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Effect of Gestational Diabetes Mellitus on Macrosomia Infants

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ABSTRACT

Aim: This study aims to explore fetal and maternal complications of macrosomia; and also to compare fetal characteristics of macrosomia infants of GDM and Non- GDM mothers.

Methodology: This is a retrospective study, on women who delivered macrosomia infants over a two-year period (2014-2015), at the University of Lubumbashi hospital and Don Bosco Clinic in Lubumbashi/ Democratic Republic of Congo. Obstetrical parameters were taken from the labor register and all data were analyzed using SPSS 17.00 statistical software; independent and paired sample t- test, Chi-square tests were performed (α=0.05 level, 95 % confidence interval).

Results: A total of 87 women, with a mean age of 32.73 51 (± 5.16) were enrolled into the study. From these women 54 % had Gestational Diabetes Mellitus (GDM).Mean birth weight of babies from GDM mothers (4182.25 ± 177) was higher than those with Non-GDM mothers (4156±165.662) with a p value <0.05.This study revealed that GDM induce hypoglycemia in newborn(X2=4.252 and p=0.001) but other parameters such as Cephalohematoma and perineal mortality were not statistically associated with GDM.

Conclusion: Fetal characteristics of macrosomia can be different when it occurs in infants from GDM mothers or non-GDM mothers. Hypoglycemia in infants was found to have a strong association with GDM. The main recommendation is to increase Glucose control during pregnancy in order to minimize any risk in the infants.

Key Words: Macrosomia, Gestational Diabetes, Democratic Republic of Congo

INTRODUCTION

Fetal macrosomia is defined as birth weight >4000 g [1]. Numbers of studies have related birth weight to several maternal characteristics, including racial origin, age, body mass index, parity, cigarette smoking, and medical conditions, such as pre-pregnancy diabetes mellitus [2]. In all these risk factors diabetes has a strongest association with macrosomia (macrosomia was detected in 70% to80% of pregnancies that were complicated by diabetes mellitus) [3]. There are three types of Diabetes Mellitus: Type I, Type II and Gestational Diabetes, this study will focus more on Gestational diabetes Mellitus (GDM), which occurs when a woman without diabetes develops high blood sugar levels during pregnancy.

GDM has an important link with the incidence of overweight in the newborn [4]. Genetic as well as epigenetic factors play a great role in the GDM pathogenesis, which is shown by the fact that this complication also affects women with normal BMI. Infants of women with GDM are at an increased risk of becoming overweight or obese at a young age (during adolescence) and are more likely to develop type II diabetes later in life. In addition, findings of several studies that epigenetic alterations of different genes of the fetus of a GDM mother

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in utero could result in the transgenerational transmission of GDM and type II diabetes are of concern [5].

Fetal macrosomia is also associated with a range of maternal and fetal complications such as shoulder dystocia, birth asphyxia, nerve injuries, clavicular and humerus fractures in neonates, admission to the intensive-care nursery, and increased perinatal mortality for the newborn, vaginal and perineal trauma, uterine rupture, postpartum infection and hemorrhage to the mother [6]. It can also be linked to Cephalohematoma, which is defined as a hemorrhage of blood between the skull and the periosteum of a newborn baby secondary to rupture of blood vessels crossing the periosteum [7].

This study will aim to explore fetal and maternal complications of macrosomia; and also to compare fetal characteristics of macrosomia infants of GDM and Non- GDM mothers.

I. DESIGN/METHODS

This is a retrospective study of macrosomia infants (baby weighing 4kg or more), born at the University of Lubumbashi hospital and Don Bosco Clinic in Lubumbashi/ Democratic Republic of Congo over a two-year period (2014-2015).

Data collection

Obstetrics data were obtained from the labor register. Maternal information collected were age, parity, macrosomia antecedents and GDM. Labor event considered was mode of delivery (caesarean sectional emergency or vaginal deliveries). The neonatal information collected were weight of the baby, sex of the baby, Head circumference, Apgar score at 1, at 5 and at 10 minutes. Maternal complications taken into consideration were perineal trauma, postpartum hemorrhage, infection and uterine rupture, Neonatal complication such as hypoglycemia, cephalomatoma, nerve injuries (Brachial plexus palsy) and whether the fetus was alive or dead(perinatal mortality) were also taken into consideration.

Women with diabetes antecedents, meaning women who knew themselves as being diabetics before pregnancy, were excluded from the study.

Glycaemia control during pregnancy

Glycaemia control was done once for each of the three trimesters of the pregnancy. A non-challenge blood glucose test was used. It involved measuring glucose levels in blood samples without challenging the subject with glucose solutions [8]. Criteria for diagnosis of gestational diabetes was defined when the level of glucose intolerance was>95 mg/dl, and a woman was diagnosed with gestational diabetes when glucose intolerance continues beyond 24–28 weeks of gestation.

Neonatal Hypoglycemia

Neonatal hypoglycemia is defined as a plasma glucose level of less than 40 mg/dl, in the first 24 hours of life and less than 50 mg/dl thereafter [9].

Statistical analysis

All data were analyzed using SPSS 17.00 statistical software; measurement data are analyzed by independent and paired sample t- test for comparison. Categorical data were analyzed by chi-square test, α=0.05 level, with a 95 % confidence interval.

RESULTS

1. Mothers information and post-partum complication

A total of 87 women, with an age between 21 to 42 years (Mean age: 32.7351 ± 5.16) delivered macrocosmic babies at the University Hospital and Don Bosco Clinic of Lubumbashi during the study period. It was observed that 72macrocosmic neonates (82.7%) were delivered from multiparty mothers and 50mothers (57.5%) had macrocosmic babies before (antecedent of macrosomia), and 47 mothers (54 %) had GDM. The percentage of women who delivered vaginally was 70.1 % (61women) while 29.9% (26 women) delivered by cesarean section.

Macrosomia usually causes some complications among women. This study revealed that only one woman (1.1%) had infection after delivery, 11 women (12.6 %) suffer from post-partum hemorrhage, and one woman (1.1 %) had uterine rupture. Among women who deliver vaginally 19 (21.9%) had perineal trauma, (X^2= 7.675 and p value = 0.000), showing a strong association between perineal trauma and vaginal delivered.

2. Infants information

There were 46 (52.8 %) male babies and 41 (47.1 %) female babies; the mean birth weight of the macrocosmic babies was 4168.51 ± 170.72and the mean head circumference (in cm) was 36.041 ± 1.064.Comparing the mean birth weight of male to female babies, this study shows that the mean weight was higher in males(4194.22 ± 164.945) than in females (4139.51± 176.365)with a p value < 0.05.They were no brachial plexus palsy, but 14(16.1 %) had hypoglycemia, 6(6.8 %) babies had cephalohematoma and 2 (2.3 %) babies died during labor (perinatal mortality).

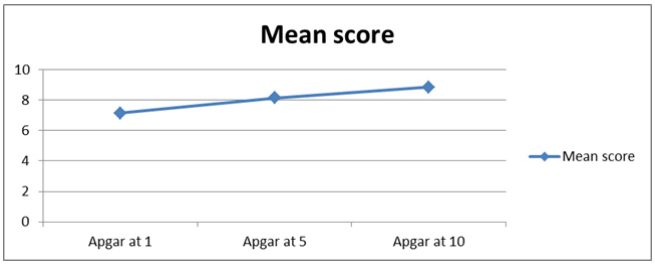

Figure 1: Comparison mean of Apgar at 1 minute vs 5 minutes and at 5 vs 10 minutes

This figure shows that the mean Apgar score of the babies was increased from minute 1 to 5 and from minute 5 to 10. P =0.000 for both Apgar 1 vs 5, and Apgar 5 vs 10.

3. Comparison of Mean weight and head circumference between infants from GDM and Non GDM mothers

Table 1: Comparison of Mean birth weight and Mean Head circumference between babies from GDM and non-GDM

Variables	GDM	Non GDM	p value
Mean Birth weight	4182.25 ± 177	4156±165.662	0.001
Mean Head circumference	36.128±1.080	35.867± 1.056	0.254

There was statistically difference in the birth weight of babies in the two groups of the mothers ($p<0.05$), the mean value in infants from GDM mothers was higher than in Non-GDM mothers. But the difference in mean value of head circumference was not statistically different in the two groups $p>0.05$.

4. Comparison of Apgar score at 1, 5, and 10 minute in the two groups of babies.

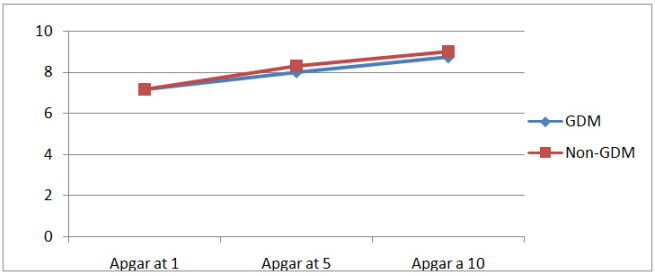

Figure 2: Comparison of Apgar score at 1, 5, and 10 minute in the two groups.

Figure 2 shows that the mean Apgar score at 1, 5 and 10 minute was higher in Non-GDM infants than GDM infants but this difference was not statistically different because the p values were > 0.05.

5. Comparison of neonatal outcomes between GDM and Non GDM women

Table 2 shows that GDM have an association with Neonatal Hypoglycemia in the newborn.

Table 2: Comparison of neonatal complications between Babies from GDM and Non-GDM mothers

Variables		GDM	Non-GDM	chi square and p-value
Cephalohematoma (N=80)	yes	0	5	X2 = 5.385 p= 0.060
	No	40	35	
Hypoglycemia (N=87)	Yes	5	9	X2 = 4.252 p= 0.001
	No	42	31	
Perinatal mortality (N= 78)	Yes	0	2	X2 = 2.053 p= 0.152
	No	39	37	

DISCUSSION

In our study the percentage of caesarean delivery was low (29.9%) compared to studies done by other authors. The prevalence of caesarean section in a study among Pakistani women was 40.5% and the rate of cesarean section among women delivering macrosomia babies was 47.6% in Saudi Arabia [10][11]. Other works, however, failed to find a substantial decrease in fetal morbidity and mortality in macrosomia babies delivered by caesarean section to justify the high prevalence of caesarean section, and therefore advocate earlier induction at term in mothers of macrocosmic babies [12] [13]. However, with a high percentage of vaginal delivery in our study, there was a very low perinatal mortality.

Fetal sex influences macrosomia potential, male infants weigh more than female infants[14], and our study has confirmed this assertion.

The most feared complication of macrosomia is shoulder dystocia .Up to one fourth of the infants with shoulder dystocia had described to suffer from brachial plexus or facial nerve injuries or fractures of the humerus or clavicle [15]. But in this study, no brachial plexus palsy was reported.

Comparing the mean birth weight of the babies, it was observed that infants from GDM mothers have a mean birth weight higher than those with Non-GDM mothers. This can be explaining by the fact that all of the nutrients the fetus receives come directly from the mother's blood. If the maternal blood has too much glucose, the pancreas of the fetus

senses the high glucose levels and produces more insulin in an attempt to use this glucose. The fetus converts the extra glucose to fat. Even when the mother has gestational diabetes, the fetus is able to produce all the insulin it needs. The combination of high blood glucose levels from the mother and high insulin levels in the fetus results in large deposits of fat which causes the fetus to grow excessively large [16]. However the mean head circumference was high in babies from GDM mothers than in non- GDM mothers but not statistically significant; this result corroborate with a study done by Joan. L et al which affirm that usually, head circumferences are not typically increased in Infants from diabetic mothers [17].

The study has shown that there were 6(6.8%) babies with cephalohematoma in this population of macrosomia infants. But there was no statistical correlation between cephalohematoma and GDM. Cephalohematoma occurs in Macrosomia infants if the baby is atypically large, resulting in complication of vaginal birth. There is a risk of prolonged labor in which the fetus might be stuck in the birth canal. Instrumental delivery (with forceps or vacuum) may be needed, and even unplanned or emergency cesarean section may be necessary [5].

Low Apgar score has been related to many factors such as umbilical cord problems, uterine rupture, trauma, macrosomia, severe preeclampsia and Amniotic fluid embolism [18]. In this study, the Apgar score at 1, 5 and 10 minute was good (>7), indicating it was always normal. However comparing Apgar means at1, 5 and 10 minute of the two groups of babies, the mean Apgar score was quiet high in infants from Non- GDM mothers has compared to those from GDM mothers. This could be related to the fact that infant from GDM are at risk of hypoglycemia and have a high birth weight than those from Non-GDM mothers.

This study revealed also that GDM induce hypoglycemia in newborn. This result corroborate with a study done by Ogunyemi. D et al , that suggested that diabetes was protective of neonatal hypoglycemia, which may be explained by optimum maternal glucose management; nevertheless macrosomia was independently predictive of neonatal hypoglycemia [19]. Another study done in Austria has shown that infants of diabetic mothers are at risk for hypoglycemia [20].Hypoglycemia refers to low blood glucose in the baby immediately after delivery. This problem occurs if the mother's blood glucose levels have been consistently high, causing the fetus to have a high level of insulin in its circulation. After delivery, the baby continues to have a high insulin level, but it no longer has the high level of glucose from its mother, resulting in the newborn's blood glucose level becoming very low. The baby's blood glucose level is checked after birth, and if the level is too low, it may be necessary to give the baby glucose intravenously [16].

It is worth nothing that there are a number of outcomes that may be due to GDM that our study did not explore; further research is recommended with a larger sample size.

CONCLUSION

There are various fetal outcome associated with fetal macrosomia such as hypoglycemia, brachial plexus palsy and perinatal mortality. This study revealed that a number of these outcomes can be different when it occurs in infants from GDM mothers or non-GDM mothers. Hypoglycemia in infants was found to have a strong association with GDM; while perinatal mortality, brachial plexus palsy or cephalohematoma didn't t have a statistical association with GDM. From this result, it can be recommend that:

- Glucose control during pregnancy should be increased in order to reduce the risk of hypoglycemia in newborn.
- Cooperation of gynecologists, pediatricians and dieticians should be enhanced in order to minimize adverse maternal and fetal outcomes.

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