 2021, forty pregnant women who had gestational diabetes mellitus were compared with the sixty pregnant women who had not the disease. pregnant women who had gestational diabetes mellitus had lower parity than non-diabetic mothers, more likely to smoke, more often obese, and more had a history of previous cesarean delivery. Elective cesarean section was more in diabetic group than non-diabetic group. The majority of newborns for both group were male babies. All macrosomic babies were examine by neonatologist. Neonatal intensive care unit (NICU) admission was more for diabetic group than non-diabetic group.

Conclusions: Both macrosomic infants of diabetic and non-diabetic mothers are at risk for neonatal complications especially infants of diabetic mothers and male babies in the short term period.

Keywords: Gestational Diabetes Mellitus; Macrosomia; Neonatal Outcomes

1. Introduction

Macrosomia is defined as excessive intrauterine growth regardless of gestational age, or a birth weight greater than 4000g. The condition is associated with an increased risk of maternal and neonatal complications, and is a risk factor for operative delivery, as well as maternal and infant traumatic injury, also it is an important factor in decision-making during delivery [1, 2]. Macrosomia may be related to constitutional factors (familial trait, male sex, ethnicity), environmental factors (Gestational diabetes mellitus (GDM), diabetes, gestational weight gain, maternal obesity, post-term gestation, multiparty and large placenta in early pregnancy), or heritable genetic [3, 4]. Common

pathogenesis for macrosomia is maternal, and fetal, hyperglycemia. then release of insulin, insulin-like growth factors, and growth hormone that leads to increased fetal glycogen and fat deposition [5]. Although there are no test highly sensitive and specific for diagnosis of macrosomia but two-dimensional ultrasound examination is the standard modality used for diagnosis of macrosomia [6, 7]. For women with diabetes mellitus, avoiding hyperglycemia is a proven means of reducing the frequency of macrosomia [8, 9].

For obese women, pre-pregnancy weight loss can reduce the risk of delivering a macrosomic infant. For women of normal weight, avoidance of excessive gestational weight gain can reduce the risk of macrosomia [10, 11]. Infants of both diabetic and non-diabetic mothers who were macrosomia may have long-term metabolic effects that increase the risk of obesity [12, 13], and insulin resistance [14]. Ongoing studies will be needed to see whether effects increase the incidence of adult diseases such as obesity, diabetes, and cardiovascular disease.

2. Methods

2.1 Design and setting

This retrospective cohort study was conducted at the Duhok Obstetrics and Gynecology Teaching Hospital, Hive Pediatrics Teaching Hospital and Kurdistan Private Hospital in Iraqi Kurdistan between March 2017 and March 2021. This study was approved by the Committee of Scientific research unit of Duhok Obstetrics and Gynecology Teaching Hospital. The study included hundred pregnant women, they were divided into two groups; first group (Diabetic mothers) included pregnant woman who had GDM, second group (Non-Diabetic mothers) included pregnant women who had not the disease. Both groups were included their

macrocosmic babies. The inclusion criteria for the study group were, all pregnant women with documented who had GDM and their macrosomic newborns. Pregnancies affected by congenital anomalies were excluded from the study. After complete history, clinical examination, and investigations, written informed consent was taken in both the groups.

Baseline characteristics for both groups were taken, including maternal age, parity, obesity (a body mass index of greater than or equal to 30). History of smoking, previous history of cesarean delivery and mode of delivery as cesarean section was performed in diabetic mother with an estimated fetal weight more than 4000 g, and in non-diabetic mother with an estimated fetal weight of more than 4500 g. Clinical outcomes examined were neonatal outcomes. All newborns were followed up by neonatologist. Neonatal outcomes were recorded as gender of the babies, birth weight was estimated, and macrosomia was defined by a birth weight ≥ 4000 g irrespective of gestational age. A pgar score of the babies were recorded at 1 and 5 minutes. Neonatal complications were recorded such as admission to neonatal intensive care unite (NICU), transient tachypnea of newborn (TTN), respiratory distress syndrome, meconium aspiration and hypoglycemia. Both groups were compared with respect to baseline characteristics and associations between neonatal outcomes of pregnant women with GDM and without the disease.

2.2 Statistical analysis

The data were statistically analyzed using a software package, current versions IBM (SPSS) Statistic, descriptive statistics for nominal variables were expressed as number and percentage (%), where as quantitative variables were expressed as mean \pm

standard deviation. Student's t-test was applied to difference of mean of quantitative variables. The chi-square distribution test was used to compare categorical data. For interpretation of results, p value < 0.05 was considered significant.

3. Results

During the study period, from March 2017 to March 2021, forty pregnant women who had GDM were compared with the sixty pregnant women who had not the disease.

3.1 Baseline characteristics for both groups

The baseline characteristics of these mothers are summarized in Table 1. The mean age of pregnant woman who had GDM was 25.3 ± 2.3 , while for non-diabetic mothers was 23.7 ± 3.3 . There was no statistically significant difference between both groups regarding the female age ($P=1000$). Pregnant women who had GDM had lower parity than non-diabetic mothers ($p= 0.0138$), and this is statistically significant. Pregnant women who had GDM more likely to smoke ($p=0.001$), and this is statistically significant, also diabetic women were more often obese than non-diabetic mothers. Thirty-three cases of diabetic mothers and fifteen cases of non-diabetic mothers had a history of previous cesarean delivery ($p< 0.0001$), and this is statistically highly significant. Regarding mode of delivery, elective cesarean section was more in diabetic group than non-diabetic group, about (87.5%) of diabetic mothers were delivered by elective cesarean section while only (41.6%) in non-diabetic group ($p< 0.0001$), and this is statistically highly significant.

3.2 Neonatal outcomes

Neonatal outcome of macrocosmic babies for diabetic mothers compared with macrocosmic babies of non

diabetic mothers are summarized in Table 2.

Regarding gender of newborns, majority of newborns for both group were male babies, (28) cases for diabetic group vs (36) cases for non-diabetic group (p=0.3099), and this is statistically insignificant. Infants of diabetic women were more heavier than infants of non-diabetic group, the mean birth weight for both group were (4053 ± 201 vs 4230 ± 511) respectively, (p=0.0398) and this is statistically significant. The mean gestational age for newborns of diabetic group and non-diabetic group were 38 ± 2 vs 39 ± 1, (p=0.0013), and this is statistically significant. Regarding apgar score for newborns, about (10) cases of diabetic group the apgar score of their babies were of less than 5 at 1minute, while for non-diabetic group was only (5)

cases, (P=0.0229) and this is statistically significant. All macrocosmic babies were examine by neonatologist, NICU admission was more for diabetic group than non-diabetic group, and this statistically highly significant (P< 0.0001).

The most common causes for NICU admission for diabetic group were transient tachypnea of newborn and hypoglycemia, and this is statistically significant in compared with the non-diabetic group (P=0.0002 P=0.0217 respectively). More shoulder dystocia cases were detected in non-diabetic group because this group was achieved more spontaneous vaginal delivery than the diabetic group, only one case of birth trauma was recorded in the form of clavicle fracture in the non-diabetic group.

Patient Characteristics	Diabetic Mother (N=40)	Non- Diabetic Mother (N=60)	P-Value
Maternal age (years)	25.3 ± 2.3	23.7 ± 3.3	1
parity	3.41 ± 1.33	4.43 ± 2.33	0.0138
Smoking	10 (25%)	2 (3.3%)	0.001
Obesity	13 (32.5%)	5 (8.33%)	0.001
Previous cesarean section	33 (82.5%)	15 (25%)	< 0.0001
Mode of delivery			
Emergency CS	2 (5%)	10 (16.6%)	0.0814
Elective CS	35 (87.5%)	25 (41.6%)	< 0.0001
Spontaneous VD	3 (7.5%)	25 (41.6%)	0.0002

Quantitative variables presented as mean ± SD, nominal variables as number (percent), P < 0.05 = Significant, P < 0.001 =highly significant, P > 0.05 = Not significant

Table 1: Baseline characteristics in pregnant women who had GDM compared with pregnant women without the disease.

Neonatal outcomes	Infant of Diabetic mother (n=40)	Infants of NON-Diabetic mother (n=60)	P-Value
Gender	28 (70%)	36 (60%)	0.3099
Birth weight	4053 ± 201	4230 ± 511	0.0398
Gestational age	38 ± 2	39 ± 1	0.0013
Apgar score <5			
1 minute	10 (25%)	5 (8.33%)	0.0229
5 minute	4 (10%)	1 (1.6%)	0.0593
NICU admission	25 (62.5%)	10 (16.6%)	< 0.0001
Transient tachypnea	12 (30%)	2 (3.33%)	0.0002
Respiratory distress	2 (5%)	1 (1.6%)	0.3281
Hypoglasemia	9 (22.5%)	4 (6.66%)	0.0217
Meconium aspiration	2 (5%)	3 (5%)	1
Shoulder dystocia	1 (2.5%)	3 (5%)	0.534
Neonatal injury	0 (0%)	1 (1.6%)	0.4238

Quantitative variables presented as mean ± SD, nominal variables as number (percent), P < 0.05 = Significant, P < 0.001 =highly significant, P > 0.05 = Not significant

Table 2: Neonatal outcome of macrosomic babies for diabetic mothers compared with macrosomic babies of non diabetic mothers.

4. Discussion

Fetal macrosomia continues to be an obstetric challenge. This is due to the inaccuracy of clinical or sonographic diagnosis also because of the difficulty in prediction of its complications, especially shoulder dystocia [15]. In our study there were significantly more macrosomic infants in non-diabetic women compared to diabetic women, similar data reported in one study [16]. However in one study showed more macrosomic newborns in diabetic women than non-diabetic women [17]. In term of baseline characteristics.

In this study, there was no significant difference between both groups regarding the female age . Maternal age more than 35 year is an important risk factor for macrosomic infant deliveries [18]. In the one study reported that pregnant women less than 20 years

formed about 5.7% of the study, while pregnant women over 40 years were 4.9% of the study [19]. Increase in parity is an important risk factor for infant macrosomia [20]. In our study pregnant women who had GDM had lower parity than non-diabetic mothers. One study reported that 78% of non diabetic women were multiparous [21].

In one study showed that the caesarean delivery rate in macrosomic infants was between 37% and 54% [22]. To avoid complications during vaginal delivery and the difficulties of identifying a macrosomic baby, this study has showed a higher percentage of caesarean deliveries compared to vaginal deliveries, and more were among diabetic mothers, this is similar to one study that showed caesarean rate was 59.6% among diabetics versus 28.5% in non-diabetics [23].

In our study the data showed that pregnant women with diabetic delivered at an earlier gestational age than non-diabetic group, similar data was found in one study [24]. In our study most of the macrosomic babies were male. Similar findings were seen in one study [25]. Apgar score of <5 at 1 and 5 minute was observed in macrosomic fetuses [26], also in our study was recorded, more often was in diabetic group than non-diabetic group. Macrosomic infant increases the need for NICU admission and less among macrosomic infants of non-diabetic mothers [24, 27]. Similar data was seen in our study that NICU admission was more in diabetic group especially due to transient tachypnea of newborn and hypoglycemia. Regarding respiratory morbidity, a high incidence of neonatal transient tachypnea was observed in our study probably due to more cesarean deliveries.

In one study found a significantly higher incidence of all complications including hypoglycaemia and respiratory distress [28]. Regarding metabolic complications during the neonatal period for macrosomic infants, in our study more hypoglycemia was detected in infants of diabetic mothers than infants of non-diabetic. In comparison, other studies have recorded lower rates for hypoglycemia (5.1%) [29]. In another study did not find a significant association between maternal glucose intolerance and hypoglycemia [30]. Regarding the incidence of birth related injuries, previous studies have reported that increasing birth weight predisposes infants to difficult delivery, birth trauma, and increasing rates of neonatal injury [31, 32]. Swedish study reported injury rates of 0.6% for normal weight infants versus 8.0% for macrosomic deliveries ≥ 4500 g were observed [33].

In our study only one case of neonatal injuries was reported in non-diabetic group, probably as a hospital

policy more elective cesarean delivery is performed for macrosomic baby, and only few cases achieved spontaneous vaginal delivery. The frequency of shoulder dystocia has been reported as 0.2-3 % of all births in obstetrics emergency. In one study reported that the risks for shoulder dystocia in diabetic mothers are not significantly different from nondiabetic mothers [34]. In our study found that the diabetic mothers had shoulder dystocia only in 1 (2.5%) case compared to non-diabetic mothers 3 (5%).

This study had two limitations that must be considered. First, the sample size was insufficient. Second, we had no information regarding long term effects of macrosomia on the neonates. The strength of this study was its focus on most of the neonatal complications related to macrosomic infant.

5. Conclusions

Both macrosomic infants of diabetic and non-diabetic mothers are at risk for neonatal complications especially infants of diabetic mothers and male babies in the short term period, especially hypoglycemia, respiratory morbidity, caesarean section delivery, and NICU admission. Future studies need to study the effectiveness of glycemic control on improving neonatal outcomes.

Abbreviations

'Not applicable' for that section.

Declarations

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