A COMPARATIVE STUDY OF MACROSOMIA IN INFANTS BORN TO DIABETIC AND NON- DIABETIC MOTHERS

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ABSTRACT

Objective: To compare macrosomia in infants of diabetic and non-diabetic mothers, and to study macrosomia associated shoulder dystocia and mode of delivery.

Material and Methods: This study was carried out on babies born to diabetic as well as non-diabetic healthy mothers at Gynae unit Hayatabad Medical Complex Peshawar in association with Anatomy department Khyber Girls Medical College Peshawar. A total number of 100 diabetic and 100 nondiabetic healthy mothers were selected for this study. After delivery, the weight and sex of the babies born to diabetic as well as nondiabetic mothers along with the mother's age, parity and mode of delivery were noted on an observation sheet. The student's t test was applied for all quantitative data. A p-value of ≤ 0.05 was taken significant.

Results: Macrosomia was significantly higher in infants of diabetic mothers as compared to those of non-diabetic mothers (P =0.0001). Compared to infants of non-diabetic mothers, infants of diabetic mothers had a significantly higher birth weight (P =.0001).Cesarean sections and instrumental deliveries were significantly higher (P = 0.0001) in diabetic mothers as compared to non-diabetic mothers. No significant difference was found between the mean age (P =0.655) and parity of the diabetic and non-diabetic mothers. Of the 48 infants of diabetic mothers delivered vaginally, 08 were complicated by shoulder dystocia. Conversely, only 01 of the 79 infants born to non-diabetic mothers delivered vaginally experienced shoulder dystocia (P value =.022). Of 37 macrosomic infants born to diabetic mothers 26 were male and 11 were females. (P value =.005). Conversely of 6 macrosomic infants born to non-diabetic mothers 4 were males and 2 were females (P value =.679) showing that male infants of diabetic mothers were significantly more affected by macrosomia.

Conclusion: A significant difference was noted when birth weight of babies born to diabetic mothers was compared with the babies of nondiabetic mothers. Macrosomia was significantly more common in infants of diabetic women as compared to those of non -diabetic women. Macrosomia associated shoulder dystocia, instrumental and cesarean deliveries are also more common in diabetic women than non-diabetic women. This larger weight and macrosomia of babies may be due to maternal diabetes. This condition affects the normal development of fetus leading to an increased morbidity and mortality in babies and mothers.

Key Words: Macrosomia, IDMs, Shoulder dystocia, Hyperinsulinemia, Mode of delivery, Cesarean sections, Instrumental delivery, Parity, Pre-gestational diabetes.

INTRODUCTION

High blood glucose levels during pregnancy can affect the growing fetus adversely and produce birth defects. Poorly controlled diabetes mellitus can lead to macrosomia (big baby), defects of central nervous system, sacral agenesis, vertebral anomalies, congenital heart defects and limb defects[1]. In diabetic mother's high maternal blood glucose level results in high fetal blood glucose levels. This leads to fetal hyperinsulinemia, by stimulating insulin production from fetal pancreases. Hyperinsulinemia leads to increase body growth and fat deposition, which are known as macrosomia.[2,3] Excessive fetal growth is undesirable because it is associated with higher rates for cesarean delivery, birth trauma, stillbirth, neonatal hypertrophic cardiomyopathy and hypoglycemia.[3] These big babies have a higher risk of birth injuries, facial nerve injuries, and asphyxia. In macrosomic babies having birth weight of more than 4500 g, the risk of clavicular fracture is approximately 10-folds and risk of brachial plexus injury is approximately 18 to 21-folds.[4,5]

Pre-gestational diabetes type 1 and type 2 can lead to alterations from fertilization, through all pregnancy period and even after it ends. It predisposes the fetus to many alterations in organogenesis and also predisposes the mother to diabetic complications like

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nephropathy and retinopathy or the course of these complications may be accelerated6. Gestational diabetes is generally more commonly associated with alterations in fetal growth[7].

Macrosomia is defined by the American College of Obstetricians and Gynecologists as newborns having birth weight of more than 4,000 g irrespective of gestational age or higher than 90th percentiles for their gestational age after correcting for neonatal sex and ethnicity[8]. Macrosomia affects 3 to 15% of all pregnancies.[9]

Macrosomia associated morbidity and mortality can be classified into maternal, fetal and neonatal groups. A recent study investigated an association between birth weight and fetal mortality showed that birth weight of 4000 g in diabetic mothers and more than 4250 g in non-diabetic mothers is associated with higher fetal mortality rates.[10]

Macrosomic fetus represents a frequent clinical challenge in current obstetrics. There is enough evidence to support that being born macrosomic is also associated with health risks in future. Prediction of fetal macrosomia is an inaccurate task even with modern ultrasound equipment.[11]

Macrosomia is a known cause of maternal and fetal mortality and morbidity. Maternal diabetes, ethnicity, delayed pregnancy, multiparty and obesity have been shown to have very important role in determining the birth weight of the fetus[12,13]. Macrosomia has been associated with various complications like asphyxia, traumatic birth injuries and shoulder dystocia which is a failure of fetal anterior shoulder to pass below the symphysis pubis or requires significant manipulation after the delivery of the fetal head leading to obstructed labour.[13]

Macrosomia is associated with higher rates of instrumental deliveries and maternal injuries regardless of parity and also with increased rates of caesarean deliveries and shoulder dystocia among nulliparas.[14]

MATERIALS AND METHODS

This study was carried out on babies born to diabetic as well as nondiabetic healthy mothers at Gynae Unit Hayatabad Medical Complex, Peshawar in association with Anatomy Department Khyber Girls Medical College, Peshawar from January 2015 to June 2015. A total number of 100 diabetic mother and 100 nondiabetic healthy mothers were selected for this study. The babies having associated gross congenital anomalies were excluded from this study. The mother having other chronic diseases, twin pregnancies were also excluded from this study. After delivery, the weight and sex of the babies born to diabetic as well as non-diabetic mothers along with the mother's age, parity and mode of delivery were noted on an observation sheet. Newborns weighing more than 4kg (400gms) were labeled as macrosomic, as defined by (ACOG) criterion.

Confidentiality of the patients was ensured by keeping the observation sheet without name and by giving specific number to each patient. The distribution of different variables in these groups were studied by using, percentage for qualitative data, and by describing the arithmetic mean ± standard deviation for quantitative data. The chi-squared test and independent samples t-test were carried out for statistical analysis. The data was analyzed with help SPSS version 20. A p-value ≤ 0.05 was considered significant.

RESULTS

In the present study, a total of 200 mothers (hundred each for diabetic and non-diabetic) and their

Table 1: characteristics of the newborns in both the groups

	Non-diabetic n=100	Diabetic n=100	P-value
Macrosomia	06 (06%)	37 (37%)	0.0001*
Newborn weight in kg	2.925+0.4808	3.546+0.9970	.0001*

Table 2: characteristics of the mothers in both the groups

	Non – diabetic n= 100	Diabetic n=100	P -value
Maternal age	28.24+5.316	25.91+ 5.301	0.655
Parity			
Primigravida (0)	29	25	
Multigravida (2-3)	62	66	
Grand multigravida (above 4)	09	09	0.81
Delivery type			
Normal vaginal delivery	79 (79%)	48 (48%)	
Instrumental delivery	08 (08%)	16 (16%)	
Cesarean section	13 (13%)	36 (36%)	.0001*
Shoulder dystocia	01 (1.2%)	08 (16.6%)	.017*

Table 3: Male to female ratio of macrosomic newborns

Macrosomia	Male newborns	Female newborns	P-value
Diabetic mothers	26	11	.005*
Non-diabetic mothers	4	2	.679

newborns were studied. Characteristics of the newborns for both groups are summarized in the Table 1. Characteristics of the mothers in both these groups are summarized in Table 2.

Compared to infants of non-diabetic mothers, those of diabetic mothers had a significantly higher birth weight (3.546+0.9970 VS 2.925+0.4808, p value = .0001). Macrosomia was significantly more common in babies of diabetic mothers compared to non-diabetic (37% VS 6%, p - value =0.0001) as shown in Table 1.

Cesarean sections (36% VS 13%, p value = 0. 0001), and instrumental deliveries (16% VS 08%) were significantly higher in diabetic mothers as compared to non-diabetic mothers. No significant difference was found between the mean age (28.24+5.316 VS 25.91+ 5.301, p value =0.655) and parity of the diabetic and non-diabetic mothers. Out of the 48 infants of diabetic mothers delivered vaginally, 08 were complicated by shoulder dystocia. Conversely, only 01 of the 79 infants born to the normal non-diabetic mothers delivered vaginally experienced shoulder dystocia (16.6% VS 1.2%, p value =.017). (Table 2)

Of 37 macrosomic infants born to diabetic mothers 26 were male and 11 were females. (70% VS 29, 8%, p value =.005). conversely of 6 macrosomic Infants born to non-diabetic mothers 4 were males and 2 were females (66.6% VS 33.3 %, p value =.679) which shows that in both groups male infants were predominantly affected by macrosomia as compared to female infants (Table.3)

DISCUSSION

Birth weight of the newborns: A significant difference (p=0.0001) was noted when the weight of all babies born to non diabetic mothers was compared to all babies born to diabetic mothers, as the mean birth weight of all babies related to nondiabetic mothers was 2.925 kg and was 3.546 kg in babies born to diabetic mothers. The increased body weight noted in all babies may be the result of intrauterine exposure to high glucose level which affected both male and female babies. This finding is consisting with most of the international studies which showed higher births weights of IDMs as compared to infants of non-diabetic mothers[15]. This increased blood glucose level predisposes these babies to increased body weight as well as obesity[16]. In babies with increased than normal birth weight, there is increased risk of developing obesity or diabetes later in the life[17].

Macrosomia in the newborns: In our study 37% newborns of diabetic mothers were macrosomic as compared to 6% newborns of non-diabetic mothers. This finding is consistent with international studies, one such study showed 8-fold increases in macrosomia in infants of diabetic mothers as compared to general population[18]. Another study performed showed 53% newborns had macrosomia for women with type 1 and 38% for newborns of women with type 2 diabetes.[19]. A study carried out by Radhia, on 130 ladies with GDM showed macrosomia in 29% of babies as compared to 10% for newborns of healthy pregnant mothers[20].

Age and parity of the mothers: There was non-significant difference (p =0.665) between parity, and the average age of diabetic (28.24) and non-diabetic mothers (25.91). Although many researchers have reported age, as an independent factor for fetal macrosomia. Said et al has reported maternal age as a separate risk factor for fetal macrosomia.[21] Aliyu has reported that the association between maternal-fetal birth outcomes and high parity and are not consistent. In the older literature multiparity is suggested as a risk factor for negative birth outcomes, more recent reports are not supportive. As comparison across studies were also complicated by some other important factors like maternal age, level of prenatal care socioeconomic status, study design and the definition of parity itself.[22]

Mode of delivery of the mothers: In our study 36% diabetic mothers were delivered through cesarean section as compared to 13% non-diabetic mothers. These values are comparable to international studies showing a cesarean section rate of 35-45% for diabetic women, in different countries[23]. Inge M Evers in his study on type 1 diabetic women reported that, the rate of caesarean section was (44.3%) almost four-fold higher as compared to general population. Fetal distress, pre-eclampsia, and macrosomia were the major causes for cesarean section in these women[24]. A study Performed on women with type 1 diabetes and general population by Dorte M. Jensen the cesarean section rate was 55.9 and 12.6%, respectively[25]. Cordero has reported that infants of diabetic mothers were more likely to be delivered by cesarean section while infants of non-diabetic more were more likely to be delivered vaginally.[26]

Shoulder dystocia: Shoulder dystocia was significantly higher (p=.017) among the infants of diabetic mothers when compared to non-diabetic. The reason could possibly be higher birth weights and fetal macrosomia which was more common among infants of

diabetic mothers. Most of the international studies have reported higher rates of shoulder dystocia in babies born to diabetic mothers as compared to non-diabetic[27]. Maternal diabetes seems the most commonly reported risk factor of shoulder dystocia in the literature[28]. Based on fetal weight, the overall incidence of shoulder dystocia varies. A rate of 0.6 to 1.4% has been recorded in infants with a birth weight ranging from 2500g - 4000g and increasing to 5-9% in infants weighing 4000g - 4500g[29-31]. In primigravida and multigravida women, shoulder dystocia occurs with almost equal frequencies, although it is more common in IDMs[29,32].

Male predominance in macrosomic newborns: Male were significantly (p=.005) more affected by macrosomia in IDMs as compared to infants born to non-diabetic mothers. A study performed by Akin y et al. on macrosomic newborns showed male predominance (p = 0.0001)[33]. Di Renzo GC et al has also reported higher rates of fetal macrosomia, cord prolapse and cesarean sections among male newborns compared with females.[34]

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